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OFFICE OF RAIL AND ROAD

#33582 - Scope 1 & 2 Carbon Emissions

Independent Reporter Review of Network Rail's Strategic Business Plan Forecasts of Scope 1 and 2 Carbon Emissions for the CP7 Period

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AMENDMENT HISTORY

Version	Sections	Amendment Details
1.1	Various	Minor editorial updates following Network Rail and ORR comments.

EXECUTIVE SUMMARY

The Office of Rail and Road (ORR) and Network Rail are seeking to understand if Network Rail's Strategic Business Plan (SBP) forecasts of Scope 1 and 2 carbon emissions are realistic and supported by robust benchmarks, management and operational approaches for the period known as Control Period 7 (CP7).

In the role of Independent Reporter (IR), an AMCL-led team comprising AMCL, AQC, CPCS, and Eracura was appointed by ORR and Network Rail to undertake a review of Network Rail's CP7 Scope 1 and 2 carbon emissions forecasts for CP7.

The review was carried out through a series of interviews with key sustainability, carbon and energy leads within each of Network Rail's five Regions and Route Services, and a desktop review of information and data provided by each Region to support their forecast of Scope 1 and 2 carbon emissions.

The review has sought to identify whether Network Rail's plans and forecasts for decarbonisation of Scope 1 and 2 emissions in CP7 (the period from April 2024 to March 2029) are robust, consistent, well evidenced and sufficient to meet the requirements of the High Level Output Specifications (HLOSs) for England & Wales and Scotland and milestones set out in the Department for Transport (DfT) Rail Environment Policy Statement and Transport Scotland Rail Services Decarbonisation Action Plan.

Network Rail has set a target to reduce Scope 1 and 2 carbon emissions by 46% by the end of CP7 in 2029 compared to a 2018-19 baseline position. ORR is also keen to understand if Network Rail's forecasts are sufficiently ambitious in relation to this target.

Summary of Key Findings and Recommendations

The IR finds that Network Rail's Scope 1 and 2 carbon emissions plans and forecasts for CP7 are sufficient to meet the core requirements of the HLOSs, DfT's Rail Environment Policy Statement and TS's Rail Services Decarbonisation Action Plan.

Each of the Regions has developed a robust plan for decarbonising non-traction Scope 1 and 2 emissions, which focusses on replacement of road vehicles (cars and vans) with electric or other zero emission vehicles by 2027, and a range of energy efficiency and renewable energy schemes to reduce energy consumption and carbon emissions, which have been allocated funding for CP7. At a national level, Network Rail is planning to deliver direct wire Power Purchase Agreements for renewable non-traction electricity, the first of which is due to come online during the first year of CP7.

The IR has not seen evidence that Route Services has developed a CP7 decarbonisation plan in the same level of detail as the Regions, but have a key function in the delivery of the transition to Zero Emissions Vehicles (ZEVs) by 2027. Route Services are also responsible for a fleet of rail-based machines, and the IR has found that emissions from fuelling of these machines do not appear to be captured in Network Rail's carbon reporting and decarbonisation plans.

Network Rail has set a target for 21% reduction in Scope 1 and 2 carbon emissions during CP7, which coupled with a predicted 25% reduction during CP6 will keep Network Rail on track to reduce carbon emissions by 46% compared to a CP5 exit (2018-19) baseline. This aligns with a Science Based Target trajectory aligned to the 1.5 degree global warming pathway (i.e. 2050 net zero).

All of the Regions have produced more detailed analysis of forecast CP7 decarbonisation than presented in their SBPs, and many of these forecast a CP7 carbon emissions saving well above the 21% target.

Whilst the IR finds that Network Rails decarbonisation plans and strategies are aligned to the requirements of the HLOSs and sufficient to achieve the carbon reduction targets set in the SBPs, there are a number of areas for improvement or development identified by the IR in relation to the CP7 Scope 1 and 2 carbon emissions forecasting for Network Rail and ORR to consider.

The IR has the following eight key findings of the review:

Key Finding 1: There is inconsistency in approach to CP7 forecasting between Regions, but they are all likely to deliver the target. Each Region has been tasked with developing a CP7 Scope 1 and 2 decarbonisation plan. Network Rail has provided support to Regions in developing the plans at a high level, and the main decarbonisation strategies which appear in the SBPs are reasonably well aligned.

However, in terms of forecasting and quantifying the expected emissions reductions in CP7, Network Rail appear to have provided little in the way of detailed guidance to Regions. This has resulted in Regions each taking subtly different approaches leading to poor comparability between Regional forecasts in terms of detail and the confidence in the level of emissions reductions that is expected. One common theme in discussions with Regions is that the process would greatly benefit from some centralised consistent guidance to help align the approach robustly across the Regions and central functions.

Although there is some uncertainty in the likely emissions reductions that will be achieved, the IR has confidence from the information provided by Regions that they will be able to meet the 21% carbon reduction target in CP7.

Whilst the Regions have presented a year-by-year glide path of predicted Scope 1 and 2 carbon emissions reductions through CP7, for most Regions these appear to be a linear trajectory to meet the 21% target described in the SBPs. Given the likely back-end loading of some key decarbonisation measures such as the ZEV transition, it seems unlikely that a linear trajectory in carbon emissions reductions should be expected.

Key Finding 2: The IR has not seen evidence that Route Services has fully quantified its Scope 1 and 2 emissions, developed a CP7 decarbonisation plan or have confidence that Route Services can meet the CP7 carbon reduction target. Route Services has a key role in the ZEV transition and the Route Services SBP includes commitments to replace its own fleet of road vehicles with ZEVs, but it is not clear if any other emissions sources are considered, nor if Route Services have adopted the 21% carbon reduction target adopted by the Regions (and Network Rail nationally).

It is though acknowledged that the IR has not been able to speak directly to members of the Route Services decarbonisation team as part of this Stage 1 review.

In addition, the IR has identified that emissions from Network Rail's fleet of 2,500 rail-based machines are substantial in the context of the currently reported Scope 1 and 2 emissions and are not presently accounted for in Network Rail's carbon emissions reporting or forecasts. A large proportion of these machines are operated by third parties and therefore emissions are Scope 3, but a proportion of the machines are operated directly by Route Services and could contribute up to 25% of Network Rail's national Scope 1 and 2 carbon emissions.

The IR has not seen evidence that Route Services has a system of reporting and governance for Scope 1 and 2 carbon emissions in place, beyond the compilation of data for national reporting lead by the TA.

Key Finding 3: The IR has seen insufficient detail in plans for the ZEV transition to have confidence in its success. To meet the requirements of the DfT's Rail Environment Policy Statement which sets a mandate to replace all internal combustion engine cars and vans in the Network Rail road fleet by 2027, a robust and detailed plan of infrastructure upgrades and vehicle supply and operation is required. Detailed analysis has been undertaken within Route Services and separately by Scotland's Railways to plan for the ZEV transition, but there has been no evidence provided to the IR that a formal centralised plan has been implemented by Network Rail. There are a number of challenges to the ZEV transition and its success is important to the success of Network Rail's decarbonisation plans and targets for CP7.

Each Region is clearly spending a lot of time and effort planning for the ZEV transition programme, which has already begun with vehicles being rolled out across all Regions. Substantial funding has been secured for the programme across all Regions for CP7. However, all Regions report challenges to the vehicle rollout in terms of delivery of sufficient infrastructure for vehicle charging (such as electricity substation and DNO upgrades and EV charging points) as well as cultural challenges around the limitations of where to charge vehicles, whether vehicles can be kept at home as many of the current ICE fleet are, as well as issues around range anxiety. An issue was also raised with the IR that procurement of electric vehicles has been prioritised, but the delivery of the charging infrastructure needs to keep up ahead of vehicle delivery to ensure the ZEV transition is successfully delivered.

The IR has not seen evidence of there being a consolidated strategy in place, with appropriate levels of engagement between Route Services, who handle vehicle leasing, and the Regions and routes who are responsible for delivering the required infrastructure.

Key Finding 4: Network Rail's Scope 1 and 2 carbon footprint would benefit from re-baselining. All Regions have reported significant data cleansing with respect to energy data and some major issues with respect to large quantities of energy being billed to Network Rail which are now sub metered (e.g., tenants' energy, Waterloo and City Line at Waterloo Station, Crossrail works for Wales and Western). It therefore seems clear to the IR that there is uncertainty in Network Rail's 2018-19 energy consumption and carbon emissions baseline and corresponding uncertainty in the monitoring and reporting of the success of Network Rail's decarbonisation plans.

Key Finding 5: The framework for assurance and governance of CP7 decarbonisation performance is not well developed. Network Rail has set a 21% carbon reduction target for CP7, which when combined with the existing 25% reduction target for CP6 (if achieved), will complete the planned 46% reduction between CP5 exit and CP7 exit. The IR understands that assurance is currently based on periodic reporting of carbon and energy emissions, however it is unclear whether there is a central assurance and governance process in place to ensure consistency between Regions and Route Services.

Key Finding 6: Additional performance indicators and targets for CP7 could be developed to assist in measuring the success of CP7 decarbonisation plans and increase ambition. During CP6 Network Rail set reduction targets for both carbon (25% by CP6 exit and 46% cumulatively by CP7 exit compared to CP5 exit baseline) and energy consumption (18% by CP6 exit). The only target for CP7 relating to Scope 1 and 2 carbon emissions is the 21% carbon reduction target, with regular reporting of emissions used as a performance indicator.

Due to the lag time between certain initiatives to save energy, fuels and carbon and the corresponding carbon emissions reductions, it is recommended that Network Rail consider other performance indicators to monitor CP7 decarbonisation performance. This is particularly important for the ZEV transition, which is not linear in the expected profile of delivery of ZEVs in CP7.

In addition, CP7 decarbonisation forecasts prepared by Regions suggest that the 21% carbon reduction target could be well exceeded, through successful delivery of the ZEV transition, energy

efficiency and renewables projects, alongside grid decarbonisation. Grid decarbonisation is a major driver, but is outside of Network Rail's control.

Network Rail has indicated in the national SBP the intention to deliver at least one direct-wire PPA for renewable non-traction energy during CP7. It is not clear to the IR whether Network Rail has defined how the carbon benefits of this PPA (and any other future PPAs) will be equitably divided by the Regions.

The IR finds that there is an opportunity to set a further ambition for non-traction Scope 1 and 2 carbon emissions reductions in CP7, which aligns more specifically with the Regions' forecasts and adopts a metric which excludes grid decarbonisation.

Key Finding 7: Network Rail has no policy on carbon offsetting. Scotland's Railways has included offsetting within its CP7 decarbonisation forecast and has secured funding for kick-starting local offsetting schemes during CP7. The IR has not seen any evidence that Network Rail has developed a policy on carbon offsetting, or agreed on how offsetting can or cannot be used in relation to the HLOSs requirements and CP7 decarbonisation plans.

It is unclear to the IR what the Network Rail or ORR policy is in relation to offsetting, and the role this could play (likely beyond CP7) in tackling Network Rail's residual Scope 1 and 2 emissions.

Key Finding 8: Scope 1 emissions from SF6 use in electrical switch gear and refrigerant losses from cooling systems have not been considered in Network Rail's CP7 decarbonisation forecasts. The focus of the CP7 decarbonisation forecasts is on car and van fleet fuel (the ZEV transition) and energy (electricity and natural gas) as these dominate Network Rail's Scope 1 and 2 carbon footprints. There is a further group of sources which are either not considered by Network Rail, or it is unclear to the IR whether they are included in the Scope 1 and 2 carbon footprint and CP7 forecasts.

Scope 1 emissions sources not considered by Network Rail in CP7 decarbonisation plans are SF6 (a greenhouse gas use in electrification systems) and gas oil (primarily used for emergency standby generators).

Scope 1 emissions source not accounted for anywhere in Network Rail's Scope 1 and 2 carbon footprints are refrigerant gases used in cooling systems and some fire suppression systems.

A summary of the key recommendations from the review is provided in the table below.

Key Finding		Recommendation	Priority
Key Finding 1	There is inconsistency in approach to CP7 forecasting between Regions, but they are all likely to deliver the target.	Network Rail should develop a guidance framework to support and assist Regions and central functions in the forecasting and reporting of CP7 Scope 1 and 2 carbon emissions. The framework may include written guidance, tools, briefings or workshops and Network Rail should consider including the following in such a guidance framework: • Agreed carbon emissions factors for energy and fuels, taking account of grid decarbonisation and planned PPAs; • Guidance on appropriate assumptions in relation to BAU energy efficiencies to apply to the forecasts; • Guidance on approaches to estimating electricity consumption from electric vehicles, and assumptions on fleet rollout; • Advice on treatment of sub-metered tenant energy from the energy consumption data; • Advice on treatment of uncertainty; and • An agreed set of deliverables for the CP7 plan, (e.g., waterfall charts, year-by-year carbon emissions trajectory, written plan, supporting evidence).	**High**
		Regions should develop updated CP7 decarbonisation forecasts to include year-by-year carbon emissions trajectories for CP7 to show the anticipated glide path for decarbonisation through CP7 and allow better monitoring of progress towards the decarbonisation target. Updated forecasts should adopt aligned assumptions guided by the recommendation for a guidance framework set out above.	**Medium**
	The IR has not seen evidence that Route Services has fully	Route Services should develop a CP7 carbon emissions forecast and decarbonisation plan.	**High**

Key Finding 2	quantified its Scope 1 and 2 emissions, developed a CP7 decarbonisation plan or have confidence that Route Services can meet the CP7 carbon reduction target.	Route Services should quantify Scope 1 carbon emissions from rail-based machines and include these in its baseline carbon footprint and future decarbonisation plans.	**High**
		Route Services should develop or demonstrate the existence of a process of reporting and governance of its Scope 1 and 2 carbon emissions.	**Medium**
Key Finding 3	The IR has seen insufficient detail in plans for the ZEV transition to have confidence in its success.	Network Rail should undertake a detailed review of the ZEV transition programme and implement a strategy for successful delivery of the required infrastructure across Network Rail, which will allow for setting of appropriate leading and lagging performance indicators to track success or identify delay in the ZEV transition, setting the focus on infrastructure delivery before vehicle procurement.	**High**
Key Finding 4	Network Rail's Scope 1 and 2 carbon footprint would benefit from re-baselining.	Network Rail should consider re-baselining its Scope 1 and 2 carbon emissions prior to CP7 to take into account data cleansing in CP6.	**High**
		Network Rail should agree a consistent approach to treatment of tenant's energy within the carbon emissions reporting, in the event that further sub-metering of energy occurs during CP7.	**Medium**
Key Finding 5	The framework for assurance and governance of CP7 decarbonisation performance is not well developed.	Network Rail should set out a clear process to assure the Region and Route Services plans and delivery.	**Medium**
Key Finding 6	Additional performance indicators and targets for CP7 could be developed to assist in measuring the success of CP7 decarbonisation plans and increase ambition.	Network Rail should develop additional performance indicators to track key decarbonisation measures in CP7, in particular the ZEV transition and planned and costed energy efficiency measures.	**High**
		Network Rail should consider the development of further ambition target for Scope 1 and 2 carbon emissions. This should be linked to the level of ambition set by the Regions and the degree to which CP7 carbon emissions are forecasts and may be	**Medium**

		Region or function specific. To focus any such target on measures over which Network Rail has control, grid decarbonisation (other than via direct wire PPAs) should be discounted from the target.	
		Network Rail should define how to equitably divide the carbon emissions benefits of non-traction PPAs between the Regions and central functions.	**Medium**
Key Finding 7	Network Rail has no policy on carbon offsetting.	Network Rail should develop a policy on the role of offsetting and how this can be investigated and used by Regions to offset residual Scope 1 and 2 emissions for CP8.	**Low**
Key Finding 8	Scope 1 emissions from SF6 use in electrical switch gear and refrigerant losses from cooling systems have not been considered in Network Rail's CP7 decarbonisation forecasts.	Network Rail should commission a study to assess SF6 use and emissions on the network and undertake an optioneering study to identify potential strategies to reduce or eliminate SF6 gas use and release.	**Low**
		Network Rail should work to assess and quantify refrigerant use in Network Rail assets, estimate annual emissions from refrigerant leakage and include these emissions in ongoing Scope 1 and 2 carbon emissions reporting.	**Low**

1. CONTENTS

1. INTRODUCTION

The Office of Rail and Road (ORR) and Network Rail are seeking to understand if Network Rail's Strategic Business Plan (SBP) forecasts of Scope 1 and 2 carbon emissions are realistic and supported by robust benchmarks, management and operational approaches for the period known as Control Period 7 (CP7).

1.1 Context

ORR seek to understand the extent to which Network Rail's forecasts and strategies for reducing its Scope 1 and 2 carbon emissions during Control Period 7 (CP7) are robust, adequately planned and evidenced, and sufficiently ambitious. CP7 runs from April 2024 to March 2029.

In the role as Independent Reporter (IR) and AMCL-led team comprising AMCL, AQC, CPCS, and Eracura was appointed by ORR and Network Rail to undertake a review of Network Rail's CP7 Scope 1 and 2 carbon emissions forecasts for CP7.

Scope 1 carbon emissions are direct emissions associated with Network Rail's assets. These are primarily diesel fuel consumption in Network Rail vehicles. Scope 2 carbon emissions are related to the generation of energy (electricity) purchased and consumed by Network Rail.

Within this report, the term 'carbon' is used for simplicity as a general term to refer to all Greenhouse Gas (GHG) emissions. The work is not limited to carbon (in the form of carbon dioxide), but all GHG compounds where relevant to Network Rail emissions. The term carbon is consistent with the terminology used in the National High Level Output Specification (HLOS) and Scottish HLOS and Network Rail's SBPs.

Network Rail carried out an analysis of its Scope 1 and 2 carbon emissions in 2019 and developed a Science Based Targets (SBTi) trajectory for reducing its Scope 1 and 2 emissions in line with a pathway consistent with maintaining global average temperatures below 1.5 degrees above pre-industrial levels. In response to the SBTi report, a 46% reduction target has been adopted by Network Rail for its Scope 1 and 2 emissions, with an interim target of 25% reduction by CP6 exit in March 2024, and a further 21% reduction from a CP6 exit baseline required during CP7.

The IR was commissioned to undertake a review of the approaches adopted across the Regions to forecasting Scope 1 and 2 carbon emissions through CP7 and their plans and strategies to reduce emissions and achieve the 46% reduction target by CP7 exit (compared to a CP5 exit baseline position). The work has been informed through desktop reviews of information, supplemented with remote interviews and meetings with regional carbon and energy leads, Route Services and the Technical Authority (TA), all though MS Teams.

1.2 Objectives

The objective of this IR work package is to review Network Rail's work to develop CP7 forecasts and strategies for Scope 1 and 2 carbon emissions and establish whether they are robust, in particular whether they have set the correct level of ambition and whether Network Rail has taken a reasonable approach to the level of uncertainty around its forecasts and the risks to delivery. This will feed into ORR's work for the Periodic Review 23 (PR23) in advance of CP7.

1.3 Key Requirements

The Scope requires a review of:

- Expectations relating to performance with reducing Scope 1 and 2 carbon emissions both on an annual basis and across the whole five years of CP7 (tier 1 measure in ORR's outcomes framework);
- The alignment of forecasts with the strategy and activities set out in the SBP to deliver the above tier 1 outcome.

The review has been undertaken to appraise Network Rail's approach to developing its decarbonisation plans for CP7 and forecasting of carbon emissions performance through CP7 to CP7 exit in 2029.

ORR has requested assurance or otherwise in the robustness of the plans and to understand where best practice lies and how plans can be improved to better ensure success in meeting the HLOSs requirements and carbon reduction performance target.

The key area of focus for this IR activity is on the 46% carbon reduction target (to be achieved by CP7 exit relative to a CP5 exit baseline). However, the key question remains "are Network Rail's plans and forecasts for CP7 decarbonisation robust and well evidenced?" This is broken down into the following series of top-level questions to be answered during the Stage 1 review:

- Has Network Rail taken a reasonable approach to developing its Scope 1 and 2 carbon emissions forecasts for CP7 and set realistic success measure forecasts, taking all circumstances into account?
- Are approaches consistent across all Regions. If not, how do approaches taken by different Regions compare, e.g., is there best practice?
- Are the forecasts supported by an appropriate level of detail in the plans to deliver the expected performance levels, including appropriate expression of uncertainty in the outputs?
- Has there been effective collaboration with the supply chain, stakeholders and partners in developing the forecasts, and are the dependencies clearly defined?
- Is there evidence that consistent and equitable approaches will be taken to reporting Scope 1 and 2 carbon emissions performance across the Regions, which demonstrate similar levels of innovation and effort set for all Regions?
- Do the targets set for Scope 1 and 2 carbon emissions provide sufficient ambition to deliver on HLOS requirements for England & Wales and Scotland and milestones set out in the DfT Rail Environment Policy Statement and Transport Scotland Rail Services Decarbonisation Action Plan?
- Is the level of ambition, governance, corporate strategy, and operating models across Regions and central functions realistic, sufficient or below the level needed to deliver targets against the CP7 baseline?
- Are there any key risks – threats and opportunities - that have not been taken into account?

Following the Stage 1 review (which this report relates to), there is a Stage 2 review to answer the following final question:

- Has Network Rail satisfactorily addressed specific issues raised in Stage 1?

The scope of works required all Regions and central functions be reviewed, although Scope 1 and 2 emissions from central functions are either included in the Regions, (e.g., TA) or are very small such that no carbon monitoring or reporting is undertaken. The exception is Route Services, which plays an

important role in the decarbonisation of Scope 1 and 2 emissions in CP7 through the management of the Zero Emission Vehicle (ZEV) rollout programme and manages the organisation's specialist rail fleet. The review therefore includes North West & Central (NW&C), Eastern, Southern, Scotland's Railway, Wales & Western and Route Services.

1.4 Methodology

1.4.1 Stage 1

The study is being conducted in two stages. As this report outlines the findings from Stage 1, the methodology below is focused on this first stage.

This stage was undertaken between April and July 2023 and is divided into two phases.

1.4.1.1 Phase 1

This commenced with an inception meeting where the IR resource team and the client representative team (representatives from ORR and the Network Rail TA) met to discuss the project and share available information.

Following the meeting a revised timeline was produced by the IR to account for a later than expected starting date.

As there was limited available technical information to review it was agreed with the client that the IR would make contact with all five Regions with the purpose of arranging meetings to discuss the various approaches taken and to extract as much detailed information as was available at that time. All Regions were contacted by the IR outlining the information request and explaining the purpose of the project.

Initial meetings were held with all five Regions between 17th April and 2nd May 2023. Meetings were routinely held with the sustainability lead and if appropriate the carbon/energy lead, noting that the structure differs between Regions.

Regions were asked to provide:

- The range of activities and sources included in each baseline footprint;
- The sources of activity data (such as fuel and energy consumption);
- Key assumptions or uncertainties in the activity data;
- The emissions factors applied to calculate the carbon emissions; and
- Any variation in the application of the methodology across central functions and the Regions.

Where available the Regions were also asked to provide:

- The processes and assumptions associated with forecasting activity data and emissions through CP7;
- The approach to developing forecasts and assumptions through collaboration with suppliers and stakeholders;
- The trajectory of CP6 performance (where data exists);
- Key assumptions and milestones within each trajectory (e.g., replacement/rollout of heating plant or vehicle fleets);
- Risks or threats identified to the delivery of the trajectories;
- The supporting detail relating to the forecasts and trajectories; and

- The financial provisions made to support the delivery of the above.

The purpose of this stage was to understand the baseline and approach by each Region to ensure parity in the comparative review work and consider each plan in the context of best practice, for example, that the approach is consistent with the Greenhouse Gas Protocol.

The IR sought information on Network Rail's performance during CP6 to help guide and identify risks and opportunities with respect to decarbonisation during CP7. This included the Scope 1 and 2 carbon performance through CP6 as well as the level to which CP6 targets relating to operational investment and carbon reductions were achieved.

Each Region shared CP7 forecasts and outlined which activities were contributing to the decarbonisation trajectory. At this initial meeting all the data and assumptions underpinning the trajectories were not shared, and the majority of the information was shared subsequently.

The IR team reviewed all the information sent and held a second series of meetings with the Regions to check findings and assumptions and to seek further clarification where necessary. All meetings were completed by 8th June 2023.

Following meetings with all Regions, it became apparent that additional meetings needed to be held with:

Route Services

An initial meeting was held with the Head of Environment and Sustainability to discuss how Route Services was accounting for carbon emissions within their portfolio. As a result of this initial meeting, additional information was sought from:

- Decarbonisation Programme;
- Road Fleet;
- Rail Fleet and Engineering; and
- Air Operations, Asset Information Services.

Further meetings were held with Road fleet and Rail fleet and engineering teams at Route Services, and Air operations provided information in response to email questions from the IR.

Technical Authority – Senior Analyst

A meeting was held with the Senior Analyst (Low Emissions) to understand the approach taken to Scope 1 emissions accounting and addressed all fuel and emission sources. Discussions were held to understand how NR's internal carbon reporting tool works including the various inputs and outputs.

1.4.1.2 Phase 2

This phase examined in detail the information provided by the Regions, Route Services and the TA. It involved considering each of the proposed measures and incentives to eliminate, reduce or substitute Scope 1 and 2 emissions within the strategies. For each forecast/strategy the review and evaluation considered:

- The robustness of measures, actions and assumptions relating to decarbonisation;
- The ambition of the plans;
- Uncertainty in the forecasting and how it is expressed;
- The control of each central function and Region to deliver the measures, or reliance on other stakeholders and organisations;
- Any key risks that have not been adequately addressed; and

- The extent to which activity in the forecast / strategy is aligned to the provision of funds within the Statement of Funds Available (SoFA).

Evaluation of the forecasts and strategies for the central functions and Regions has considered the measures built into the plans to reduce emissions in terms of their impact on operations, (i.e., the level to which measures impact on the way Network Rail operates), the economic feasibility and the technological feasibility of measures and actions.

The aim has been to identify where best practice has been applied and any central functions or Regions where best practice has not been adopted. Within Network Rail best practice and guidance is usually set by the TA in the form of standards. No evidence has been provided to the IR of standards in relation to the methodology for Scope 1 and 2 emissions forecasting and reporting.

Limitations to Approach

The IR has only been able to review the information supplied by either the TA, Route Services or the Regions. The IR cannot influence the level of detail supplied. Where detail may have appeared to be lacking the IR has requested additional information or data to ensure that it had access to all the facts where possible.

It has not been possible to speak with the decarbonisation team at Route Services within this Stage 1 study and therefore it is unclear whether or to what extent a CP7 forecast, and decarbonisation plan has been developed for Route Services. Route Services Scope 1 and 2 carbon emissions as currently reported (see Appendix A) are a small component of the total Network Rail footprint, however as part of this review the IR has identified that fuel from Network Rail rail-based machines is potentially missing from Scope 1 and 2 emissions reporting. These emissions fall within the responsibility of Route Services and as such, inability to speak with the Route Services decarbonisation team potentially limits the IR's understanding of the reporting and decarbonisation plans for these rail-based assets.

No conversations have been held between the IR and the Energy Bureau who manage the Energy Link platform used for energy data metering and reporting. Each of the Regions and Route Services (plus the senior analyst at the TA interviewed by the IR) use and understand the platform and are responsible for use of the data for the carbon emissions reporting and forecasting. It is therefore not material to the findings and recommendations of the Stage 1 study but is also a recommendation for action during Stage 2.

1.5 Project Management

Two weekly project management meetings were held; an internal meeting for all members of the IR team and a client meeting attended by the IR team and members of ORR and Network Rail TA. The meetings were used to highlight issues encountered, predominantly around staff availability to attend meetings and data provision. Any impacts on the project delivery programme were clearly outlined and remedial actions agreed to.

2. NETWORK RAIL'S CARBON FOOTPRINT

This section provides an overview of Government aspirations for reducing carbon emissions and Network Rail's carbon footprint.

2.1 UK Targets

The UK Government has set out to remove all diesel-only trains (passenger and freight) from the network by 2040, to achieve their goal of reaching a net zero railway network by 2050 and maintaining significant emission reductions along the way. The Scottish Government has set out plans to decarbonise rail traction energy through the removal of diesel passenger trains from the Scottish network by 2035 and achievement of a net zero railway network by 2045.

2.2 Network Rail's Targets

The IR has had sight of Network Rail's 'Strategy to Achieve Science-based Targets' Report prepared by Carbon Credentials and dated 2019. This recommended targeting an absolute Scope 1 and 2 GHG emissions reduction of 46% by 2029 from a 2019 base year (calendar year). It made the following further recommendations:

- **Set an ambitious science-based target:** Network Rail has modelled a 1.5°C target using the SBTi Absolute Contraction Methodology resulting in a reduction in absolute Scope 1 and 2 emissions of 46% by 2029.
- **Commit to procuring 100% renewable electricity by the end of CP7:** This would significantly help Network Rail to stay on track with targets, but it is understood that this could happen as early as April 2020.
- **Commit to an entirely zero emission vehicle fleet by 2047:** To stay on track with targets, the switch away from fossil fuel burning vehicles must take place by 2047. Despite this, the switch to ZEVs could happen as early as 2028 in line with the Clean Van Commitment, which Network Rail has publicly supported and to avoid reputational damage Network Rail should follow through with this commitment.
- **Create a roadmap for how Network Rail will improve its capabilities to meet carbon targets:** Workshops identified significant opportunity to improve Network Rail's capabilities on energy and carbon management. These outputs need to be developed into an implementation plan that confirms how improvements will be made and targets will be met.

Network Rail went on to commit to decarbonise their Scope 1 and 2 emissions by 46% by the end of CP7 in their 'Our ambition for a low-emission railway 2020-50'[i] in October 2020 as shown in Figure 2.0 below. Their SBTI report modelled two decarbonisation scenarios and concluded that Scope 1 and 2 emissions could be reduced by up to 79% by the end of the CP7 period, which was based on the successful delivery of direct-wire Power Purchase Agreements (PPAs) for renewable energy (which is a Network Rail target for 2030, at the start of CP8).

The IR notes that the Figure 2.0 implies the emissions reduction also applies to Scope 3 emissions, but the IR has not seen evidence from Network Rail to corroborate this and it is understood that the target only applies to Scope 1 and 2 emissions.

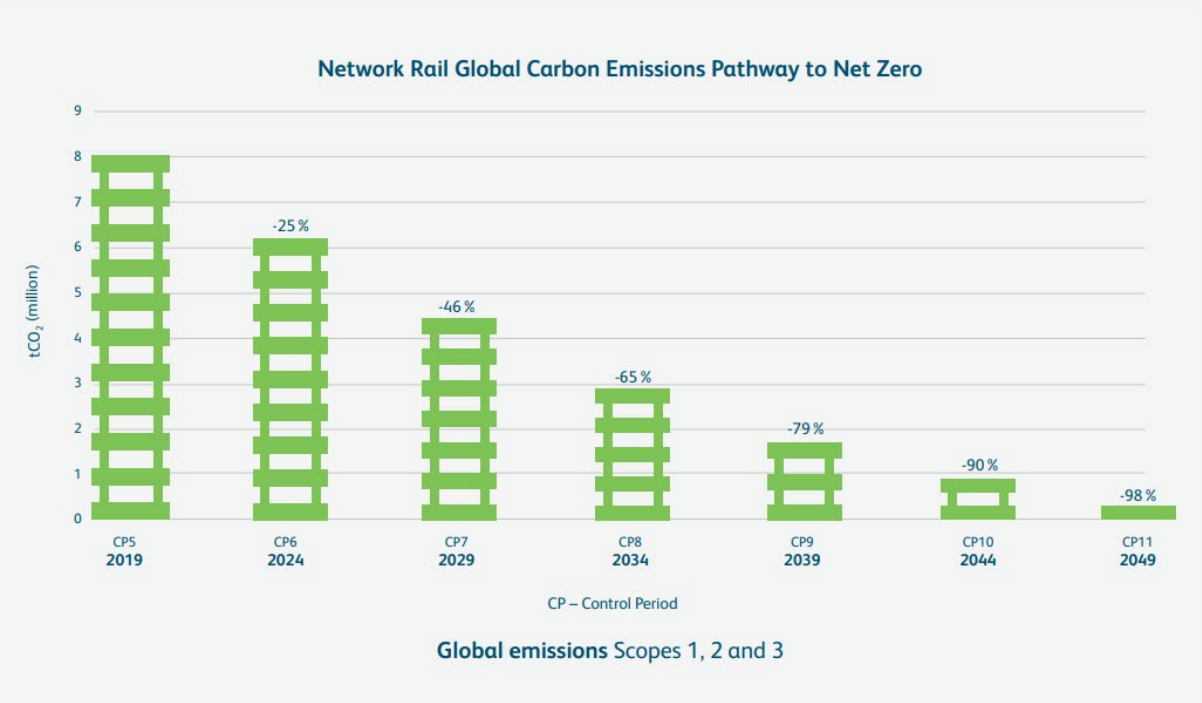

Figure 2.0: Network Rail Carbon Emissions Pathway to Net Zero

In focussing on Scopes 1 and 2, Network Rail commit to sourcing 100% of non-traction electricity from renewable generation by 2030, converting their entire road fleet to ZEVs by 2035 and minimising energy use at the offices, depots and stations that they manage and to look for innovative ways to reduce energy throughout their infrastructure. They also set out a target to reduce non-traction electricity and gas use by 18% by the end of 2023 to 2024 (CP6 exit).

2.3 Network Rail's Scope 1 and 2 Carbon Emissions

For ORR to understand the extent to which Network Rail's forecasts and strategies to reduce their emissions are robust, data provided within the Network Rail Emission Reporting Tool was used to analyse emissions from energy and fuel consumption.

Network Rail's carbon emission calculation tool is set up to take in energy and fuel data and provide output period reports and annual reports. The tool calculates the total Scope 1 and 2 carbon emissions for Network Rail, at a regional and national level for FY18/19 to FY22/23. Network Rail's route services are categorised into different Regions, including Eastern, North West & Central, Scotland, Southern, and Wales & Western.

Table 2.0 below shows the total Scope 1 and 2 emissions by each Region in tonnes CO_2e. Data are from the latest version of Network Rail's internal emissions reporting tool.

2.3.1 Network Rail's Scope 1 and 2 Emissions by Region

Table 2.0: Network Rail's Scope 1 and 2 Carbon Emissions by Region (TCO_2e)

Region	18/19	19/20	20/21	21/22	22/23
Eastern	56,286	52,555	51,358	46,417	43,273
North West & Central	52,253	50,603	46,182	43,416	40,431

Scotland's Railways	19,939	18,593	18,222	17,008	16,318
Southern	42,105	42,076	42,046	35,994	32,626
Wales & Western	36,764	34,531	30,023	26,031	24,896
Other (incl. Route Services)	8,808	8,685	7,876	8,471	6,597
Total	216,154	207,042	195,708	177,336	164,142

Scope 1 carbon emissions are direct emissions associated with Network Rail's assets. These are primarily diesel fuel consumption in Network Rail vehicles. Scope 2 carbon emissions are related to the generation of energy (electricity) purchased and consumed by Network Rail.

To provide context to the Scope 1 and 2 emissions against the total carbon footprint (including Scope 3) of Regions, Scotland's Railways has provided a percentage breakdown of their emissions, shown in Figure 2.1 below. The percentage breakdown highlights Scotland's Scope 1 and 2 emissions which make up 3% of their total Regional carbon footprint. It should be noted that this analysis is based on a high-level assessment of spend data, and the values will not be as accurate as an assessment based on volume of materials purchased data. It nonetheless provides some context to the breakdown between Network Rail's Scope 1, 2 and 3 emissions. The proportion of Scope 1 and 2 emissions to total carbon footprints across all Network Rail Regions and central functions is likely to be similar to that shown for Scotland.

2.4 Scotland's Scope 1, 2 & 3 Emissions Breakdown

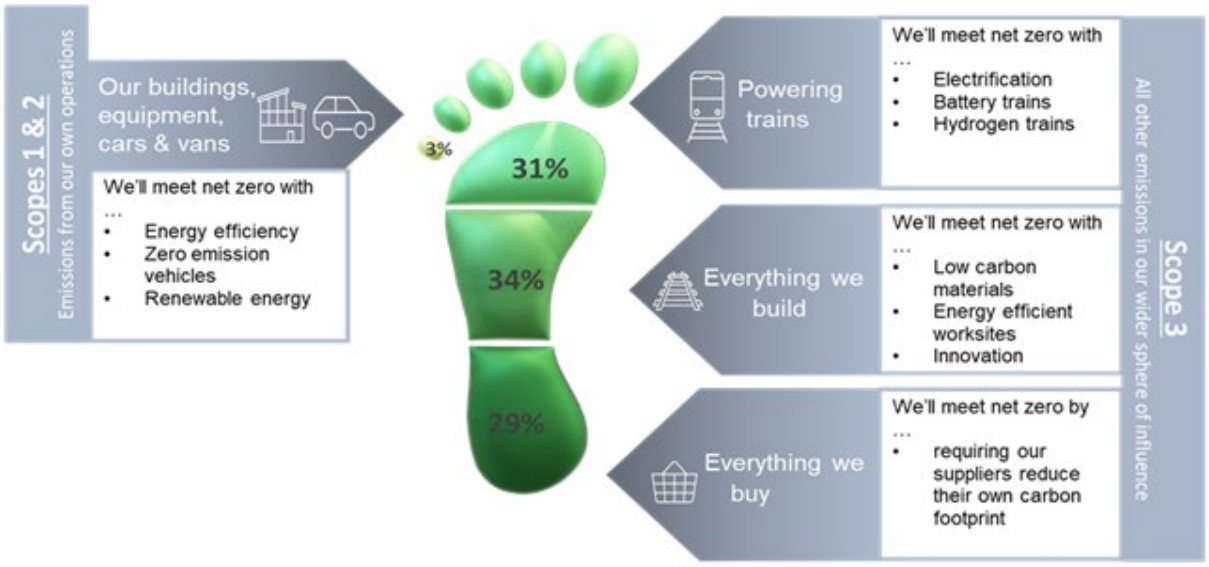

Figure 2.1: Scotland's Scope 1, 2 & 3 Emissions Breakdown

2.5 Network Rail's Scope 1 and 2 Emissions Source Breakdown

Network Rail's Regional leads have provided data on the annual breakdown of emissions (tCO_2e) from Scope 1 and 2 energy sources.

Scope 1 emission sources include natural gas, fleet fuel (diesel, unleaded petrol and LPG), bottled LPG, gas oil and SF6. Scope 2 emission sources include the electricity purchased and consumed by each Region. The tables in Appendix A show the regional emission source breakdown and the percentage contribution of each source to the overall footprint for FY18/19 to FY22/23.

2.6 Progress to date

Progress in relation to the carbon and energy targets during CP6 is summarised in Table 2.1 below. These data have been provided directly to the IR from the TA with up-to-date data and may show some minor variances to the data presented in Network Rail annual return tables. Where Network Rail are on track against the target, cells are highlighted blue and where off track or not on target cells are highlighted orange.

Table 2.1: Network Rail Progress Against CP6 Carbon and Energy Targets

	Carbon Emissions				**Energy Consumption**			
Year	**19/20**	**20/21**	**21/22**	**22/23**	**19/20**	**20/21**	**21/22**	**22/23**
Eastern	6.6%	8.8%	17.5%	23.1%	1.6%	4.8%	11.4%	15.9%
North West & Central	3.2%	11.6%	16.9%	22.6%	-5.0%	6.6%	4.3%	9.1%
Scotland's Railways	8.2%	10.0%	16.0%	19.4%	0.9%	3.4%	7.2%	3.5%
Southern	0.1%	0.1%	14.5%	22.5%	-7.4%	-9.8%	1.2%	8.2%
Wales & Western	6.1%	18.3%	29.2%	32.3%	-3.2%	9.4%	18.3%	18.9%
Other (incl. Route Services)	1.4%	10.6%	3.8%	25.1%	-1.0%	15.5%	-4.5%	21.5%
Total	**4.4%**	**9.6%**	**18.1%**	**24.2%**	**-2.9%**	**3.1%**	**7.9%**	**12.1%**
Target	**5.0%**	**10.0%**	**15.0%**	**20.0%**	**4.0%**	**7.8%**	**11.5%**	**15.1%**

Network Rail has been on target for carbon through CP6 overall, with most Regions either meeting or close to the target trajectory as of FY22/23. All Regions and other services (including Route Services) are either above or within 1% of the target as of FY22/23.

Network Rail is not (as of FY22/23) on track to meet the energy reduction target, with several Regions falling behind the target trajectory. A number of Regions reported policy changes related to COVID-19 safety as a reason for this (for example running HVAC systems at higher load due to not recirculating internal air) which affected both FY20/21 and FY21/22.

Network Rail has been able to keep on track with the carbon target while falling behind on the energy target largely due to decarbonisation of grid electricity, (i.e., a reduction in the carbon emissions from electricity generation). The relevance of this with respect to CP7 forecasting is discussed in Section 9.5.

The tables in Appendix A provide further details of Regional carbon emissions and fuel and energy consumption breakdown by source to the overall footprint for FY18/19 to FY22/23.

3. REQUIREMENTS FOR NETWORK RAIL

This section provides a high-level overview of the Scope 1 and 2 management processes and oversight and assurance at the national level within Network Rail.

The IR researched the planning processes, as defined at the national level by ORR and TA, to gain an understanding of what the Regions and Route Services had been asked to respond to.

3.1 Requirements from Government and ORR

3.1.1 Rail Policy – England and Wales

The DfT's overarching aspirations for Network Rail's environmental sustainability work are set out in the Rail Environmental Policy Statement[ii]. Chapter 8 of the Statement relates to Non-Traction Decarbonisation: Decarbonising the Rail Estate and states:

"*Decarbonising transport: a greener, better Britain sets out our ambitious plans to reduce tailpipe emissions from transport but, to reach net zero carbon emissions across the UK economy, we will need to go further and decarbonise the entire rail estate. This includes emissions from the 2,500 railway stations and more than 500 depots, maintenance and related facilities in Great Britain, as well as the whole-life carbon emissions of maintenance and construction on the rail estate. A joined-up approach led by Great British Railways, with supply chains and retailers, will be vital to help us achieve net zero carbon emissions across the non-traction elements of our railway.*"

"Network Rail has a fleet of 9,550 road vehicles to support its functions and train operating companies are likely to own and operate further vehicles. Along with the wider Government Fleet Commitment, Network Rail has committed to transition its cars and vans to zero emission vehicles by 2027.

Network Rail has identified ten potential pilot sites based on their energy capacity and vehicle usage for a major electric vehicle feasibility study. In 2019-20 Network Rail's fleet generated an estimated 48,600 tonnes of CO_2, equivalent to more than 110,000 barrels of oil. By transitioning to zero emission vehicles, all these emissions could be removed at the tailpipe and by producing or purchasing renewable energy to power these vehicles, Network Rail will ensure that as many of these emissions are removed as possible. Some emissions will remain from the production of the vehicles and batteries.

What We Want to Achieve

While challenging, we expect Network Rail and Great British Railways to meet or exceed the Government Fleet Commitment targets. We will also ask Network Rail to undertake a study to examine whether this number of road vehicles is necessary."

3.1.2 Rail Policy - Scotland

Transport Scotland set out their plan to decarbonise rail services in Scotland[iii]. This action plan focusses on decarbonising transport through modal shift to rail, and decarbonising rail traction energy through the removal of diesel passenger trains from the Scottish network by 2035. It does not specifically deal with non-traction emissions, although there is a Scottish Government target to achieve a zero-emission railway in Scotland by 2045, which will include both traction and non-traction emissions.

3.2 Network Rail Internal Requirements

3.2.1 Control Period 6 (April 2019 to March 2024)

During CP6 Network Rail has targets to reduce energy consumption by 18% and non-traction carbon emissions by 25% from a CP5 exit baseline by CP6 exit in March 2024. Carbon and energy performance is directly tracked through periodic, quarterly and annual reporting of carbon emissions and energy consumption. Wider environmental performance has also been tracked using the composite Environmental Sustainability Index (ESI) indicator. This covers:

- % non-hazardous waste reused or recycled;
- % non-hazardous waste diverted from landfill;
- % non-traction carbon emissions (tCO_2e) vs CP5 exit; and
- % non-traction energy usage (kWh) vs CP5 exit.

Carbon emissions and energy usage elements of the measure are weighted highest at 40% each, while the two waste elements are 10% each.

In the year 2021-22 ORR reported that Network Rail exceeded its network-wide targets for reusing or recycling waste, diverting waste from landfill and reducing non-traction carbon emissions. It finished behind target for reducing non-traction energy use, partly due to the increased activity in its stations.

ORR has indicated a continuing issue of accurate energy data reporting and associated governance by Network Rail, which has undermined accurate ESI reporting.

ORR undertook an Independent Reporter Review of Environmental Sustainability Data in 2021 (on data for April 2019 to March 2020) which made a number of process recommendations. It is understood by the IR that following this report, and related work in Network Rail, new environmental sustainability measures are being developed and agreed between Network Rail and ORR to potentially replace the ESI ahead of or during CP7.

CP6 Reporting Requirements

Regional Submissions

Network Rail has set up an internal energy accounting platform called Energy Link, which is used to compile energy metering and billing data centrally within the organisation. Data is extracted from the Energy Link periodically by the Energy Bureau team and reported to the TA for input into the carbon and energy reporting tool, which tracks performance against the ESI energy reduction target. This data is shared with the Regions and they are required to assure the period reports within one week. The Regions can make adjustments based on a more detailed audit of the Energy Link data for a given period.

Route Services Submission

As part of this review, the IR held discussions with a number of teams within Route Services including sustainability, road fleet, rail fleet and engineering and air operations. The IR has not seen evidence that Route Services report non-traction Scope 1 and 2 emissions performance or have prepared a decarbonisation forecast for CP7. However, the IR has not been able to speak directly with the Route Services Decarbonisation team during this Stage 1 review. Findings and recommendations within this report relating to Route Services CP7 decarbonisations plans and forecasts are therefore based on the information available to the IR at the time. Further evidence of Route Services' decarbonisation plans that may be provided by the decarbonisation team can be reviewed during Stage 2 of the study.

3.2.2 Control Period 7 (April 2024 to March 2029)

CP7 Requirements England and Wales

The formal requirements for Network Rail covering England and Wales for CP7 are set out in the HLOS issued by the Secretary of State (SoS) for Transport[iv].

Paragraph 18 states:

"*...To that end he expects clear evidence of an improvement in productivity and year-on-year efficiencies. He expects an ambitious yet realistic approach, with clear evidence of benchmarking by NR Region to drive efficiencies and a better understanding of costs. He also expects clear evidence of the use of broader initiatives to ensure accelerated delivery and more efficiency delivery, to drive improvement, as well as close, effective collaboration with the supply chain to drive efficiencies. He expects the use of ambitious yet realistic approaches where the achievement of further efficiencies is no longer appropriate, throughout all of these including considerations for making progress on climate change adaptation and decarbonisation within delivery. The Secretary of State is clear that Network Rail should continue to take measures to properly scope the cost of projects before commencement to support efficient delivery.*"

Paragraph 31 states:

"The Secretary of State expects that Network Rail will make progress on the goals of moving towards a low-emissions railway and pursuing decarbonisation objectives, alongside optimising the social value of rail infrastructure to as great an extent as is reasonably possible. This includes the consistent measurement and management of whole life carbon for all schemes (construction, renovation and maintenance) according to industry standards and guidance. Schemes are expected to set and monitor reductions targets against baselines, enlisting a range of decarbonisation mechanisms at all stages of the project lifecycle, prioritised according to the Institute of Environmental Management and Assessment's Greenhouse Gas Management Hierarchy. This includes driving carbon reductions by decreasing the volume of materials, adopting low-carbon technologies and finding efficiencies in operation."

And paragraph 33 states:

"*Beyond this, Network Rail will continue to make progress against cross-cutting government sustainability and broader environmental targets and obligations, including contributing to the achievement of Net Zero by 2050, the Greening Government Commitments and the improvement of air quality.*"

Government Targets on Fleet Decarbonisation

As noted above the UK Government as part of its Greening Government Commitments[v] set the following requirement:

"*Meet the Government Fleet Commitment for 25% of the government car fleet to be ultra-low emission vehicles (ULEV) by 31 December 2022, and for 100% of the government car and van fleet to be fully zero emissions at the tailpipe by 31 December 2027.*"

This requirement applies to Network Rail in England and Wales.

CP7 Requirements Scotland

The formal requirements for Network Rail covering Scotland for CP7 are set out in the HLOS issued by the Scottish Transport Minister[vi]. It sets out the following requirements:

Paragraph 3.36: *In order to ensure that reduction in environmental impact is demonstrable and clear, the Scottish Ministers require Network Rail to continue to improve data accuracy on carbon emissions, in particular Scope 3 data, to enable continuous carbon emissions reductions, which is normalised to cover passenger and freight volumes and set against the baseline of 31 March 2019. The metric must be*

developed with regard to Scottish Government environmental legislation and working in collaboration with Transport Scotland, Scottish Rail Holdings, ScotRail Trains Ltd and other stakeholders and be in place by 31 March 2024.

Paragraph 3.37: *During CP7, Scottish Ministers expect Network Rail to:*

- continue to deliver a sustainability strategy which makes progress towards net zero including the Scottish Government interim and subsequent climate change targets (2030 and 2045 respectively) [Scottish Government targets are 75% reduction by 2030 and net zero by 2045 compared to a 1990 baseline]
- develop and deliver a metric which must continually deliver energy and carbon reduction activities to reduce Scope 1 and 2 emissions against the baseline of 31 March 2019.....

Paragraph 3.38: *In developing metrics for the delivery of the sustainability strategy, Scottish Ministers require Network Rail to improve data maturity by increasing the range of carbon emissions data reported to include Scope 3.*

Paragraph 3.39: *Metrics must be developed aligned to the Scottish Government's environmental legislation and agreed with input from Transport Scotland, Scottish Rail Holdings, ScotRail Trains Ltd. and ORR. Agreed targets will be set in advance of and measured throughout CP7.*

Scottish Requirements on Fleet Decarbonisation

The UK Government Greening Government Commitments do not apply in Scotland, but Scotland's Railways has reported to the IR that Transport Scotland has asked Network Rail to achieve the same outcome, in regards to fleet decarbonisation, by 2030.

CP7 Measures

ORR's Periodic Review 2023 in preparation for CP7 includes agreeing a set of success measures and supporting measures. Their conclusions[vii] set out their intention to require Network Rail to report on the following:

Success Measures (Tier 1):

- Biodiversity units; and
- Carbon emissions Scope 1 and 2.

Supporting Measures (Tier 2):

- One planet indicator (One Planet Index (OPI) - composite measure made up of indicators grouped into 6 categories: waste, water, energy, refrigerants, materials and business travel);
- Carbon emissions Scope 3; and
- Air quality at stations.

The IR understand that the OPI has subsequently been further developed and Network Rail are in the process of developing new environmental sustainability measures for agreement with ORR and implementation ahead of or during CP7 (currently in the internal governance process for final approval). For the purposes of the scope of this report it is noted that a success measure will be Scope 1 and 2 carbon emissions. A summary of ORR conclusions pertinent to climate change mitigation is presented in Table 3.0 below.

Table 3.0 Relevant ORR CP7 Outcome Measures Conclusions

Outcome area	Measure	Tier	Description	Monitoring Focus
Environmental Sustainability	Carbon emissions Scope 1 and 2	Success	All Scope 1 and Scope 2 carbon emissions as defined under the Greenhouse Gas Protocol. Scope 1 emissions are all direct emissions from the activities of the infrastructure manager or under its control including fuel (oil, gas) combustion on site such as gas boilers for heating and fuel for fleet vehicles. Scope 2 emissions are all indirect emissions arising from the generation of electricity purchased and used by the infrastructure manager.	GB, Region
Environmental sustainability	One Planet Indicator (OPI)	Supporting	The environmental footprint associated with resource consumption across six material categories (waste, water, energy, refrigerants, materials and business travel) expressed as an equivalent to planet area needed to sustain the resource consumption. The ideal is no more than a "one planet economy".	GB, Region
Environmental sustainability	Carbon emissions Scope 3	Supporting	Scope 3 emissions are all other indirect emissions (excluding emissions from electricity purchased) from sources that the infrastructure manager does not own or control, including business travel, production and supply of goods, products and materials in the supply chain, waste and water.	GB, Region

CP7 Targets

As previously mentioned, Network Rail has set a target to reduce Scope 1 and 2 emissions by 46% by the end of CP7 with an interim target of 25% reduction by CP6 exit in March 2024. If that target is achieved, a further 21% reduction is required during CP7. At present no target has been set for energy reduction in CP7. Scotland's Railway has an aligned carbon emissions reductions target.

CP7 Forecast Guidance

Network Rail provided the Regions with guidance on the objectives for the development of SBPs for CP7 which includes the requirement to provide a forecast of Scope 1 and 2 carbon emissions (see Appendix B). It is understood that Network Rail agreed that each Region should present the trajectories as a waterfall chart so that ORR can gain assurance on how the different programmes of decarbonisation activities proposed by Network Rail will contribute towards delivery of its 21% reduction in Scope 1 and 2 emissions over the course of CP7. The IR has not found any evidence of any specific guidance from Network Rail on the methodology for producing these waterfall charts.

3.2.3 Summary of Non-Traction Carbon-related Targets

- Government Fleet Commitment, to transition its cars and vans to zero emission vehicles by 2027 for England and Wales and Transport Scotland requirement for Scotland's Railway to transition its cars and vans to zero emission vehicles by 2030.
- Network Rail CP7 target to reduce Scope 1 and 2 emissions by 21% during CP7 (relative to CP6 exit) in line with a 46% target reduction by CP7 exit compared to CP5 exit baseline.

In producing the CP7 forecasts, Network Rail are expected to produce waterfall charts for CP7 Scope 1 and 2 carbon emissions to provide ORR with evidence to demonstrate the contributions of the plan's measures and initiatives to achieving the target 21% emissions reduction during CP7.

3.2.4 CP7 SBP Development Requirements

The TA has requested that the Regions prepare as part of the SBP submissions an:

"*Outline overarching approach to net-zero carbon emissions, improving air quality and reducing energy use. Include:*

- Implementation of energy / carbon reduction initiatives to support achievement of targets and air quality initiatives to achieve air quality targets."

This request was set out in E&S CP7 Guidance.pptx (see Appendix B).

4. ORGANISATION STRUCTURE

In relation to this project and reporting and forecasting of Scope 1 and 2 carbon emissions, Network Rail's organisational structure is summarised in Figure 4.0 below. Within the structure each Region has sustainability and carbon, and energy leads responsible for planning and delivery of energy and carbon projects, and the TA oversee periodic carbon and management and reporting. The roles identified in Figure 4.0 represent those interviewed (or approached for interview) by the IR during this study.

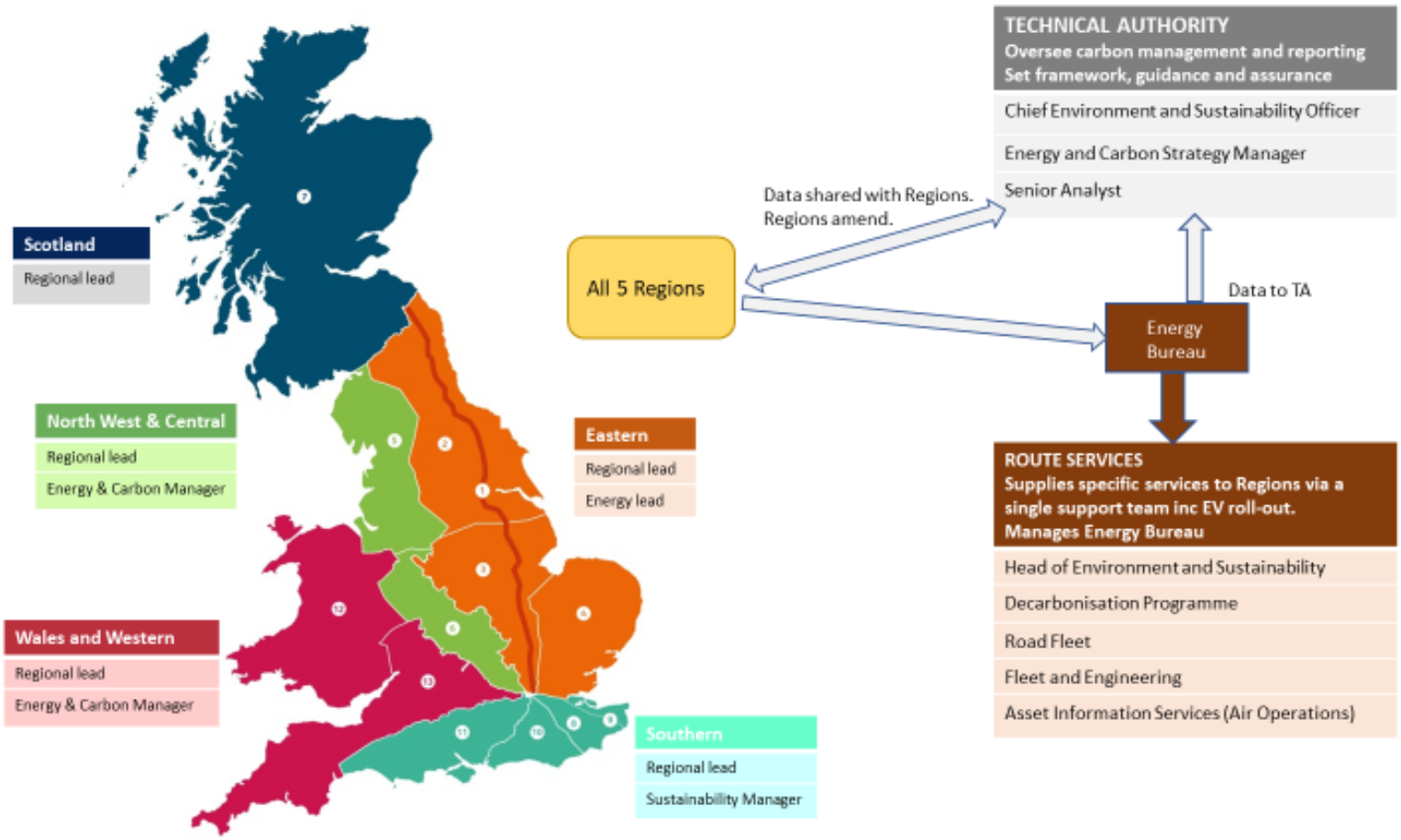

Figure 4.0: NR Organisational Structure

5. REVIEW OF STRATEGIC BUSINESS PLAN SUBMISSIONS

This section of the report provides a review of Network Rail's CP7 SBPs in relation to the commitments, objectives and targets for decarbonisation (specifically in relation to non-traction Scope 1 and 2 emissions) and relevant funding secured from the SoFA.

Network Rail has prepared 12 separate SBPs. These include an overarching national (England and Wales) SBP, and an individual SBP for each of the Network Rail Regions. In addition to these, there are SBPs for 6 central functions; Route Services, Technical Authority, National Communications, Human Resources, CFO Directorate and System Operator.

The key SBPs in relation to Scope 1 and 2 carbon emissions are the overarching national SBP for England and Wales, the 5 Region SBPs and the Route Services SBP, which are reviewed in this section. Brief commentary is also provided for the other central function SBPs for completeness.

5.1 National (England and Wales) SBP

Network Rail has consolidated the region and function plans to produce the national SBP. Chapter 8 of the national SBP sets out Network Rail's strategic plans for environmental sustainability in CP7, which includes decarbonisation.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in the national SBP:

- Progress towards net-zero carbon emissions by 2050;
- An ambition to achieve a 21% reduction in non-traction Scope 1 and 2 carbon emissions during the CP7 period (April 2024 - March 2029); and
- Target a reduction in non-traction Scope 1 and 2 carbon emissions of 46% by CP7 exit compared to a 2018-19 baseline (CP5 exit).

Network Rail also include a "risk-adjusted" forecast for Scope 1 and 2 emissions in the national SBP which is to achieve an 18% reduction in emissions during the CP7 period (3% below the 21% ambition). The IR found no detail in the SBP that explains the risk adjusted forecast.

Specific Measures and Initiatives

The national SBP includes the following references to specific measures and initiatives planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- A commitment to the introduction of a corporate power purchase agreement to be operational by 2024 which will provide 15% of non-traction energy requirements;
- Feed in 100% of non-traction electricity from renewable sources by 2030;
- Exploring opportunities to use renewable energy sources, including using unused land and roof space to generate renewable energy;
- Transition the Network Rail road fleet to electric vehicles (no target date stated);
- A budget to support research and development in relation to sustainability, including decarbonisation; and

- Further development of data collection and analysis tools to better monitor sustainability performance and to enable better business decisions, embedding sustainability at the very outset of our infrastructure projects and in our day-to-day business operations.

In relation to the aim to supply 100% of non-traction electricity from renewable sources by 2030, the SBP does not indicate whether this is likely during CP7, or at the commencement of CP8. It is expected that work to deliver this objective will be carried out in CP7.

Funding

The national SBP describes that Network Rail have a budget commitment of £290M for decarbonisation primarily comprising the transition of road fleet to EVs.

5.2 Northwest & Central Region SBP

The NW&C Region SBP provides the strategic business plan for CP7 for the NW&C Region. A section in Chapter 2 sets out the Region's aims and strategies in relation to sustainable growth during CP7, which includes decarbonisation.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in the NW&C Region SBP:

- Achieve a 21% reduction in non-traction Scope 1 and 2 carbon emissions during the CP7 period (April 2024 - March 2029); and
- Deliver CP7 sustainable growth targets, e.g. transition to 100% ZEVs by 2027, stop using natural gas by 2029.

The NW&C Region SPB (and all the Region SBPs) does not make reference to the 46% Scope 1 and 2 carbon emissions reduction target presented in the national SBP, but the Region is aligned to this target which has been identified in discussions between the Region and the IR.

Specific Measures and Initiatives

The NW&C Region SBP includes the following references to specific measures and initiatives planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- Transition the road fleet to 100% ZEVs by 2027;
- Installation of associated electric charging infrastructure to support the road fleet ZEV transition;
- Undertaking energy audits to highlight how we can reduce energy usage;
- Improved energy performance of offices and stations through the introduction of low-consumption fittings;
- Investment in work environments that improve sustainability performance, including through more efficient heating and lighting systems;
- Removal of natural gas from building portfolio by 2029; and
- Increase renewably sourced power with the aim to use 100% renewable power in our non-traction supply by 2029.

Table 10 of the NW&C Region SBP (Page 60) includes a trajectory of carbon emissions reductions through CP7. It appears to the IR that a linear annual reduction has been applied of 4.2% per annum, which may not reflect the actual trajectory of Scope 1 and 2 carbon emissions reductions, as is discussed further in Section 6.7.

In relation to the aim to supply 100% of non-traction electricity from renewable sources by 2029, it is not clear to the IR why this differs from the national SBP target of 2030, but it is assumed that these targets are intended to be aligned.

Funding

The NW&C Region SBP describes the following budget commitments for decarbonisation of non-traction Scope 1 and 2 carbon emissions in CP7:

- Capex of £15M for installation of charging points for road fleet ZEV transition;
- Opex of £16M to cover leasing costs for transition of road fleet to ZEVs.

The NW&C Region SBP does not provide any further details on funding for measures beyond the road fleet ZEV rollout.

5.3 Eastern Region SBP

The Eastern Region SBP provides the strategic business plan for CP7 for the Eastern Region. Within Chapter 2 of the Eastern Region SBP is a section setting out the Region's aims and strategies in relation to environmental sustainability and climate change adaptation during CP7, which includes decarbonisation.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in the Eastern Region SBP:

- Achieve a 21% reduction in non-traction Scope 1 and 2 carbon emissions during the CP7 period (April 2024 - March 2029).

Eastern Region has also included a "risk-adjusted" CP7 exit forecast for Scope 1 and 2 emissions in Table 14 on Page 75 of the SBP which is to achieve a 20% reduction in emissions during the CP7 period (1% below the 21% ambition). The IR found no detail in the SBP that explains the risk adjusted forecast.

Specific Measures and Initiatives

The Eastern Region SBP includes the following references to specific measures and initiatives planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- Transition the road fleet to 100% ZEVs by 2027;
- Installation of associated electric charging infrastructure to support the road fleet ZEV transition;
- Minimise energy consumption and manage energy demand, through the implementation of a range of energy saving initiatives. This includes pipeline CP6 energy projects which are carried over or scheduled to complete in CP7;
- Removal of natural gas from building portfolio by 2029;
- Installation of renewable energy, including ground and roof mounted solar PV;
- Green bank investment in ensuring new assets and asset refurbishments maximise energy efficiency; and
- Assess the cost and carbon benefits of all site-specific initiatives to ensure best value.

Figure 23 of the Eastern SBP provides a waterfall chart to demonstrate the anticipated Scope 1 and 2 carbon emissions reductions through CP6 and CP7 to demonstrate achievement of the 21% carbon

reduction target (and associated 46% target reduction compared to the CP5 exit baseline). Further analysis of the detail of the Eastern Region plan is provided in Section 6 of this report.

The Eastern Region SPB includes a greater level of detail of planned decarbonisation measures, risks and opportunities than some of the other SBPs. More detailed analysis of the Eastern Region's CP7 decarbonisation forecast is provided in Section 6 of this report.

Funding

The Eastern Region SBP describes the following budget commitments for decarbonisation of non-traction Scope 1 and 2 carbon emissions in CP7:

- Install all EV charging infrastructure to support transition to ZEV fleet: £23.3M;
- Vehicle fleet purchases: £38.2M;
- Energy demand management in CP7: £19.8M;
- Removal of natural gas from buildings portfolio: £8M;
- Ground and roof mounted PV schemes: £7M;
- Green bank: £14M; and
- Risk that CP6 shortfall increases CP7 costs: £4.2M.

The Eastern SBP summarises a total Capex on decarbonisation of £53M and a total Opex of £60.5M.

5.4 Southern Region SBP

The Southern Region SBP provides the strategic business plan for CP7 for the Southern Region. A section in Chapter 2 sets out the Region's aims and strategies in relation to environmental sustainability and climate change adaptation during CP7, which includes decarbonisation.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in the Southern Region SBP:

- Achieve a 21% reduction in non-traction Scope 1 and 2 carbon emissions during the CP7 period (April 2024 - March 2029); and
- Transform road fleet to ZEVs.

In line with the approach taken by NW&C, Southern Region include the road fleet ZEV transition as a strategic aim/outcome in the SPB rather than as an action/measure to achieve the Scope 1 and 2 carbon emissions reduction outcome (e.g. Eastern Region SBP). The IR does not believe there is any difference in the intention or ambition of the Regions to achieve the ZEV rollout by 2027 (in accordance with DfT mandate) regardless of how it is presented in the relevant SBPs.

Specific Measures and Initiatives

The Southern Region SBP includes the following references to specific measures and initiatives planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- Transition the road fleet to 100% ZEVs by 2027;
- Installation of associated electric charging infrastructure to support the road fleet ZEV transition;
- Research and development strategy to include reduction in the carbon impact of asset management and operation;

- Make energy efficiencies at the Region's highest consuming buildings, including the removal of some gas boilers and change to LED lighting as a minimum; and
- Continue to roll out solar energy systems at stations and depots, as well as start using direct renewable energy connections (initiative includes traction energy).

Annex 5 of the Southern Region SBP includes a trajectory of carbon emissions reductions through CP7. It appears to the IR that a linear annual reduction has been applied of 4.2% per annum, which may not reflect the actual trajectory of Scope 1 and 2 carbon emissions reductions, as is discussed further in Section 6.7. Annex 5 also includes a "Proposed Regulatory Baseline" scenario which forecasts as 2.2% annual reduction in Scope 1 and 2 carbon emissions during CP7, with a total reduction of 11% compared to CP6 exit. The IR found no detail in the SBP that explains the proposed regulatory baseline forecast.

Funding

The Southern Region SBP does not include any specific funding details or information for decarbonisation measures and initiatives. Based on information provided to the IR by Southern Region, specific funding for the ZEV rollout and energy efficiency initiatives during CP7 has been secured from the SoFA, with a total value of £59.7M, as follows:

- Install all EV charging infrastructure to support transition to ZEV fleet: £20M;
- Vehicle fleet purchases: £19.7M;
- Energy audits and energy efficiency measures and interventions: £15M; and
- Renewable energy connections: £5M (includes funding for non-traction and traction energy).

A breakdown of Capex and Opex for the Southern Region has not been provided to the IR.

5.5 Scotland's Railway SBP

Scotland's Railways' SBP provides the strategic business plan for CP7 for Scotland. A section in Chapter 2 sets out the Region's aims and strategies in relation to delivering net zero.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in Scotland's Railways' SBP:

- Support the Scottish Government's legal requirement for net zero by 2045; and
- Improve upon a CP6 exit forecast of a 25% reduction in Scope 1 and 2 CO_2e emissions against the CP5 exit baseline to reach a total reduction of 46.2% by 2028/29 against the same baseline.

Scotland's Railways therefore aims to achieve a 21.2% reduction in Scope 1 and 2 emissions in CP7. The SBP does not provide any explanation of why the target reduction is 0.2% greater than those in other Region's SBPs. It may be related to the Region requiring a steeper decarbonisation trajectory to account for the Scottish Government's commitments to net zero by 2045 compared to 2050 in England and Wales. However, in this case the IR would expect Scotland to require a slightly greater reduction in CP7 compared to other Regions. Scotland's Railways have nonetheless planned for large reductions in Scope 1 and 2 emissions in CP7, as is discussed in Section 6.3.

Specific Measures and Initiatives

Scotland's Railways SBP identifies that the following measures and initiatives are planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- Transition the road fleet to 100% ZEVs;

- Installation of associated electric charging infrastructure to support the road fleet ZEV transition;
- Targeted improvements in energy efficiency in buildings;
- Purchase electricity from 100% renewable sources to power non-traction activity; and
- Carbon offsetting strategy and schemes.

Scotland's Railways is the only Region to include carbon offsetting within its decarbonisation strategy. In the SBP it states this is to enable Scotland's Railways to exit CP7 with carbon neutral operations. The Region intends to use the allocated funds for development of local offsetting projects in Scotland and the Scottish economy.

Table 2.4 of Scotland's Railways' SBP includes a trajectory of carbon emissions reductions through CP7. It appears to the IR that a linear annual reduction has been applied of 4.2% per annum, with the exception of CP7 Year 1 (2024-25) when a 4.4% reduction is forecast. This largely linear trajectory may not reflect the actual trajectory of Scope 1 and 2 carbon emissions reductions, as is discussed further in Section 6.7. It also seems at odds with the statement on Page 21 of the SBP that Scotland's Railways intends to exit CP7 with carbon neutral operations.

Funding

Scotland's Railways' SBP describes that £26M of funding has been allocated for decarbonisation and biodiversity, of which £19M represents Capex and £7M in Opex. Based on information provided to the IR by Scotland's Railways, the breakdown of funding for CP7 decarbonisation secured from the SoFA, is as follows:

- Install all EV charging infrastructure to support transition to ZEV fleet: £17.7M (Capex);
- Vehicle fleet purchases: £6.0M (Opex);
- Energy efficiency measures and interventions: £1.0M (£0.8M Capex, £0.2M Opex);
- 100% renewable non-traction energy: £0.3M (Opex); and
- Carbon offset strategy and schemes: £0.13M (Opex).

The total allocated funding for Scotland's Railways decarbonisation during CP7 is £25.2M (comprising £18.7M Capex and £6.5M Opex). The remaining £0.8M of funding is for biodiversity.

5.6 Wales & Western Region SBP

The Wales and Western Region SBP provides the strategic business plan for CP7 for the Wales and Western Region. Within Chapter 2 of the Wales and Western Region SBP is a section setting out the Region's aims and strategies in relation to environmental sustainability (titled "*Making our railway the greener way for people and goods to travel*") during CP7, which includes decarbonisation.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in the Wales and Western Region SBP:

- Reduce carbon emissions.

The Wales and Western Region does not appear to clearly define a specific carbon reduction target as an overarching aim or objective within the SBP, but from interviews with the Region, the IR is aware that Wales and Western aspire to achieve the 21% Scope 1 and 2 carbon emissions reduction target in line with other Regions.

Specific Measures and Initiatives

The Wales and Western Region SBP includes the following references to specific measures and initiatives planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- Transition the road fleet to 100% ZEVs by 2027;
- Installation of associated electric charging infrastructure to support the road fleet ZEV transition;
- Trials for hydrogen vehicles and infrastructure;
- Transitioning to non-diesel plant (assumed to refer to non-road equipment);
- A suite of energy intervention initiatives to reduce energy consumption including combined heat and power, forced air cooling systems, lighting replacements, and optimising building management systems; and
- Renewable energy schemes including use of unused land and roof space for renewable energy (e.g. PV) infrastructure.

The long-term scorecard on Page 47 of the Wales and Western Region SBP includes a trajectory of carbon emissions reductions through CP7. It appears to the IR that a linear annual reduction has been applied of 4% per annum, which reaches 20% by CP7 exit (1% shortfall to the 21% target), but may not reflect the actual trajectory of Scope 1 and 2 carbon emissions reductions, as is discussed further in Section 6.7.

Funding

The Wales and Western Region SBP describes the following budget commitments for decarbonisation of non-traction Scope 1 and 2 carbon emissions in CP7:

- Capex of £39M; and
- Opex of £1.8M.

The funding is to cover installation of solar PV on operational buildings, contribution to Welsh and UK Government net zero legislation (it is not clear to the IR what this includes), and charging infrastructure for the ZEV rollout, but a breakdown of costs for individual measures and initiatives is not presented in the SBP.

5.7 Route Services SBP

The Route Services SBP provides the strategic business plan for CP7 for the Route Services function of Network Rail. Within Chapter 2 a section sets the Region's aims and strategies in relation to environmental sustainability and climate change adaptation, which includes decarbonisation. There is a further section on decarbonisation in Chapter 3 of the Route Services SBP.

Objectives and Targets

The following key objectives and targets relevant to non-traction Scope 1 and 2 carbon emissions are set out in the Route Services SBP:

- Deploy electric vehicles and charging infrastructure to transition the road fleet to ZEVs;
- Deploy science-based targets; and
- Quantify and reduce carbon emissions under Route Services control (i.e. Scope 1 and 2).

The IR finds no detail in the Route Services SBP to describe the scope of deployment of Science Based Targets and whether this is aligned with or supplementary to Network Rail's application of Science

Based Targets to non-traction Scope 1 and 2 emissions. The SBP implies this initiative would be related to supply chain and procurement and thus Scope 3 emissions.

Specific Measures and Initiatives

The Route Services SBP includes the following references to specific measures and initiatives planned for CP7 to reduce non-traction Scope 1 and 2 carbon emissions:

- Managing the transition to ZEVs and delivering the necessary charging infrastructure;
- Deliver procurement pathways required to enable the delivery of zero-emission vehicle infrastructure and transition to electric vehicles;
- Transition traditional grid electricity supply into renewables through innovative power purchase agreements;
- Establishing a low cost / low carbon by design approach to the development and delivery of renewals and enhancements;
- Introduce further battery-powered shunt locos in our local distribution centres, in addition to the four delivered in CP6;
- Deliver alternative-powered equipment on-site and potentially on-track including green hydrogen as a fuel source; and
- Engage support from a third-party expert to build these initiatives into a sustainability roadmap, based on science-based targets to baseline our sustainability improvements over CP7.

The Route Services SBP does not include any breakdown or trajectory for Scope 1 and 2 emissions nor commit to the 21% CP7 reduction target.

Funding

The Route Services SBP describes a budget allocation of £33M for decarbonisation primarily comprising the transition of road fleet to EVs.

5.8 Other SBPs

In addition to the SBPs summarised in the previous sections, Network Rail has published SBPs covering a number of its central functions including the Technical Authority, National Communications, Human Resources, CFO Directorate and System Operator.

Most of these functions sit within assets owned and managed by Network Rail regions and only have minor, if any, Scope 1 and 2 carbon emissions. For this reason, decarbonisation coverage in these SBPs is limited, and summarised as follows:

- **Technical Authority SBP:** refers to an objective to reach net zero carbon emissions by 2050 (2045 in Scotland. Includes £8M Capex funding allocation for environmental initiatives, which includes decarbonisation (as well as air quality, biodiversity etc.);
- **System Operator SBP:** refers to the 21% Scope 1 and 2 carbon emissions reduction target described in the national and regional SBPs, but includes no details or budget for decarbonisation;
- **CFO Directorate SBP:** refers to aim to supply 100% non-traction energy with renewables by 2030, as set out in the national SBP. Includes £3.1M Capex allocation for electric vehicle charging infrastructure;
- **National Communications SBP:** no reference to carbon emissions or decarbonisation;

- **Human Resources SBP:** no reference to carbon emissions or decarbonisation.

5.9 SBP Summary

A summary of the content of the Network Rail SBPs with respect to non-traction Scope 1 and 2 carbon emissions is provided in Table 4.0. The information in the table principally covers information as it is presented in the SBPs, but this is supplemented with additional information provided to the IR by the Regions where relevant (for example in relation to allocated funding).

Item	National (England and Wales)	NW&C	Eastern	Southern	Scotland's Railways	Wales and Western	Route Services
Objectives and Targets							
Key Scope 1 and 2 Carbon Emissions Objective(s)/ Target(s) for CP7	21% reduction in CP7. 46% reduction CP6 + CP7.	21% reduction in CP7.	21% reduction in CP7.	21% reduction in CP7.	21.2% reduction in CP7.	Reduction in carbon emissions.	Quantify and reduce carbon emissions. Deploy SBTIs.
Measures and Initiatives							
ZEV Rollout	Transition of road fleet to ZEVs.	Transition of road fleet to ZEVs by 2027.	Transition of road fleet to ZEVs by 2027.	Transition of road fleet to ZEVs by 2027.	Transition of road fleet to ZEVs by 2027.	Transition of road fleet to ZEVs by 2027.	Transition of road fleet to ZEVs by 2027. Deliver procurement pathways to allow ZEV transition.
Energy Efficiency	n/a	Removal of natural gas by 2029. Energy audits to identify energy saving potential.	Removal of natural gas by 2029. A range of energy saving initiatives to minimise energy consumption and	Energy efficiencies at highest consuming assets including removal of some gas boilers and	Energy efficiency schemes including LED upgrades and building control system optimisation.	Energy initiatives including combined heat and power, forced air cooling systems, lighting upgrades and optimised	Adoption of low carbon by design approach to renewals and enhancements.

		Improved energy performance of buildings from low-consumption fittings, and more efficient heating and lighting.	manage energy demand.	LED lighting upgrades.		building management systems.	
Renewable Energy	Corporate PPA providing 15% non-traction electricity from solar farm 2024. Feed in 100% non-traction electricity from renewables by 2030. Explore opportunities to use renewable energy sources, including unused land and roof spaces for PV.	Increase renewable energy with aim to use 100% renewable power in non-traction supply by 2029.	Installation of renewable energy including ground and roof mounted solar PV.	Solar energy systems at stations and depots, Use of direct renewable energy connections.	100% non-traction electricity from renewable sources.	Renewable energy schemes including use of unused land and roof space for solar PV.	Transition grid electricity supply to renewables through innovative PPAs.
Other Measures and Initiatives	Budget to support research and development in	n/a	Green bank investment to ensure new	Research and development on carbon impact	Carbon offsetting strategy and	Trials of hydrogen vehicles and infrastructure.	Introduce further battery powered shunt locos at

	relation to decarbonisation. Development of data collection and analysis tools to enable better monitoring and business decisions.		assets and refurbishments maximise energy efficiency. Assess cost and carbon benefits of site-specific initiatives to ensure best value.	of asset management and operation.	schemes to enable carbon neutral operations at CP7 exit.	Transitioning to non-diesel plant.	local distribution centres. Deliver alternative-powered site equipment. Engage third party support for development of SBTIs and sustainability roadmap.
Allocated Funding for Decarbonisation							
Capex	Not stated	£15.0M	£53.0M	Not stated	£18.7M	£39.0M	Not stated
Opex	Not stated	£16.0M	£60.5M	Not stated	£6.5M	£1.8M	Not stated
Total	£290.0M	£31.0M	£113.5M	£59.7M	£25.2M	£40.8M	£33.0M

Table 5.0 Summary of Sustainable Business Plan Content in Relation to Scope 1 and 2 Carbon Emissions

Findings

The IR finds that the overall content of the SBPs with respect to decarbonisation of non-traction Scope 1 and 2 carbon emissions is broadly consistent across the Network Rail Regions and central functions.

There are differences in some of the specific measures and initiatives planned, and the detail presented in each of the SBPs (Eastern Region in particular has more detail than others), but the targets and objectives are well aligned.

All the SBPs describe a CP7 Scope 1 and 2 emissions reduction target of 21%. The IR note that Network Rail's SBTi target is for a 46% reduction by CP7 exit compared to the CP5 exit baseline. Whilst the 21% target is intended to be related to this, the achievement of the 46% SBTi target is dependent on the CP6 exit position. If the CP6 exit position meets or exceeds 25% reduction to the CP5 baseline, then 21% aligns with the 46% target, however if the 25% CP6 target is not met, then further reductions will be required beyond 21% in CP7 to stay within the SBTi trajectory.

In terms of allocated funding, all Regions and Route Services have funds allocated for decarbonisation from the SoFA. The IR observes that there appear to be some quite large differences in the allocated funding, the reasons for which are unclear. These are:

- Eastern Region appears to have disproportionately large funding allocation compared to other Regions; and
- NW&C and Eastern have relatively balanced funding for Capex and Opex, whereas Scotland's Railways and Wales and Western have comparatively low allocation for Opex compared to the Capex funding.

It is clear from the detailed breakdown of allocated funding for decarbonisation, such as that provided by Eastern, Southern and Scotland's Railways, that the majority of allocated funds are to be spent on the ZEV transition. Further analysis of the expected carbon reductions in CP7 from the ZEV transition is provided in Section 6.3.

There is a large funding allocation for CP7 decarbonisation secured by each of the Regions, which is predominated by funding for the ZEV transition. The IR does not have visibility of understanding of the SoFA process to comment on the sufficiency of the allocated funds.

6. KEY OBSERVATIONS AND FINDINGS

This section provides a review of trajectory development processes and carbon reduction planning at the regional and Route Services level within Network Rail, incorporating differences between CP6 and CP7, and highlights areas for improvement and consideration as good practice. It answers the questions within the Key Requirements of the Scope of Works as summarised in Section 1.3.

The IR reviewed the information provided by the Regions and Route Services showing how they had developed their baselines, their trajectories and any plans to deliver the trajectories.

6.1 Role of the Technical Authority

Approach

In the current operating model, the TA has an overview of Scope 1 and 2 carbon emissions performance through its role in ESI reporting, and adopts a role of framework setting, assurance and governance. The TA led the development of the SBTIs targets for the organisations, although Scotland's Railways has calculated its own SBTI aligned to the Scottish Government's net zero target date of 2045.

It appears to the IR, that the TA is closely involved in the delivery of instructions to and co-ordination of the Regions in developing CP7 carbon emission forecasts. It is also apparent that ORR also has direct lines of communication with the Regions in this regard.

Observations

One key observation of the IR in this study, which feeds through to the key findings and recommendations in Section 7, is that the level of guidance and support provided to the Regions and central functions to support the development of CP7 decarbonisation strategies appears to be limited to date.

The TA also have a key role in the compilation of Scope 1 and 2 emissions monitoring and reporting, currently as part of periodic reporting against ESI targets. At present the only target set by Network Rail for Scope 1 and 2 carbon emissions in CP7 is the 21% Scope 1 and 2 carbon emissions reduction target (to achieve a combined reduction of 46% in CP6 and CP7 from the CP5 exit baseline). However the target for ZEV transition by 2027 is firmly linked to Scope 1 and 2 emissions reductions.

Findings

The absence of methodological guidance has left the Regions largely to their own devices in terms of assumptions and approaches to developing the CP7 decarbonisation plans. The IR believes that much more consistent and aligned plans would have been developed if a more detailed framework and guidance had been developed by the TA to help steer the Regions. Examples of elements of guidance that would aid alignment of the plans and strategies include:

- Agreed carbon emissions factors for energy and fuels, taking account of grid decarbonisation and planned Power Purchase Agreements (PPAs);
- Guidance on appropriate assumptions in relation to BAU energy efficiencies to apply to the forecasts;

- Guidance on approaches to estimating electricity consumption from electric vehicle charging, and assumptions on ZEV fleet rollout;
- Advice on netting off sub-metered tenant energy from the energy consumption data and other advice relevant to changes in energy baseline;
- Advice on the treatment of uncertainty; and
- An agreed set of deliverables for the CP7 plan, (e.g., waterfall charts, year-by-year carbon emissions trajectory, written plan, supporting evidence).

The IR's findings in relation to the CP7 Scope 1 and 2 carbon emissions target is set out in Section 6.8.1.

6.2 Approach to CP6 Monitoring and Reporting of Scope 1 and 2 Emissions

The following sections provide a review of the approaches taken by the Regions and Route Services to monitoring and reporting Scope 1 and 2 carbon emissions with primary focus on current practices for CP6. Evaluation of decarbonisation measures and strategies for CP6 is not part of scope of this study, but as the monitoring and reporting procedures currently employed by Network Rail are likely to form the basis of monitoring and reporting for energy and carbon in CP7, these procedures form part of this review.

6.2.1 Approach to Fleet Fuel Consumption Monitoring and Reporting in CP6

Approach

The overall approach to monitoring and reporting of fleet fuel consumption is consistent across all Regions and Route Services and managed centrally by the TA.

Fuel consumption data is gathered from fuel cards, company credit cards and expense claims. Fuel card data provides precise fuel volumes, whereas fuel consumption from credit card and expense receipts are estimated using an assumption on average cost per litre of fuel.

Data is compiled each period, (i.e., every 4 weeks in line with Network Rail's 13-period year).

Fuel data is compiled and converted to CO_2e using Government factors published by the DESNZ (formerly BEIS).

Data is recorded in a centrally produced carbon reporting tool and use for periodic ESI reporting. This is an Excel spreadsheet tool developed internally by Network Rail.

Observations

The approach of using cost to estimate fuel volumes introduces some uncertainty as fuel costs fluctuate daily/weekly and vary depending on fuelling location.

As the periodic data recorded is fuel purchases, it may not accurately reflect fuel consumption in any given period (as fuel may remain in the fuel tank for several days/weeks following refuelling).

Findings

In terms of the cost estimate approach to estimating fuel volumes from expense receipts, the margin of uncertainty across Network Rail's overall fuel consumption will be very small indeed and thus immaterial, as 95% of total fuel purchases are on fuel cards where fuel volume data is recorded.

In terms of fuel purchase, the data is not accurately representing consumption at a period-level resolution, this will only introduce a very small margin of uncertainty and as such is not material. The overall approach adopted by Network Rail is sufficiently robust given the data sources available.

The observations and findings in this section relate specifically to Network Rail's road fleet fuel consumption. Network Rail also operates a fleet of 2,500 rail-based machines, which are discussed in Section 6.6.

6.2.2 Approach to Energy Consumption Monitoring and Reporting in CP6

Approach

The overall approach to monitoring and reporting energy consumption (electricity and natural gas) during CP6 is consistent across all Regions and central functions.

Network Rail has set up an internal energy accounting platform called Energy Link, which is used to compile energy metering and billing data centrally within the organisation.

Data is extracted from the Energy Link periodically by the Energy Bureau Team, which TA then input into the carbon and energy reporting tool, which tracks performance against the ESI energy reduction target. This data is shared with the Regions, which can make adjustments based on more detailed audit of the Energy Link data for a given period. Due to delays in energy billing, the energy data is reported to ORR two periods in arrears.

A key component of the CP6 reporting procedure is that Network Rail has set an energy reduction target for CP6 of 18%, which is monitored in tandem with the carbon reduction target. No such energy target has been set for CP7, which forms part of discussion later in this report.

During interviews, a number of Regions commented to the IR regarding issues and limitations relating to use of the Energy Link system, causing low confidence by some Regions in relation to the energy data and baseline. The IR has not been able to speak to the Energy Bureau team which manages the Energy Link system, but many of the issues raised may be related to constraints on the capacity of the Energy Bureau and Energy Link training across the Regions.

A number of regions have reported that the baseline energy data used in the CP5 exit (2018/19) has, in their view, considerable uncertainty. During CP6 all regions have completed a programme of tenant submeter installations, data auditing and cleansing to improve the understanding and confidence in the data and the understanding of Network Rail and tenants' energy consumption.

Overall, the energy performance in CP6 is mixed, with a number of Regions off target against the 18% reduction target (see Section 2.5). Performance of the Regions against the 25% CP6 carbon reduction target is currently on track.

Observations

Some of the outcomes of the energy cleansing and auditing processes seem to the IR to be quite significant in the reported energy data through CP6, for example:

- Southern Region reported an energy audit of Waterloo Station identified energy consumption billed through NR included traction energy consumption for the Waterloo and City underground line and a hotel;
- North West and Central Region reported anomalies in Energy Link data as substantial as 100 times increase in energy consumption of some assets between one period and the next;
- Wales and Western Region reported that energy usage by the Crossrail works in west London were included in its baseline energy billing in 2018/19. This energy consumption is no longer billed to Wales and Western as the Elizabeth line is now open and operational; and

- Faulty meters were reported by a number of Regions.

It is clear that throughout CP6, Regions have been grappling with issues of poor data quality and confidence related to energy consumption but are all now in a position to have a much higher level of confidence in their energy data.

A number of Regions have suggested the need for a re-baselining exercise for Scope 1 and 2 carbon emissions. For example, some Regions (e.g. Southern) are removing energy consumption from non-rail assets which affects the baseline and others (e.g. Scotland's Railways) consider there to be assets in their portfolio which were excluded from the 2018/19 baseline.

It is understood by the IR that a re-baselining exercise has been agreed by ORR and Scotland's Railways.

In addition, some Regions have suggested reporting of gross energy consumption (including tenants' submetering) and net energy consumption (excluding tenants' sub metering) so that energy performance in areas that Network Rail have direct control can be better monitored. Currently for Scope 1 and 2 carbon emissions reporting, gross energy consumption is used.

In terms of energy and carbon performance, the fact that Regions may be behind target for energy but on target for carbon is primarily linked to decarbonisation of the national electricity grid which means that whilst energy reductions have not been substantial across all Regions, the carbon intensity of the purchased energy has been reducing. The IR has been asked by ORR to provide some commentary on grid decarbonisation within this report, which is discussed further in Section 6.5.

As previously mentioned, Network Rail undertakes periodic reporting of energy consumption and Scope 1 and 2 emissions. Energy consumption varies greatly periodically and seasonally due to ambient temperatures, and seasonal Network Rail activities, and is reported two periods in arrears. In terms of monitoring performance against the Scope 1 and 2 emissions target tracking cumulative emissions against an annual target on a 4-week basis risks the creation of an unclear and confusing view of performance. Network Rail regions have also commented that it places an administrative burden which may be disproportionate and perhaps distracting for the energy teams as explanations for anomalous results are sought throughout the year.

As previously mentioned, it is unlikely that the carbon reduction trajectory to the end of CP7 is linear given the likely back-end loading of the delivery of ZEV and associated infrastructure. Comparing periodic data to a straight-line trajectory is likely to raise concerns of underperformance in the first years of the control period and miss any real warnings of issues with delivery of the projects which will produce the carbon emissions reductions. In the absence of a better forecast of the trajectory and any leading indicators of the delivery of key projects real any issues with delivery of the CP7 target will only become apparent late in the control period when they will be difficult to address.

Findings

The approach to monitoring and reporting of energy and carbon emissions has developed considerably through CP6. The use of the TA's carbon emissions reporting tool ensures consistency in the periodic reporting of current carbon emissions, however, a lack of confidence in the FY18/19 baseline remains.

Due to uncertainties in the energy data, the IR considers a re-baselining exercise (such as that agreed for Scotland's Railways) would be beneficial for all Regions ahead of CP7.

The monitoring of Scope 1 and 2 emissions reductions would most usefully be set against a realistic trajectory for reductions showing estimated reductions year on year and if possible a leading indicator for the key projects which are expected to deliver the emissions reductions, for example the ZEV transition programme (vehicles and live infrastructure).

6.2.3 Approach to Other Scope 1 Emissions Monitoring and Reporting

Approach

Beyond fuel consumption and energy (electricity and natural gas) there is a small group of other Scope 1 emissions sources that are linked to Network Rail activities. These are:

- Sulphur Hexafluoride (SF6), which is a very potent greenhouse gas used in some electrification systems;
- Gas oil, which is used for heating in some older off-grid assets and back-up generators;
- LPG, used in some remote assets; and
- Refrigerants, which are used in cooling and air conditioning systems and potentially some fire protection systems.

The reported approach to monitoring and reporting these emissions is consistent across all Regions and central functions as follows:

- SF6 emissions are assumed based on historic data (for which little information or knowledge exists within Network Rail). The assumption remains that SF6 emissions are the same each year and apportioned by Region based on total electrified track mileage;
- Gas oil and LPG emissions are monitored by billing data; and
- Refrigerants are not considered by Network Rail, Regions or central functions in any of its Scope 1 and 2 carbon monitoring and reporting.

Observations

There seems to be substantial uncertainty in the estimate of SF6 emissions. It is unlikely that these emissions are sufficiently uncertainty to be material in the context of the current Scope 1 and 2 carbon emissions footprint, but future analysis to better define these emissions would be beneficial.

Network Rail's position that emissions from refrigerant leakage in cooling systems will be a very small portion of the Scope 1 and 2 emissions is likely to be reasonable at present. However, as refrigerant gases can have very high global warming potentials, it seems to be a gap in the Scope 1 and 2 carbon footprint that should not be ignored indefinitely.

Findings

The current approach to reporting minor Scope 1 and 2 emissions is adequate given their relatively small contribution to the overall footprint.

Future work to better define and understand SF6 emissions would be beneficial. Likewise, consideration to quantifying refrigerant gas emissions is another useful exercise for Network Rail to programme into CP7.

6.3 Approach to Forecast Decarbonisation of Scope 1 and 2 Emissions in CP7

6.3.1 Region's CP7 Decarbonisation Forecasts

This section provides further detail on Network Rail's decarbonisation plans and forecasts for CP7, which builds upon the review of the SBP submissions provided in Section 5. It is based on information shared directly with the IR by the TA, Regions and Route Services.

Approach

The key elements of the CP7 decarbonisation forecasts for the Regions have been incorporated in the SBPs and summarised in Section 2 of this report.

Each of the Regions has provided the IR with CP7 decarbonisation forecasts and data, which allow a more detailed appraisal of the measures planned by each Region and the potential Scope 1 and 2 carbon emissions reductions these are forecast to deliver. A summary of the analysis carried out by the IR based on the information provided by the Regions is shown in Table 6.0. The analysis only includes information made available to the IR by the Regions.

Table 6.0 shows the measures and initiatives included in Scope 1 and 2 carbon emissions waterfall charts for CP7 shared with the IR to allow a comparison of the consistency in specific measures and initiatives planned by each Region. The table includes a summary (where data are available) of the forecast carbon emissions savings in terms of total tonnes of CO_2e, and a % saving relative to the baseline. The waterfall charts provided by the Regions and IR analysis/interpretation is provided in Appendix C.

The IR has not been provided with evidence that Route Services have developed a detailed CP7 decarbonisation forecast and therefore the analysis focusses on the 5 Regions.

Review of CP7 Decarbonisation of Scope 1 & 2 Emissions						
Measure/Initiative	**NW&C**	**Eastern**	**Southern**	**Wales and Western**	**Scotland's Railways**	**IR Comments**
Energy Efficiency Measures and Initiatives						
Bottom-up planned and costed energy efficiency schemes	No	Yes	Yes	Yes	Yes	Specific approaches to estimating energy savings from investments using a bottom-up approach varies between Regions. NW&C have not produced these yet, but are planning to produce bottom-up measures as part of the Delivery Plan for the SBP.
Top-down estimated and uncosted energy efficiency schemes	Yes	No	No	No	No	NW&C assume 30% reduction in energy consumption from the Region's largest energy consuming assets during CP7 (the largest energy consuming assets are those contributing 80% of the total annual energy consumption).
Top-down estimated BAU energy savings	Yes	Yes	Yes	No	No	BAU energy efficiencies are estimated as 2% per annum (10% for CP7) for Eastern and Southern, and 6% per annum (30% for CP7) by NW&C.
Forecast Savings in CP7 (TCO_2e)	8,671	3,743	4,178	2,063	5,073	The IR believes the savings for Scotland's Railways include savings related to purchase of 100% renewable energy, which is why this value appears larger than other Regions. The predicted savings for NW&C also appear higher than other Regions which may be due to the reliance on top-
Forecast Savings in CP7 (%)	16.6	6.7	9.2	5.6	25.4	

						down estimates of energy savings as opposed to use of a bottom-up approach.
Renewable Energy Measures and Initiatives						
Solar PV projects	No	Yes	Yes	No	No	Wales and Western has solar projects in its strategic plans, but has not itemised carbon emissions savings in the data provided to the IR for this review (Appendix D).
Renewable Energy Tariff	No	No	No	No	Yes	
Forecast Savings (TCO_2e)	0	267	194	0	0	In the data provided to the IR by Wales and Western and Scotland's Railways, it is understood that emissions savings from renewables are included in the energy efficiency savings.
Forecast Savings (%)	0	0.5	0.4	0	0	
ZEV Fleet Transition Measures and Initiatives						
Additional energy for electric vehicles	Yes	Yes	Yes	Yes	Yes	Approaches to estimating fuel savings and additional energy burden for the EV rollout differ by Region.
Diesel fuel reduction from ZEV rollout	No	Yes	Yes	Yes	Yes	
Forecast Savings (TCO_2e)	-2,000	9,447	5,063	4,000	3,910	Eastern Region has the largest vehicle fleet/fuel use (see Appendix B) and therefore expect the largest savings from ZEV rollout. NW&C has not provided data to the IR on fuel savings for the ZEV rollout, and therefore this analysis only reflects the expected additional emissions from electric vehicle charging.
Forecast Savings (%)	-3.8	16.8	11.2	10.9	19.6	
PPAs and Grid Decarbonisation						

PPAs	No	No	No	No	No	PPAs are managed centrally and included in the national (England and Wales) SBP, but are not considered in any of the Regions decarbonisation plans (see Section 6.5.1).
Grid electricity decarbonisation	No	Yes	Yes	No	Yes	Two different datasets have been used by Regions to forecast grid decarbonisation. Eastern has used the Government trajectory for public sector energy consumption published in HM Treasury Green Book guidance[viii] (which forecasts a 58% reduction in grid carbon during CP7), whilst Scotland and Southern have used the Government trajectory for the power sector published in energy and emissions projections 2021 to 2040[ix] (which forecasts a 37% reduction in grid carbon during CP7). This can be seen to drive higher savings for Eastern Region than for Southern and Scotland. Section 6.5 provides further analysis of grid decarbonisation.
Forecast Savings (TCO_2e)	0	15,510	7,372	0	4,643	
Forecast Savings (%)	0	27.6	16.3	0	23.3	
Other Measures and Initiatives						
Data validation	No	No	Yes	No	No	Southern Region has accounted for removal of non-rail assets from the energy consumption values which reduces Region-wide energy consumption by a small amount. See forecasts in Appendix C.
Offsetting	No	No	No	No	Yes	Scotland's Railways has included a funding allocation for development of local carbon offsetting strategies and schemes.
Forecast Savings (TCO_2e)	0	0	190	0	1,314	
Forecast Savings (%)	0	0	0.4	0	6.6	

CP7 Scope 1 and 2 Emissions Summary							
Total Projected Carbon Emissions Reduction by CP7 Exit (Incl. Grid Decarbonisation)	TCO_2e	n/a	28,967	16,997	n/a	14,940	NW&C and Wales and Western have not provided forecasts which include grid decarbonisation. With grid decarbonisation, the forecast reductions in CP7 are well above the 21% target set out in the SBPs.
	%	n/a	51.5	37.6	n/a	100	
Total Projected Carbon Emissions Reduction by CP7 Exit (Excl. Grid Decarbonisation)	TCO_2e	6,671	13,457	9,625	6,063	10,297	Without the benefits of grid decarbonisation, Eastern, Southern and Scotland's Railways are forecast to meet the 21% reduction target for CP7. Success against the 46% reduction target vs the CP5 exit baseline will depend on the CP6 exit position, with most Regions on track to meet the CP6 target reduction of 25% (see Section 2.5).
	%	12.7	23.9	21.3	16.5	51.6	
Allocated Funding (See Table 5.0)		£31M	£113.5M	£59.7M	£25.2M	£40.8M	The allocated funding is broadly consistent with the forecast Scope 1 and 2 emissions reductions excluding grid decarbonisation (i.e. reflective of the savings from Network Rail controlled and funded measures and incentives). I.e. those Regions with larger planned emissions reductions have larger funding allocations.

Table 6.0: Regional Approaches to CP7 Decarbonisation Plans

A summary of the Region's forecasts from Table 6.0 is also shown in the graph in Figure 6.0. The figure shows the forecast Scope 1 and 2 carbon emissions reductions in CP7 based on the forecasts provided by the Regions (Appendix C). The graph highlights the forecast emissions savings without grid decarbonisation (square labels) and with grid decarbonisation (round labels).

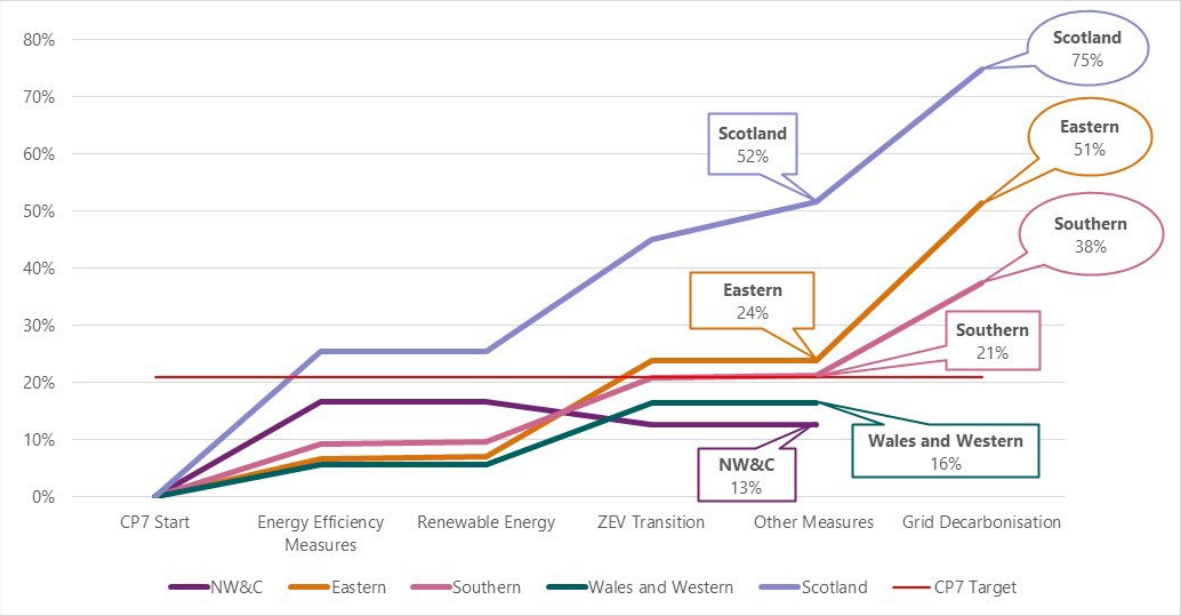

Figure 6.0: Regional Forecast CP7 Scope 1 and 2 Carbon Emission Reductions

Observations

The IR has identified that the overarching approaches and measures to plan for CP7 Scope 1 and 2 decarbonisation are broadly consistent as discussed in Section 5 in relation to the SBPs. The detail of each of the Region's CP7 decarbonisation plans and forecasts do differ in terms of the specific measures and initiatives planned and the approaches and assumptions used to estimate the carbon savings.

A summary of the Region's forecast Scope 1 and 2 carbon emissions savings in CP7 as presented in Table 6.0 are as follows:

- Eastern, Southern and Scotland's Railways: all forecast to achieve the 21% target emissions reductions for CP7 described in the SBPs, with or without the influence of grid decarbonisation (see Section 6.5).
- Wales and Western: forecast a shortfall to the 21% target emissions reduction without grid decarbonisation (16.5%), however, as other Regions estimate savings of 16.3% to 27.6% from grid decarbonisation alone, it is very likely that Wales and Western's forecast would exceed the 21% target with grid decarbonisation included;
- NW&C: forecast a shortfall to the 21% target emissions reduction (12.7%), but this excludes reductions in Scope 1 emissions from ZEV rollover and grid decarbonisation.

Overall, the forecasts appear positive in terms of the ability of Regions to meet the 21% CP7 reduction target, although the role of grid decarbonisation is important in the level of challenge to meeting the target, as discussed further in Section 6.5.

One major omission identified by the IR during this study is the Scope 1 emissions from Network Rail's fleet of rail-based machines used for track monitoring and maintenance. Although a large proportion of these assets are fuelled and operated by third parties, meaning these are Scope 3 emissions, there are a number of rail-based machines operated directly by Network Rail. The IR has not seen any clear

evidence that Scope 1 emissions from these machines are included anywhere in Network Rail's decarbonisation plans. Further discussion on rail-based machines is provided in Section 6.6.

Findings

In the main, the forecasts include an appropriate level of detail to demonstrate the likely success of the 21% CP7 Scope 1 and 2 emissions reduction target (and corresponding 46% target for CP6 and CP7 combined), and the requirements of the HLOSs. The exception is NW&C which has not provided a complete CP7 forecast to the IR as analysis of the reductions from the ZEV transition has not been completed.

The forecasts would benefit from better alignment and consistency between Regions and NW&C should work to develop a complete CP7 carbon forecast including the ZEV transition.

Network Rail's Scope 1 and 2 emissions footprint and forecast would benefit from the inclusion of fuel consumption by rail-based machines. This need not sit with the Regions' footprints, but should be included centrally.

6.3.2 Other Scope 1 Emissions in CP7

Approach

None of the Regions have included any specific measures for decarbonisation of the other Scope 1 emissions sources discussed in Section 6.2.3 during CP7.

Observations

These minor Scope 1 sources only contribute a very small amount to Network Rail's Scope 1 and 2 carbon footprints at present and therefore it is understandable that they are largely ignored in the forecasts and decarbonisation plans.

The IR noted that although Network Rail continues to use gas insulated switchgear containing SF6 in its DC traction network distribution substations, alternatives are becoming available. There is little evidence of confidence of Network Rail in their SF6 emissions holdings and whether these are rising with increased electrification, or reducing as electrification projects and upgrades reduce SF6 use in favour of alternative methods. Elimination of the risk of SF6 escapes will be an important step in improving Network Rail's overall carbon reduction strategy in future.

Network Rail's position that emissions from refrigerant leakage in cooling systems will be a very small portion of the Scope 1 and 2 emissions is likely to be reasonable at present. However, as refrigerant gases can have very high global warming potentials, it seems to be a gap in the Scope 1 and 2 carbon footprint that should not be ignored indefinitely.

If Network Rail's CP7 decarbonisation plans and strategies are successful, these residual Scope 1 emissions will make up a much larger portion of Network Rail's Scope 1 and 2 emissions at CP7 exit, as fleet fuel and energy emissions will have been considerably reduced through the ZEV transition and grid decarbonisation (and/or PPAs). Residual Scope 1 and 2 emissions at CP7 exit will also include fuel consumption of large plant and vehicles.

It is therefore considered appropriate that these emissions sources are subject to further analysis during CP7 as part of planning for CP8, but it is considered acceptable that little effort is directed to reducing these emissions as part of meeting the CP7 carbon target.

Findings

The combined contribution of these sources is <15% of Network Rail's Scope 1 and 2 emissions (see data in Appendix B) and therefore would play a minor role in achieving the target 21% CP7 emissions

reduction. Network Rail's approach to give these minor Scope 1 sources little or no attention in CP7 forecasts is therefore not a major failing at this stage.

Ensuring a robust quantification of and progress with SF6 elimination could usefully be added to Network Rail's internal and external reporting of carbon emissions reductions. Likewise, consideration to quantifying refrigerant gas emissions is another useful exercise in readiness for CP8.

6.4 ZEV Fleet Transition

The road fleet ZEV transition programme responds to the DfT requirement set out in Section 3 that all cars and vans in England and Wales should be ZEVs by 2027. This requires Network Rail to replace the majority of its fleet of circa 9,500 road licenced vehicles.

The responsibility for developing and delivering the ZEV transition programme sits with Route Services. However, a number of the Regions are electing to lead the transition within their Regions, with support from Route Services. Southern Region has explained to the IR that this is due to the role of asset managers and regional and route level maintenance and infrastructure teams in delivering the required charging infrastructure that they feel is best managed at a Region level.

Further analysis of Network Rail's preparation for the fleet rollout programme, and the challenges and risks to successful delivery are provided in Appendix C.

6.4.1 Progress to Date on ZEV Transition

A pilot trial at depots in Swindon and Bristol was launched in 2020, which involved 9 ZEVs deployed across these two sites.

Network Rail has worked with its fleet supply partner Novuna to ring fence 400 electric vehicles for fleet rollout in the next couple of years.

In CP6 Year 4 (to 31st March 2023), Network Rail increased the number of ZEVs used on its network to 66. A large number of these (34 vehicles) were deployed in the Southern Region.

Although there are a number of ZEVs now operating in the Network Rail fleet, Route Services and most regions report that currently infrastructure for ZEVs (DNO upgrades and electric vehicle charge point installations) are not keeping pace with the trajectory of ZEV supply expected in the coming years. Route Services and a number of Regions reported to the IR that delivery of infrastructure at many depots and assets can be a lengthy process, in the order of 18 months or more, and requires a large number of signatures/approvals within Network Rail which slows the process.

In addition, it is acknowledged by Route Services and Regions that ZEV rollout will require a number of cultural and behavioural changes related to different methods of fuelling electric vehicles, (i.e., the process is longer, often taking several hours), the current arrangements for home start (employees keeping Network Rail vehicles at home), and processes for renumerating staff for expenditure to recharge Network Rail vehicles away from depots, (e.g., at home or third party recharge stations). Route Services has a working group including representatives of HR, TA and Regions to developing policies on investment in home charging, and other cultural and behavioural changes associated with ZEVs. The policies were intended to be developed in 2022 but are still in draft and the IR understand should be in place before CP7 starts.

6.4.2 Preparation and Forecasting for ZEV Transition in CP7

Route Services has developed a detailed plan for road fleet ZEV transition which plans a potential rollout pathway on a vehicle and asset-by-asset level. The details of this plan do not appear to have

been formalised centrally though and whilst guiding day-to-day delivery of the strategy within Route Services, the IR found no evidence that they are guiding strategic level decision making and planning. Further details of Route Services planning for the ZEV transition are provided in Appendix D. The IR has found no evidence that Route Services currently monitor and report, nor have a decarbonisation plan for rail-based machines, which is discussed further in Section 6.6.

Scotland's Railways work on planning the ZEV transition is supported by a detailed report, which sets out the trajectory for fleet rollout based on the current Scottish vehicle fleet, planned fleet renewal programmes (to ensure as few vehicles as possible need be renewed before the end of their existing lease), required infrastructure upgrades and analyses costs associated with infrastructure upgrades, additional leasing costs, additional electricity costs (and associated reduced fuel costs). Some key extracts from the Scotland's Railway Road Fleet Decarbonisation Strategy are provided in Appendix D.

All Regions except NW&C have modelled the expected benefits of the ZEV transition programme as part of Scope 1 and 2 emissions forecasts for CP7. This includes forecast reductions in emissions from fuel consumption (while accounting for increased electricity for vehicle charging). NW&C has modelled increased energy demand for EVs, but not the corresponding diesel fuel reductions. A summary of the forecast Scope 1 and 2 emissions implications of the ZEV transition are provided in Table 6.1. The table is informed by the information provided to the IR by the Regions (see Appendix C) and is compared to the CP5 exit baseline and the CP6 Year 4 fleet fuel emissions data from Appendix A, which is the latest available at the time of reporting.

Table 6.1 Impact of ZEV Transition of Scope 1 and 2 Carbon Emissions

Region	Unit	NW&C	Eastern	Southern	Wales and Western	Scotland's Railways
CP5 Exit Scope 1 and 2 Emissions Baseline (TCO_2e)	A	52,253	56,286	45,268	36,763	19,939
CP6 Year 4 Scope 1 Emissions from Fleet Fuel (TCO_2e)	B	10,405	13,479	6,692	6,667	4,722
CP6 Year 4 Scope 2 Emissions from Energy (TCO_2e)	C	22,425	20,673	19,460	14,164	8,578
CP7 Forecast Reduction in Scope 1 Emissions from Fleet Fuel	TCO_2e	n/a	13,465	n/a	6,400	4,620
	% of B	n/a	99.9%	n/a	96.0%	97.8%
CP7 Forecast Increase in Scope 2 Emissions from EV Charging	TCO_2e	2,000	4,018	n/a	2,400	710
	% of C	8.9%	19.4%	n/a	16.9%	8.3%
CP7 Net Reduction in Scope 1 and 2 Emissions from ZEV Transition	TCO_2e	n/a	9,447	5,063	4,000	3,910
	% of A	n/a	16.8%	11.2%	10.9%	19.6%

The table shows that based on the Regions data, the ZEV fleet rollover is expected to:

- reduce Scope 1 emissions from fleet fuel by around 96% to 99% (although this calculation ignores growth and therefore the calculated percentage emissions saving is likely to be high);

- increase Scope 2 emissions from electricity consumption (for vehicle charging) by around 8% to 19% (although this calculation ignores grid decarbonisation and therefore the calculated percentage emissions saving is likely to be high); and
- leads to a net Scope 1 and 2 emissions reduction of around 11% to 20% vs the CP5 exit baseline.

Overall, the ZEV transition is forecast to result in substantial reductions in Scope 1 and 2 carbon emissions and will therefore play a major role for all Regions in meeting the 21% CP7 decarbonisation target.

6.4.2 Challenges to the ZEV Transition

The ZEV transition is a key Network Rail target for CP7 (specifically December 2027) which is described in all the relevant SBPs (see Section 5). There are a number of challenges to the success of the ZEV transition though which have been raised to IR through interviews with Region's and Route Services road fleet team.

Route Services report that while the ZEV trial was successful from an operational perspective, there were lessons learned in relation to the delivery of infrastructure, which for the Bristol site took almost two years to install.

Key challenges to the ZEV transition raised to the IR by Route Services and Regions include:

- Timescales and cost for infrastructure upgrades and installation (months or years in some cases);
- Available electricity supply (a large number of depots require substantial DNO upgrades);
- Unclear policies and plans on home start and charging points at employees' homes;
- Challenges of home start where employee's homes do not have private parking, or require third-party permissions, (e.g., tenanted dwellings or managed apartment complexes);
- Availability of electric vehicles (especially vans which make up the bulk of Network Rail's fleet, and 4x4 vehicles which have limited ZEV alternatives currently);
- Potential cultural resistance to the new technology its potential impact on working practice; and
- A lack of co-ordination and planning at an organisational level.

The lack of co-ordination and planning at an organisational level relates to management focus on vehicle supply, with little consideration to infrastructure constraints. It seems best practice to the IR to ensure that infrastructure is in place before EVs are supplied, but the current strategy appears to be back to front in that vehicles are being purchased/ringfenced, without confidence that sufficient infrastructure will be in place.

Home start charging provides opportunities and advantages in terms of speed of installation (much simpler, cheaper and more rapid to arrange than major upgrades at depots), but as yet is not being implemented while strategic policies and plans are developed. This seems to the IR to be an important area of focus in the short term.

Overall, the ZEV rollout is important for two reasons; firstly, it is a key contribution to meeting the CP7 Scope 1 and 2 emissions reduction target and SBTi trajectory (see Table 6.0), and secondly it is directly mandated by DfT and Scottish Government. Further attention is warranted in this area to ensure a

robust and detailed plan and programme for all aspects of this project is adopted and followed to maximise the likelihood of successful fleet rollout by 2027 in accordance with the DfT target.

6.5 Electricity Grid Decarbonisation

ORR has asked the IR to consider the role of electricity grid decarbonisation in the CP7 forecasts. Firstly, for clarity, electricity decarbonisation is already included in Network Rail's Scope 1 and 2 carbon emissions reporting in CP6 and is therefore included in reporting against the success of the CP6 carbon emissions reduction target of 25%. Therefore, in relation to the CP6 and CP7 combined carbon emissions reduction target of 46%, it is the opinion of the IR that it is appropriate for grid decarbonisation to be included in the target and considered in the CP7 forecasts. The key reasons for this opinion are:

- The SBTi work linked to the adopted 46% target includes the impact of grid decarbonisation in the SBTi trajectory and (insofar as recommending renewable Power Purchase Agreements (PPAs) to be considered) actively includes electricity supply decarbonisation in its recommended strategies to Network Rail; and
- Monitoring and reporting of carbon emissions during CP6 uses Government data on annual electricity grid intensity which has been decarbonising each year through CP6. This means that in analysis of performance against the CP6 carbon target, grid decarbonisation is already embedded.

Data published by Government[viii] (and used by Eastern Region in its CP7 forecast) predicts that between 2019 (CP5 exit) and 2029 (CP7 exit), national grid electricity supply for the public sector will decarbonise by up to 72%. The forecast decarbonisation within the CP7 period alone is 58%.

Scotland's Railways and Southern Region have used a different Government resource to forecast grid decarbonisation[ix], but this also forecasts a large reduction in carbon intensity of 66% between CP5 exit and CP7 exit, of which 37% reduction in CP7.

The effect of grid decarbonisation occurring in line with either of these trajectories is substantial, as demonstrated in Table 6.2 below, which shows the forecast reductions in CP7 for each Region from grid decarbonisation alone.

Table 6.2: Analysis of Potential Carbon Reductions from Grid Decarbonisation (%)

Region	HM Treasury Greenbook Guidance (Eastern)	DESNZ Energy and Emissions Projections (Southern and Scotland's Railways)
NW&C	25%	16%
Eastern	21%	14%
Southern	27%	17%
Wales & Western	22%	14%
Scotland's Railways	25%	16%

The analysis in Table 6.2 is further detailed in Appendix C, and is produced by the IR based on the latest available year of Region's electricity emissions data (CP6 Year 4; 2022 to 2023) and the

decarbonisation trajectories obtained from the two Government resources used by the Regions. The values therefore differ slightly to the Region's estimates in Table 6.0, but are in a similar range of magnitude. It can be seen that grid decarbonisation could reduce Network Rail's Scope 1 and 2 emissions during CP7 by 14% to 27%.

In both cases, the potential reduction represents a large portion, or potentially all of the 21% CP7 target reduction. Whilst on one hand this could allow achievement of the target independent of the success of other Network Rail decarbonisation measures (such as the ZEV transition), as the success of grid decarbonisation is not in Network Rail's control, it is the opinion of the IR that it would be unfair to set a target that relies heavily on a substantial amount of grid decarbonisation. The scale of the challenge in following the Government's forecast trajectory is significant, and the Committee for Climate Change (CCC) has flagged in their latest (2022) progress report to Parliament that the UK is not on track with power sector decarbonisation by 2035. The relevance of this to Network Rail's targets and ambition with respect to Scope 1 and 2 carbon emissions is discussed in Section 6.8.1.

6.5.1 Power Purchase Agreements

One initiative that NR is pursuing, which acts as an alternative to grid decarbonisation in reducing Scope 2 emissions (and as recommended in the 2019 SBTi report), is 100% direct wire renewable PPAs for non-traction energy. The TA is leading this initiative and set out in the national SBP that a solar farm is being built to supply 15% of Network Rail's total annual non-traction energy consumption by 2024, and further PPAs are planned to provide 100% renewable energy for the whole of Network Rail by 2030. This will eliminate any risk around the success of national grid decarbonisation and ensure all of Network Rail's non-traction electricity emissions are reduced to net zero by or soon after CP7 exit.

These PPAs are not however considered in any the Scope 1 and 2 carbon emissions forecasts. It is recommended that scenario modelling is considered to show the effect of introduction of these PPAs, and Network Rail consider how the benefit of 2025 PPA will be divided between Regions and central functions. Network Rail should consider how carbon benefits from electricity supplied via renewable PPAs can be equitably divided between Regions and central functions. This should then be provided as advice to the Regions to enable them to inform their trajectories.

6.6 Rail Based Machines

The IR has identified that diesel fuel used by Network Rail's fleet of 2,500 rail-based maintenance machines (high output machines, new measurement train etc.) is not included within the Scope 1 and 2 carbon footprints. The IR understands that a large number of these are operated by third parties and therefore count as Scope 3 emissions, however a portion of the fleet is operated directly by Network Rail and is therefore a Scope 1 emission source.

The IR is conscious that Network Rail may consider these to be traction emissions and therefore outside the scope of this study and the CP7 Scope 1 and 2 carbon emissions target. However the IR has not seen any clear evidence that emissions from rail-based machines are included in any other decarbonisation plans. The HLOSs do not indicate that these should be excluded (see Section 3.2.2) and therefore the omission of these emissions risks being a significant case of carbon leakage.

The rail fleet and engineering team within Route Services has provided an estimate to the IR of annual diesel fuel consumption by rail-based machines owned and operated by Network Rail. The estimated annual fuel consumption is 16 million litres. This is equivalent to Network Rail's annual road fleet fuel consumption (see Appendix A). However, this only represents a small proportion of the fuel use by rail-based machines, which Route Services estimates to be up to 50 million litres per year when machines operated and fuelled by third party contractors is included. The carbon emissions from rail-

based machines could be around 25% of the reported Network Rail Scope 1 and 2 emissions, and are therefore large in the context of Network Rail's reported carbon footprint, as summarised in Table 6.3.

Table 6.3 – Rail-Based Machines Carbon Emissions Analysis

Parameter	Value	Reference/Note
Estimated annual diesel fuel consumption of Network Rail operated rail machines	16 million litres	Route Services fleet engineering team.
Carbon emissions factor for diesel fuel	2.51 $kgCO_2e/L$	UK Government GHG factors for Company Reporting[x].
Estimated annual Scope 1 carbon emissions from Network Rail operated rail machines	40,160 TCO_2e	Fuel consumption x emissions factor / 1000.
Network Rail annual Scope 1 and 2 carbon emissions (CP6 Year 4)	164,142 TCO_2e	Table 2.0
Scope 1 carbon emissions from Network Rail operated rail machines as proportion of reported Network Rail Scope 1 and 2 carbon emissions	24.5%	Fuel consumption emissions / total annual emissions x 100.

The rail fleet engineering team within Route Services has advised the IR that there is no plan in place or resource investigating decarbonisation of Network Rail's fleet of rail-based machines, however the IR acknowledges the Route Services SBP mentions plans for electric shunting engines (see Section 5) and the IR has not been able to speak to the Route Services decarbonisation team as part of this review.

The emissions from rail-based machines are significant and these machines have a very long service life (20-40) years and may be challenging to decarbonise. Network Rail would benefit from defining where these emissions are included in its wider carbon footprint to ensure they are not missed and improve monitoring and planning for decarbonisation.

6.7 Key Questions

This section of the report responds directly to the key questions raised by ORR and Network Rail in the Scope of works and summarised in Section 1.3.

Question 1: Has the Region taken a reasonable approach to developing its Scope 1 and 2 carbon emissions forecasts for CP7 and set realistic success measure forecasts, taking all circumstances into account?

Approaches

The overall approach to development of CP7 Scope 1 and 2 carbon emissions forecasts includes consistent high-level actions and themes across most of the Regions, with all Regions planning for ZEV fleet transition and energy saving initiatives across its assets and described in relevant SBPs.

The Regions maintain good communication to share ideas and collaborate in developing the approaches to forecasting, but report that they receive little in the way of central guidance or advice to support them.

Success measurement for Scope 1 and 2 carbon emissions in CP7 is limited to the 21% carbon reduction target (46% total reduction relative to the 2018/19 baseline position). Network Rail has though set linked targets to transition 100% of cars and vans to ZEVs by 2027 and to deliver PPAs covering 100% non-traction electricity from renewable sources by 2030.

Observations

Although the overarching themes and actions considered in the regional forecasts are similar, the detail behind the forecasts differs substantially. NW&C for example are reliant on top-down assumptions regarding energy and carbon savings, where other Regions like Scotland have taken a bottom-up approach, with Eastern and Southern Regions adopting a hybrid approach.

The IR has not seen evidence that any of the Regions have prepared a forecast of realistic expected emissions reductions each year through CP7. The PR23 draft determination outcomes report[xi] includes year on year trajectories, however the IR observes that for all Regions, the forecast annual reductions are linear (as also discussed in relation to those presented in SBPs for NW&C and Southern discussed in Section 5). It is unlikely that during CP7 the emissions reductions will be linear due to the programme of transition to ZEVs and other planned interventions which are likely to back load the carbon reductions to later in the control period. Further development of realistic forecasts of year-by-year emissions reductions during CP7 would be beneficial to monitoring of progress and success towards the 21% CP7 target.

Most of the Regions reported to the IR that they have a low-level of confidence in the 2018/19 baseline emissions. This results in uncertainty as to whether the baseline position the Regions are reporting performance against is higher or lower than it should be, therefore making the challenge of meeting the target easier or harder than it might otherwise be.

Route Services have not provided evidence that they have developed a CP7 Scope 1 and 2 carbon forecasts.

Findings

The overall approach followed by the majority of Regions in developing its Scope 1 and 2 forecasts are reasonable. NW&C appear behind other Regions in the detail of forecasting and would benefit from alignment with others. It is understood this is planned during development of the SBP delivery plan.

It is very unlikely, particularly if the ZEV transition completes as planning in 2027, that Scope 1 and 2 emissions reductions will be linear through CP7 (as is indicated by trajectories in the SBPs and PR23 draft determination outcomes report). All Regions should follow the example set by Eastern Region in forecasting an as close to real year-by-year emissions trajectory through CP7 as possible to allow more robust monitoring of progress during CP7.

Network Rail would benefit from re-baselining its Scope 1 and 2 carbon emissions ahead of CP7 to account for better confidence in energy consumption. Re-baselining should ideally include fleet emissions in addition to energy, and include rail-based machines as discussed in Section 6.6.

Question 2: Are approaches consistent across all regions? How do approaches compare and is there best practice?

Approach

The approaches to forecasting CP7 decarbonisation by each Region are summarised in Table 6.0 in Section 6.3. Each Region has approached the CP7 Scope 1 and 2 carbon emissions forecasting in a slightly different way. There has been no centralised guidance in terms of how to approach the forecasts and therefore Regions have approached the forecasts as they feel is best or appropriate.

There has though been a good level of communication and knowledge sharing between Regions in terms of the forecasting.

Route Services has not provided evidence that they have developed a CP7 Scope 1 and 2 carbon forecast.

Observations

There are a number of inconsistencies between the approaches taken by Regions and Route Services to CP7 forecasting. This being said, the overall strategies between Regions have many similar themes including approaching energy efficiency savings with focus on the biggest energy using assets and consideration to the ZEV transition.

However, the detail in the approaches is quite diverse, with the following key assumptions and issues differing between Regions:

- Approach to decarbonisation of the electricity grid;
- Whether to assume BAU energy efficiency savings;
- The level of detail in energy efficiency forecasting and planning;
- Inclusion of solar PV installations; and
- Consideration to the ZEV transition programme.
- None of the Regions consider fuel emissions from rail-based machines and the IR has not seen clear evidence that these are accounted for by Route Services (or any other central function) either. None of these machines are owned by Regions and therefore it appears fair that these emissions are considered in the footprint and forecast for Route Services, by whom the machines are owned and operated.

Findings

There is room for improvement in the consistency of the forecasts across the Regions. Many of the inconsistencies could be avoided if Regions were provided with central guidance covering the expected scope, methodologies and deliverables in terms of reporting their CP7 decarbonisation forecasts.

Best practice in the development of the forecasts is found in Scotland, with broadly similar good practice followed by Southern and Eastern Regions. NW&C currently has developed a less comprehensive and detailed forecast than other Regions.

Question 3: Are the forecasts supported by an appropriate level of detail in the plans to deliver the expected performance levels, including appropriate expression of uncertainty in the outputs?

Approach

Eastern, Southern, Wales & Western and Scotland Regions have all provided evidence to the IR which shows that their plans for energy efficiency measures in CP7 (including solar PV schemes where relevant) are supported with detailed analysis of the expected energy and carbon benefits of their proposed investments, and associated costs.

NW&C does not yet appear to be as well developed in planning of energy efficiency initiatives and their Scope 1 and 2 forecasts are based on higher level assumptions of likely energy savings. NW&C do though report that work is ongoing to plan such initiatives using a bottom-up approach as part of development of its SBP Delivery Plan.

In terms of ZEV transition, substantial planning has been undertaken by Route Services, and separately by the Regions to plan for the delivery of electric vehicle charging infrastructure and ZEVs.

The road fleet team within Route Services and separately Scotland's Railways have produced very detailed analyses and planning for the ZEV transition programme (including infrastructure upgrades), which goes down to a vehicle and individual asset level and includes uncertainty analysis/sensitivity testing. Southern Region has made good initial progress on the ZEV fleet transition programme and has shared lessons with Route Services in relation to the complexity of delivery issues including power supplies.

Observations

The two main actions for decarbonisation of Scope 1 and 2 emissions in CP7 within the Region's control or influence are energy saving measures and the ZEV transition. Grid decarbonisation will have a large influence on Scope 2 emissions (as evaluated in Section 6.5), but is outside of the control of Network Rail (except for negotiation of renewable PPAs).

It does not appear to the IR that Regions and Route Services have been given any clear remit on what the CP7 Scope 1 and 2 forecast and plan should look like or how it should be presented, therefore it has been difficult for the IR to fully appraise the details behind the forecasts. It is clear that the Regions have put a lot of work into planning, costing and programming energy efficiency interventions and initiatives, but the drivers for these are not solely for carbon emissions reductions and so much of the detail has not been produced specifically for, or is held alongside, the CP7 carbon forecasts.

The plan/analysis for ZEV transition shared by Route Services does not appear to be driving Network Rail's decision making in terms of the ZEV transition though, which is likely to increase risk in terms of successful delivery of the programme.

None of the Regions or Route Services have demonstrated to the IR that uncertainty has been considered in the CP7 forecasts. From interviews it is clear that all Regions are conscious of uncertainty in relation to elements of their forecasts, in particular the fleet ZEV transition programme and key energy efficiency initiatives, but none of the Regions have attempted to quantify the implications of any delay or failure in the delivery of these measures.

Findings

The Regions have so far only shared relatively high-level information and data regarding the CP7 Scope 1 and 2 forecasts with the IR. None of the Regions, or Route Services, have provided any evidence that uncertainty analysis has been undertaken.

Route Services has developed a very detailed plan for the ZEV transition programme, but it does not appear to be driving Network Rail's decision making in terms of the ZEV transition. There also appears to have been some changes in strategy in terms of whether the fleet rollout would be managed centrally or within Regions. This is likely to increase risk in terms of successful delivery of the programme.

In terms of successful achievement of the 21% CP7 emissions reduction target, the Regions have set out plans and strategies that demonstrate how the target can be met. The forecasts (where complete i.e. Eastern, Southern and Scotland's Railways) indicated reductions in the order of 40% to 50% might be expected in CP7 (see Table 6.0). Assuming the CP6 target of 25% reduction is met this would lead to total reductions from the CP5 exit baseline of circa. 65% to 75%, which is above the 46% SBTI trajectory. Further discussion on the target is provided in Section 6.8.1.

Question 4: Has there been effective collaboration with the supply chain, stakeholders and partners in developing the forecasts, and are the dependencies clearly defined?

Approach

The Regions have provided little evidence to the IR to demonstrate the level of supply and stakeholder engagement in development of the forecasts, nor clearly defined any dependencies. There are some examples of detailed engagement in relation to planned energy efficiency measures at specific assets and in interviews many of the Regions refer to engagement with partners and supply chain, but not directly in relation to developing the CP7 carbon forecast.

Scotland's Railway has engaged consultants (in collaboration with ScotRail) to develop Scotland-specific science-based targets, and is investigating local, (i.e., Scotland-based) opportunities for carbon offsetting.

The road fleet team at Route Services has reported that there has been engagement with relevant suppliers and stakeholders in planning for supply of ZEVs, and the installation of required infrastructure for charging. In addition to this, Wales & Western report engagement with Transport for Wales and Great Western Railways regarding the potential partnerships in relation to sharing electric vehicle charging infrastructure.

Observations

Although little evidence has been shared or discussed with the IR in terms of supply chain and stakeholder engagement, this does not mean it has not been taking place. Several Regions report energy efficiency or decarbonisation measures planned for CP6 that are moving into CP7, which has the benefit of front-ending measures in CP7, but also a level of advancement in planning for delivery.

Energy efficiencies, grid decarbonisation and EV rollout are key elements to all forecasts (or should be for those where ZEV rollout or grid decarbonisation is currently not fully included) and identifying key dependencies to delivering these measures is important to the process.

It is not clear to the IR that the level of collaboration between Regions (either centrally or at route level) and if Route Services has been as effective as it should be with respect to the ZEV rollout programme. There appears to be a slight friction between fleet teams at a route or Region level having focus on operations and delivery, but little or no understanding or experience with decarbonisation.

Findings

The forecasting would benefit from development of some form of dependencies log or register which would help guide collaboration and engagement through CP7.

The success of the CP7 decarbonisation would benefit from better collaboration between Route Services and Regions/routes in terms of the EV rollout programme.

Question 5: Is there evidence that consistent and equitable approaches will be taken to reporting Scope 1 and 2 carbon emissions performance across the Regions, which demonstrates similar levels of innovation and effort set for all Regions?

Approach

The approach to reporting Scope 1 and 2 emissions during CP6 is managed centrally by the TA, with input data from fuel cards, energy metering/billing and other sources feeding into a central reporting tool designed and owned by the TA.

The performance is monitored on a periodic (4-weekly) basis throughout the 13 periods of the year (but is reported two periods in arrears due to delays in energy billing). Monitoring of energy and carbon is at a Regional/function level, which encompasses all assets in each Region's portfolio.

During CP6, innovation and effort between the Regions has been driven by the application of both a carbon reduction target, but also an energy reduction target. There is currently no energy reduction target set for CP7.

Each of the Regions has adopted the same carbon reduction target for CP7 of 21%.

Observations

There are four main components to Network Rail's Scope 1 and 2 decarbonisation in CP7:

- ZEV Transition: this is a considerable challenge but if successful will deliver considerable emissions reductions (see Table 6.0, Table 6.1 and Appendix C). It will require substantial effort, innovation and investment from all Regions and central functions (principally Route Services);
- Energy efficiency improvements and renewable energy: these will deliver smaller carbon emissions reductions than the ZEV transition (see Table 6.0 and Appendix D), but require a high level of effort, innovation and investment by Regions;
- PPAs: plans for a solar farm to supply 15% of non-traction energy from 2024 and a target for 100% renewable PPAs by 2030 with result in substantial carbon emissions reductions, and requires a high level of innovation, effort and investment from Network Rail centrally, but no input from the Regions; and
- Grid decarbonisation: this has the potential to deliver substantial carbon emissions reductions, but requires no Network Rail effort or investment.

Effort, innovation and investment at Regional level is focussed on energy efficiencies and renewables, and the ZEV transition. The opinion of the IR is that whilst reporting of Scope 1 and 2 carbon emissions is important, reporting of CP7 progress in relation to energy efficiency measures and the ZEV transition would benefit additional performance indicators and metrics. It is understood that the existing reporting mechanisms will be revised for CP7, but the final reporting framework is not yet agreed, which provides an opportunity to devise and introduce such additional reporting metrics. Further discussion on reporting metrics and targets is provided in Section 6.8.1.

In relation to equity, each of the Regions has a similar carbon emissions footprint in terms of the contribution of key sources to the footprint, with all dominated by road fleet fuel and electricity (see Appendix B). Whilst there are differences in absolute emissions, it is therefore fairly equitable to apply a consistent percentage carbon emissions reduction target to all Regions. The inclusion of fuel use from rail-based machines to the footprint is likely to result in inequity for Route Services, which would

have a greater challenge in terms of reducing carbon emissions as the rail-based fleet emissions will be difficult to make large reductions to within CP7.

All Regions report Scope 1 and 2 carbon emissions periodically, following the same procedure which is led by the TA in the population of Network Rail's internal carbon reporting tool. As previously discussed, it is unlikely that the carbon reduction trajectory to the end of CP7 is linear and as such comparison of the periodic data to a straight-line trajectory has the potential to raise concerns of underperformance in the first years of the control period and miss any real warnings of issues with delivery of the projects which will produce the carbon emissions reductions.

Findings

Network Rail is able to use or build upon its existing Scope 1 and 2 carbon emissions reporting procedures to ensure equitable reporting of data in CP7. The application of a consistent CP7 Scope 1 and 2 emissions reduction target as a percentage reduction represents reasonable equity between Regions which all have similar carbon footprints.

In relation to reporting and performance, to reliably track the performance of Regions in relation to key funded measures linked to CP7 decarbonisation (principally the ZEV transition and energy efficiency initiatives), it is recommended that in addition to the carbon emissions target, other performance metrics and targets are developed for CP7 as this will continue to drive innovation and ambition to reduce energy, carbon and potentially cost within the Regions. Further discussion on reporting metrics and targets is provided in Section 6.8.1.

The monitoring of Scope 1 and 2 emissions reductions would most usefully be set against a realistic trajectory for reductions showing estimated reductions year on year and if possible a leading indicator for the key projects which are expected to deliver the emissions reductions, for example the ZEV transition programme (vehicles and live infrastructure).

Question 6: Do the targets set for Scope 1 and 2 carbon emissions provide sufficient ambition to deliver on HLOS requirements for England & Wales and Scotland and milestones set out in the DfT's Rail Environment Policy Statement and TS' Rail Services Decarbonisation Action Plan?

Approach

The key requirements of the HLOSs for England & Wales and Scotland, the DfT's Rail Environment Policy Statement and TS's Rail Services Decarbonisation Action Plan relating to non-traction Scope 1 and 2 carbon emissions are summarised in Section 3.2 of this report.

The main points within these plans that relate to non-traction Scope 1 and 2 carbon emissions are:

- Decarbonise on a trajectory consistent with achieving net zero carbon by 2050 (2045 in Scotland);
- Setting and meeting SBTs as milestones on the pathway (i.e., the 46% CP7 exit carbon reduction target);
- Transition all cars and vans to ZEVs by 2027 (2030 in Scotland); and
- Develop and deliver a metric which must continually deliver energy and carbon reduction activities to reduce Scope 1 and 2 emissions against the baseline of 31 March 2019 (Scotland HLOS only).

Observations

The analysis in Section 6.3 shows that all Regions are likely to deliver on the key HLOS, DfT and TS requirements in terms of decarbonisation trajectories, i.e., achieving the 21% CP7 reduction target and 46% CP6 and CP7 SBTI trajectory and therefore the requirement to remain on track for net zero in 2050 (2045 in Scotland). With the expected trajectory of grid decarbonisation, the energy efficiency incentives being delivered by many of the Regions and the ZEV transition programme, the 46% reduction target, whilst sufficiently ambitious to achieve the HLOS requirements, does not seem in isolation particularly ambitious. For example, the SBTi report commissioned by Network Rail recommended a more ambitious 79% Scope 1 and 2 emissions reduction target was set for 2030. This would however likely need a 100% renewable PPA covering all of non-traction electricity. The IR provides further comment on ambition and targets in Section 6.8.1.

For Scotland, the target is more complex as it relates to 75% reduction in emissions by 2030, but this is compared to a 1990 baseline and therefore cannot be directly compared to the 46% trajectory set against a 2018-19 baseline. However, as Scotland has planned for and forecast to reach net zero by CP7 exit, the plan is sufficiently ambitious to achieve the Scotland HLOS requirements in this regard.

The main risk appears to be meeting the requirement of DfT's Rail Environment Policy Statement to transition all cars and vans to ZEVs by 2027. Route Services and all Regions have raised concerns about the risk of delivery of the requisite infrastructure. Route Services have set out an ambitious plan to achieve the target, it is noted that the focus of senior oversight appears to be on the supply of vehicles. There is a risk of a lack of recognition of both the infrastructure challenges and the cultural/behavioural changes needed in operating an entirely ZEV fleet. The IR found no evidence of measures tracking these two latter elements of the transition being presented to senior Governance for review.

Findings

In relation to decarbonisation, then Network Rail's CP7 decarbonisation target is sufficient to meet the core HLOSs requirements. However, in relation to the level of reduction in Scope 1 and 2 carbon emissions that could be achieved by CP7 exit, a more ambitious stretch target could be adopted (see Section 6.8.1).

Network Rail need to formally adopt a robust plan for ZEV transition if the requirements of the DfT's Rail Environment Policy Statement are to be met focussing on all aspects of the changeover to an ZEV fleet and report activity and outcome metrics in relation to this. There is likely to be a huge amount of stress on electric vehicles, electric vehicle charging infrastructure and DNO upgrades as all public organisations work to meeting the DfT target.

In addition, the exclusion of emissions from rail-based machines (see Section 6.6) is a gap in Network Rail's decarbonisation plans which should be addressed to better respond to the HLOSs requirements.

Question 7: Is the level of ambition, governance, corporate strategy, and operating models across Regions and central functions realistic, sufficient or below the level needed to deliver targets against the CP7 baseline?

Approach

The ambition set for CP7 is to achieve a 46% reduction in Scope 1 and 2 carbon emissions relative to the 2018/19 baseline, which represents a 21% reduction on the target CP6 exit position.

The proposed Governance and reporting structure for CP7 is not yet fully defined. ORR has set Scope 1 and 2 emissions as a Tier 1 success measure. Further, the IR understand Network Rail are moving away from the current system of periodic ESI reporting, and adopting a new measure for

environmental reporting. The IR understand that the final Governance and reporting framework for CP7 is not yet finalised. In the current model, periodic reporting is completed two months in arrears and reported regionally to exec level for review. The reporting targets currently in place relate only to carbon and energy (and for CP7 are currently limited to carbon only) and do not track any leading performance indicators or activity measures, (e.g., number of LED replacement schemes implemented, volume of solar PV installed, number of electric vehicle charge points/charge point capacity delivered).

Network Rail's corporate strategy with respect to Scope 1 and 2 carbon emissions is set out in the overarching document 'Our ambition for a low-emission railway 2020-50'[i]. The implementation of that strategy and delivery of both the DfT EV target and ORR Scope 1 and 2 reduction targets by the Regions is set out in the SBPs. The SBPs focus investment on a number of key themes described (see Section 5) including delivery of the ZEV fleet transition by 2027, renewable PPAs targeted for 2024 and by 2030, sustainable new build projects, solar PV and other energy efficiency strategies.

The operating model for Network Rail means there is a necessary level of devolution for Scope 1 and 2 carbon emissions, from central functions, down to Regions and then further down to route level where the majority of the emissions are owned and controlled. The IR understands the TA has produced an SBP assurance report on the SBP submissions, but the IR has not been provided with this report to consider in the review. In any case, it is clear that the TA has an assurance process in place for the SBPs, part of which is the Tier 1 requirements relating to Scope 1 and 2 carbon emissions.

Observations

In terms of Governance as previously suggested there is potential to improve visibility of progress in delivering the targets relating to Scope 1 and 2 with the development of some leading indicators, confirmation of how changes to the baseline should be dealt with and a review of reporting.

It seems that in order for ambition and success in achieving the required carbon emissions targets to cascade effectively across central functions, Regions and routes, it would be beneficial to have a more mature document underpinning implementation of the strategy (an action plan) and guidance for Regions, routes and central functions to follow in developing appropriately ambitious carbon reduction programmes. Although some Regions such as NW&C appear to the IR to be behind others in terms of development of decarbonisation strategies, it is clear that the ambition of the Regions (particularly Eastern, Southern and Scotland's Railways) are greater than necessary to simply meet the 46% reduction target. Success of the road fleet ZEV transition is critical to this, as is some degree of decarbonisation of the electricity grid.

In terms of ambition, due to the potential to achieve Scope 1 and 2 carbon emissions reductions of well above 46% by CP7 exit through grid decarbonisation and the ZEV transition programme, the level of ambition in the 46% target could be increased. It is notable that the SBTi report recommended a more ambitious CP7 exit target for Scope 1 and 2 emissions of 79% reduction (see Section 2.2). This was based on securing a 100% renewable PPA, but even without this and with reliance on national grid decarbonisation, it is likely that the 46% target will be exceeded by CP7 exit.

Network Rail's strategies to reduce Scope 1 and 2 carbon emissions are focussed in the correct key areas; energy reduction, renewable energy (decarbonised energy supply) and ZEV fleet rollout (reducing fuel consumption). It is important to acknowledge that for much of the proposed investment, there will be a lag between the implementation of measures and infrastructure and a return in terms of carbon emissions reductions. For example, installation of electric vehicle charging is vital to the ZEV transition, but the carbon benefits will follow the infrastructure installation over months and years as ZEVs enter the Network Rail fleet. It therefore seems valuable to consider leading KPIs linked to delivery of the measures and strategies within the SBPs that are aimed at achieving the carbon target, rather than track performance only against the carbon target itself. This will allow better tracking of Network Rail's progress towards the carbon reduction target. It may also be of value to

develop a year-on-year trajectory in order to understand the extent to which it is likely to be back-end loaded.

Findings

The IR recommend that Network Rail develops centralised guidance to support Regions and central functions in developing CP7 decarbonisation forecasts and monitoring performance through CP7.

The IR recommend Network Rail devise some new KPIs linked to the carbon target that allow tracking of the success of measures proposed to meet the carbon reduction target, for example energy and fuel consumption and electric vehicle infrastructure installations (see Section 6.8.1).

It is recommended that the Regions present the Scope 1 and 2 carbon trajectories with estimates of year-by-year reductions during CP7 which show a realistic trajectory of carbon emissions reductions though CP7, accounting for delivery of key measures and initiatives and in particular the effect of delivering the ZEV fleet transition, which is unlikely to result in linear annual emissions reductions through CP7.

Network Rail should consider the level of ambition in the 46% carbon emissions reduction target and consider other supporting targets relating to energy and fuel consumption to help drive ambition in reducing Scope 1 and 2 carbon emissions through CP7. The IR's suggestions in relation to such targets is summarised in Section 6.8.1.

Question 8. Are there any key risks, threats and opportunities that have not been taken into account?

Risks and Threats

The key components required to meet the 21% CP7 carbon reduction target (and 46% CP6 and CP7 SBTI trajectory) as discussed throughout this section are electricity decarbonisation and ZEV transition. Energy efficiency improvements and other measures such as small-scale solar projects are valuable in the overall process but will not make or break performance against the target. Grid electricity decarbonisation is being delivered by Government and the electricity generators. Network Rail does however have a plan to negotiate renewable PPAs, which would guarantee decarbonisation of electricity should the grid not decarbonise at the rate currently forecast.

The ZEV transition programme is the area in which many of the risks reside:

- Electric vehicle charging infrastructure: the major risk to delivery of the ZEV transition, which has been raised to the IR by Route Services and a number of the Regions is delivery of the required infrastructure for charging. This includes not just charging points, but considerable DNO upgrades at many Network Rail locations if dedicated depot charging is the strategy pursued, and in ZEV trials these processes have proven to take time.
- Cultural resistance to ZEVs: a number of Regions reported a level of cultural resistance to electric vehicles. This is thought to be related to a perception of difficulty with charging electric vehicles, and range anxiety associated with these vehicles. There is also poor clarity on the working arrangements for many vehicles, for example whether current home start agreements will mean a change to vehicles stored at depots.
- ZEV transition focus on vehicle procurement not infrastructure first: Network Rail has ringfenced electric vehicles for rollout to Regions and appears to continue to work to ringfence more vehicles in future years in an attempt to ensure a supply of electric vehicles to match the target trajectory for the rollout. This is likely in response to a perception that a key risk to delivery is vehicle supply. However, it is vital that the infrastructure is in place prior to

vehicle supply, and Network Rail should recognise that purchasing vehicles will not guarantee success of the transition whilst successfully maintaining core operations.

In addition, the omission of fuel from rail-based machines has been demonstrated to result in a potentially significant underestimate of the baseline Scope 1 and 2 carbon emissions. Due to the challenges of decarbonising rail-based machines, the inclusion of these emissions will increase the challenge to meeting the 21% CP7 decarbonisation target and 46% CP6 and CP7 SBTI trajectory.

Opportunities

A number of opportunities have been identified in discussions with the Regions and Route Services which may be valuable to Network Rail to consider in the run up to and during CP7. These opportunities either relate to reductions in carbon emissions above and beyond the current target for Scope 1 and 2 emissions, or may allow a greater success for delivery of the plans and targets including the ZEV fleet rollout programme:

- Electric vehicle charging from traction energy: the traction energy network provides opportunities to charge electric vehicles without need for costly and lengthy process of DNO upgrades and allow charging at work sites away from main depots. NW&C and Wales and West Regions have both informed the IR that they are exploring such opportunities;
- Partnerships on electric vehicle charging: many other organisations including rail bodies (TfW, TS), TOCs, station retailers, British Transport Police and other infrastructure operators (e.g., water companies) share the same fleet transformation objective set by the SoS. This created the potential for partnerships to share EV charging infrastructure and accelerate the ability to rollout to ZEVs. Wales and Western and Southern Regions have both informed the IR that they are exploring such opportunities; and
- Third party solar: opportunities to partner with third party solar developers to utilise unused NR land to deliver solar projects, which would not need direct funding from NR, but be used to supply renewable energy to NR assets. Wales and Western has informed the IR that they are exploring such opportunities.

6.8 Overall Themes

This section of the report provides a summary of some of the overall themes that have emerged from the review, which cascade through to the recommendations set out in Section 7.

6.8.1 CP7 Targets and Ambition

There is a question as to how ambitious the 46% carbon reduction target is. The origin of the current target agreed between ORR and Network Rail is auditable, in that it links to the SBTi report as the minimum required reduction required by CP7 exit to stay on track with decarbonisation in line with the 1.5- degree glidepath and net zero by 2050.

The analysis in Section 6.3 of this report suggests that Network Rail expect to deliver Scope 1 and 2 carbon emissions reductions of 38% to 75% relative to the CP5 exit baseline in CP7 (based on forecast data from Scotland's Railways, Eastern and Southern). These reductions are well above the 21% target described in Network Rails SBPs (Section 5), but include the effects of electricity grid decarbonisation, which accounts for a large proportion of the reduction (see Section 6.5), but is also uncertain and completely outside of Network Rail's control.

When the benefits of grid decarbonisation are discounted, the Region's forecast Scope 1 and 2 carbon emissions reductions of between 16% to 52% (based on forecast data from Scotland's Railways, Eastern, Southern and Wales and Western). Scotland's Railways forecast stands out at 52% reduction, but the other Regions are all closer (Wales and Western – 16%, Southern – 21%, Eastern – 24%). The

main contributors to these reductions at the ZEV transition (see Section 6.4) and energy efficiency measures. The fact that Wales and Western have forecast lower percentage reductions may be related to the Region achieving high reductions in CP6 and therefore front ending progress towards the combined CP6 and CP7 46% reduction target.

From these data it can be concluded that if grid decarbonisation successfully follows the Government's target trajectory, then Network Rail might be reasonably expected to well exceed it's 21% SBP targets for CP7. However, if grid decarbonisation progresses at a slow rate, the challenge may be harder and will certainly rely on success of the ZEV transition.

As discussed in Section 6.4, the ZEV transition already represents an ambitious and challenging target for CP7 and will (if successful) be very effective at minimising Scope 1 emissions from fleet fuel. Beyond this, all Regions have developed a number of energy efficiency and renewable energy schemes to be implemented in CP7, although there is only so far these measures can go in reducing Scope 1 and 2 emissions.

There is also uncertainty in the baseline emissions data and therefore variance (Region by Region) in the level of confidence or accuracy in the start point for comparison of the reductions.

It is the opinion of the IR that due to uncertainty around grid decarbonisation and the fact it is out of control of Network Rail, that a target linked to the SBTI trajectory of 46% should be retained, but a further ambition for CP7 should be set. Given the differences in progress in decarbonisation in CP6 between Regions and the difference in allocated fundings, plans and measures in place, it would be appropriate that such a further ambition could be Region or function specific and based on each Regions' individual forecasts.

In setting further ambition targets for Scope 1 and 2 carbon emissions, it would also be more appropriate to link these to reductions independent of grid decarbonisation to focus on the measures and initiatives over which Network Rail has control such as the ZEV transition.

It is the opinion of the IR, that based on the forecast information shared, a further ambition excluding grid decarbonisation in the region of 20% to 25% for CP7 would align with the analysis of the Regions, but it is important that any such targets are agreed following a Scope 1 and 2 emissions re-baselining exercise and detailed CP7 decarbonisation forecasting setting the expected trajectory of emissions reductions through CP7.

It is the opinion of the IR that a further ambition target should be able to account for direct wire PPAs that are introduced in CP7, such as the PPA for non-traction energy announced in the national (England and Wales) SBP. However, the IR recommends that Network Rail consider how to equitably allocate the carbon benefits of this PPA (and any other future PPAs) between Regions.

Beyond a simple carbon emissions target, the ZEV transition and energy efficiency measures are vital to the success of Scope 1 and 2 decarbonisation. The IR recommends that leading and lagging performance indicators to monitor the implementation and success of these measures is considered by Network Rail. For ZEV, such a performance indicator might best relate to the delivery of funded infrastructure. For energy an energy reduction target similar to that adopted for CP6, adjusted for any projected growth and energy for electric vehicle charging.

6.8.2 Baseline

As discussed in Section 6.2, processes during CP6 have greatly improved the understanding of and confidence in Network Rail's energy data, and a number of Regions have identified issues which they consider render the CP5 exit baseline (against which Scope 1 and 2 carbon emissions performance is measured) inaccurate.

In addition, the IR has identified that it is likely that emissions from fuel used by rail-based machines (those owned and operated by Network Rail) are likely to be excluded from the carbon emissions reporting and forecasting.

Accordingly, the IR recommend that a re-baselining exercise of Scope 1 and 2 carbon emissions is undertaken ahead of CP7 to ensure the footprint is robust and complete and to improve the robustness of assessment of success against the adopted carbon reduction targets.

6.8.3 Forecast Methodology

The approaches taken by Regions to forecast Scope 1 and 2 carbon emissions are inconsistent. At a high-level the same themes are explored in terms of decarbonisation plans, but the details are sufficiently different that comparison of one plan to another is quite challenging.

All of the forecasting seen by the IR is also focussed on linear carbon emissions reductions each year through CP7. It is the opinion of the IR that due to the timescales and challenges for delivering electric vehicle charging infrastructure that it is very unlikely that emissions reductions will be linear, but likely to be backend loaded. The IR recommends that all Regions develop a similar year-by-year forecast that can be used to better measure annual progress towards the target reductions.

6.8.4 Clearer Guidance and Assurance

Most of the Regions reported uncertainty in how to approach the task of developing CP7 forecasts and trajectories, or the format for reporting and deliverables.

The process would benefit from more detailed centralised guidance to support the Regions and Route Services in development of the forecasts and plans. This would ideally include the points listed in Section 6.1. It would also provide ORR with greater confidence if the TA had a clear process to assure the Region and Route Services plans and delivery.

6.8.5 Reporting and Governance

The Tier 1 measure agreed by ORR focusses on the outcome of reducing Scope 1 and 2 carbon emissions. Due to the lag time between investment in decarbonisation measures (e.g. ZEV infrastructure, energy efficiency schemes, gas boiler replacements) and realised carbon emissions reductions it is the opinion of the IR that focus on carbon emissions reporting alone may not be (on its own) the most effective metric for tracking decarbonisation performance. Further, given the level of investment and the timescales for delivery of many of the initiatives in the SBPs it is likely that reductions in emissions will not become clear until the latter years of CP7.

It is understood that Network Rail are replacing the current ESI metric of sustainability reporting, but the replacement metric has not yet been agreed. It is therefore suggested that the metrics for reporting and governance framework for CP7 decarbonisation is further developed ahead of CP7, which might include additional performance indicators as discussed in Section 6.8.1.

6.8.6 Risks and Confidence in CP7 Plans

Overall, based on the key strategies around energy reduction and ZEV transition, combined with electricity grid decarbonisation (nationally or via renewable PPAs), there can be a high level of confidence in exceeding the 21% carbon reduction target for CP7 (and 46% CP6 and CP7 SBTI trajectory target). However, a number of key risks are evident that relate either to achievement of the target (or the degree to which it is exceeded) and/or meeting the requirements of the HLOS or DfT/TS policies:

- Infrastructure and planning issues delaying the ZEV transition and missing the 2027 target;

- Grid decarbonisation not delivering the expected carbon reductions currently forecast by Government;
- Lack of evidence on the deliverability of some of the proposed energy reduction projects; and
- Evidence from CP6 that delay to plans and programmes could push initiatives into CP8 (as a number of CP6 plans have been moved to CP7).

There are differences in the methodology and approach to CP7 decarbonisation forecasts, but the key strategies for decarbonisation (ZEV transition, energy efficiencies) are consistent between Regions and well planned and funded. There is therefore uncertainty in the precise level of carbon reductions that might be expected, but there can be reasonable confidence in the Regions achieving the 21% CP7 target described in the SBPs. This is less clear for Route Services where there is the potential that a large part of the baseline has been omitted (i.e. rail-based machines) and the IR has not found evidence of an action plan to address emissions.

Overall, there is sufficient confidence in the Region's plans to deliver the Scope 1 and 2 carbon reductions set out in the SBPs (21%), but the same confidence cannot be applied to Route Services, and the potential scale of emissions from rail-based machines (circa 25% of Network Rail's national carbon emissions) has potential to add substantial challenge to the overall Network-wide achievement of the carbon reduction target.

6.8.7 Opportunities

The IR has identified a number of opportunities to reduce risks or improve efficiency in the delivery of the target including:

- Working collaboratively with other rail sector organisations in the delivery of EV charging infrastructure;
- Considering the use of the traction energy network to reduce the extent of new or upgrade DNO connections; and
- Maximising the use of home-start charging in the early years of the EV rollout programme whilst necessary DNO upgrades are being delivered.

6.9 Other Considerations

6.9.1 Air Operations

The IR has spoken with Route Services air operations team, as Network Rail make use of two helicopters (one used nationally and the other in Scotland). Fuel use for the helicopters is not included in Network Rail's Scope 1 and 2 emissions reporting. It is understood these assets are owned and operated by a third party so would be considered a Scope 3 emission source. Analysis of estimated fuel consumption values provided by Route Services for the helicopters suggest these would only be a small contribution to Network Rail's overall Scope 1 and 2 carbon footprints if included, so are not material.

6.9.2 Preparedness for CP8

It is recommended that Network Rail carry out the following tasks in preparing for CP8:

- Develop a strategy for decarbonisation of larger diesel vehicles and plant including HGVs and road-rail vehicles, which can be updated as technological pathways for decarbonisation of these assets emerge;

- Robustly quantify and develop a strategy for decarbonisation of its fleet of rail-based machines;
- Gain a better understanding of the scale of SF6 use and emissions and the plan for elimination of SF6 emissions;
- Define the contribution of refrigerant losses and other f-gas releases to the Scope 1 and 2 carbon footprints; and
- Consider gas oil use in emergency generators and other minor fuel use in remote assets.

7. KEY FINDINGS AND RECOMMENDATIONS

This section provides details of key findings and recommendations from the study. It is intended that these recommendations are reviewed by ORR, Network Rail and the Regions and addressed or responded to as part of Stage 2 of this study.

Recommendations are provided with a priority rating of high, medium or low. The application of the priority ratings is based on the following criteria and colour coded as shown:

- **High Priority Recommendation:** issues or opportunities with a high likelihood of materially affecting the CP7 forecasts or successful achievement of the targets or HLOS requirements.
- **Medium Priority Recommendation:** issues or opportunities that could materially affect the CP7 forecasts or successful achievement of the targets or HLOS requirements, either individually or in-combination with other issues and opportunities.
- **Low Priority Recommendation:** issues or opportunities that are unlikely to materially affect the CP7 forecasts or successful achievement of the targets or HLOS requirements individually but may contribute in-combination with several other issues and opportunities.

Key Finding 1: There is inconsistency in approach to CP7 forecasting between Regions, but they are all likely to deliver the target. Each Region has been tasked with developing a CP7 Scope 1 and 2 decarbonisation plan. Network Rail has provided support to Regions in developing the plans at a high level, and the main decarbonisation strategies which appear in the SBPs are reasonably well aligned.

However, in terms of forecasting and quantifying the expected emissions reductions in CP7, Network Rail appear to have provided little in the way of detailed guidance to Regions. This has resulted in Regions each taking subtly different approaches leading to poor comparability between Regional forecasts in terms of detail and the confidence in the level of emissions reductions that is expected. One common theme in discussions with Regions is that the process would greatly benefit from some centralised consistent guidance to help align the approach robustly across the Regions and central functions.

Although there is some uncertainty in the likely emissions reductions that will be achieved, the IR has confidence from the information provided by Regions that they will be able to meet the 21% carbon reduction target in CP7.

Whilst the Regions have presented a year-by-year glide path of predicted Scope 1 and 2 carbon emissions reductions through CP7, for most Regions these appear to be a linear trajectory to meet the 21% target described in the SBPs. Given the likely back-end loading of some key decarbonisation measures such as the ZEV transition, it seems unlikely that a linear trajectory in carbon emissions reductions should be expected. Development of trajectories which reflect the actual delivery of change in each year would benefit monitoring and reporting of progress on decarbonisation in CP7.

High Priority Recommendation: Network Rail should develop a guidance framework to support and assist Regions and central functions in the forecasting and reporting of CP7 Scope 1 and 2 carbon emissions. The framework may include written guidance, tools, briefings or workshops and Network Rail should consider including the following in such a guidance framework:

- Agreed carbon emissions factors for energy and fuels, taking account of grid decarbonisation and planned PPAs;

- Guidance on appropriate assumptions in relation to BAU energy efficiencies to apply to the forecasts;
- Guidance on approaches to estimating electricity consumption from electric vehicles, and assumptions on fleet rollout;
- Advice on treatment of sub-metered tenant energy from the energy consumption data;
- Advice on treatment of uncertainty; and
- An agreed set of deliverables for the CP7 plan, (e.g., waterfall charts, year-by-year carbon emissions trajectory, written plan, supporting evidence).

Medium Priority Recommendation: Regions should develop updated CP7 decarbonisation forecasts to include year-by-year carbon emissions trajectories for CP7 to show the anticipated glide path for decarbonisation through CP7 and allow better monitoring of progress towards the decarbonisation target. Updated forecasts should adopt aligned assumptions guided by the recommendation for a guidance framework set out above.

Key Finding 2: The IR has not seen evidence that Route Services has fully quantified its Scope 1 and 2 emissions, developed a CP7 decarbonisation plan or have confidence that Route Services can meet the CP7 carbon reduction target. The IR has not seen evidence that Route Services has developed a CP7 carbon emissions forecasts or decarbonisation plan. Route Services have a key role in the ZEV transition and the Route Services SBP includes commitments to replace its own fleet of road vehicles with ZEVs, but it is not clear if any other emissions sources are considered, nor if Route Services have adopted the 21% carbon reduction target adopted by the Regions (and Network Rail nationally).

It is though acknowledged that the IR has not been able to speak directly to members of the Route Services decarbonisation team as part of this Stage 1 review.

In addition, the IR has identified that emissions from Network Rail's fleet of 2,500 rail-based machines are substantial in the context of the currently reported Scope 1 and 2 emissions and are not presently accounted for in Network Rail's carbon emissions reporting or forecasts. A large proportion of these machines are operated by third parties and therefore emissions are Scope 3, but a proportion of the machines are operated directly by Route Services and could contribute up to 25% of Network Rail's national Scope 1 and 2 carbon emissions. Given this could contribute a large proportion of Network Rail's national carbon emissions footprint, for completeness Route Services should quantify and baseline emissions from rail-based machines, and develop a CP7 decarbonisation forecast and plan which includes them.

The IR has not seen evidence that Route Services has a system of reporting and governance for Scope 1 and 2 carbon emissions in place, beyond the compilation of data for national reporting lead by the TA.

High Priority Recommendation: Route Services should develop a CP7 carbon emissions forecast and decarbonisation plan.

High Priority Recommendation: Route Services should quantify Scope 1 carbon emissions from rail-based machines and include these in its baseline carbon footprint and future decarbonisation plans.

Medium Priority Recommendation: Route Services should develop or demonstrate the existence of a process of reporting and governance of its Scope 1 and 2 carbon emissions.

Key Finding 3: The IR has seen insufficient detail in plans for the ZEV transition to have confidence in its success. To meet the requirements of the DfT's Rail Environment Policy Statement which sets a mandate to replace all internal combustion engine cars and vans in the Network Rail road fleet by 2027, a robust and detailed plan of infrastructure upgrades and vehicle supply and operation

is required. Detailed analysis has been undertaken within Route Services and separately by Scotland's Railways to plan for the ZEV transition, but there has been no evidence provided to the IR that a formal centralised plan has been implemented by Network Rail. There are a number of challenges to the ZEV transition and its success is important to the success of Network Rail's decarbonisation plans and targets for CP7.

Each Region is clearly spending a lot of time and effort planning for the ZEV transition programme, which has already begun with vehicles being rolled out across all Regions. Substantial funding has been secured for the programme across all Regions for CP7. However, all Regions report challenges to the vehicle rollout in terms of delivery of sufficient infrastructure for vehicle charging (such as electricity substation and DNO upgrades and EV charging points) as well as cultural challenges around the limitations of where to charge vehicles, whether vehicles can be kept at home as many of the current ICE fleet are, as well as issues around range anxiety. An issue was also raised with the IR that procurement of electric vehicles has been prioritised, but the delivery of the charging infrastructure needs to keep ahead of vehicle delivery to ensure the ZEV transition is successfully delivered.

The IR has not seen evidence of there being a consolidated strategy in place, with appropriate levels of engagement between Route Services, who handle vehicle leasing, and the Regions and routes who are responsible for delivering the required infrastructure.

High Priority Recommendation: Network Rail should undertake a detailed review of the ZEV transition programme and implement a strategy for successful delivery of the required infrastructure across Network Rail, which will allow for setting of appropriate leading and lagging performance indicators to track success or identify delay in the ZEV transition, setting the focus on infrastructure delivery before vehicle procurement.

Key Finding 4: Network Rail's Scope 1 and 2 carbon footprint would benefit from re-baselining. All Regions have reported significant data cleansing with respect to energy data and some major issues with respect to large quantities of energy being billed to Network Rail which are now sub metered (e.g., tenants' energy, Waterloo and City Line at Waterloo Station, Crossrail works for Wales and Western). It therefore seems clear to the IR that there is uncertainty in Network Rail's 2018-19 energy consumption and carbon emissions baseline and corresponding uncertainty in the monitoring and reporting of the success of Network Rail's decarbonisation plans.

High Priority Recommendation: Network Rail should consider re-baselining its Scope 1 and 2 carbon emissions prior to CP7 to take into account data cleansing in CP6.

Medium Priority Recommendation: Network Rail should agree a consistent approach to treatment of tenant's energy within the carbon emissions reporting, in the event that further sub-metering of energy occurs during CP7.

Key Finding 5: The framework for assurance and governance of CP7 decarbonisation performance is not well developed. Network Rail has set a 21% carbon reduction target for CP7, which when combined with the existing 25% reduction target for CP6 (if achieved), will complete the planned 46% reduction between CP5 exit and CP7 exit. The IR understands that assurance is currently based on periodic reporting of carbon and energy emissions, however it is unclear whether there is a central assurance and governance process in place to ensure consistency between Regions and Route Services.

Medium Priority Recommendation: Network Rail should set out a clear process to assure the Region and Route Services plans and delivery.

Key Finding 6: Additional performance indicators and targets for CP7 could be developed to assist in measuring the success of CP7 decarbonisation plans and increase ambition. During CP6 Network Rail set reduction targets for both carbon (25% by CP6 exit and 46% cumulatively by CP7 exit compared to CP5 exit baseline) and energy consumption (18% by CP6 exit). The only target for CP7

relating to Scope 1 and 2 carbon emissions is the 21% carbon reduction target, with regular reporting of emissions used as a performance indicator.

Due to the lag time between certain initiatives to save energy, fuels and carbon and the corresponding carbon emissions reductions, it is recommended that Network Rail consider other performance indicators to monitor CP7 decarbonisation performance. This is particularly important for the ZEV transition, which is not linear in the expected profile of delivery of ZEVs in CP7.

In addition, CP7 decarbonisation forecasts prepared by Regions suggest that the 21% carbon reduction target could be well exceeded, through successful delivery of the ZEV transition, energy efficiency and renewables projects, alongside grid decarbonisation. Grid decarbonisation is a major driver, but is outside of Network Rail's control.

Network Rail has indicated in the national SBP the intention to deliver at least one direct-wire PPA for renewable non-traction energy during CP7. It is not clear to the IR whether Network Rail has defined how the carbon benefits of this PPA (and any other future PPAs) will be equitably divided by the Regions.

The IR finds that there is an opportunity to set a further ambition for non-traction Scope 1 and 2 carbon emissions reductions in CP7, which aligns more specifically with the Regions' forecasts and adopts a metric which excludes grid decarbonisation.

High Priority Recommendation: Network Rail should develop additional performance indicators to track key decarbonisation measures in CP7, in particular the ZEV transition and planned and costed energy efficiency measures.

Medium Priority Recommendation: Network Rail should consider the development of further ambition target for Scope 1 and 2 carbon emissions. This should be linked to the level of ambition set by the Regions and the degree to which CP7 carbon emissions are forecasts and may be Region or function specific. To focus any such target on measures over which Network Rail has control, grid decarbonisation (other than via direct wire PPAs) should be discounted from the target.

Medium Priority Recommendation: Network Rail should define how to equitably divide the carbon emissions benefits of non-traction PPAs between the Regions and central functions.

Key Finding 7: Network Rail has no policy on carbon offsetting. Scotland's Railways has included offsetting within its CP7 decarbonisation forecast and has secured funding for kick-starting local offsetting schemes during CP7. The IR has not seen any evidence that Network Rail has developed a policy on carbon offsetting, or agreed on how offsetting can or cannot be used in relation to the HLOSs requirements and CP7 decarbonisation plans.

It is unclear to the IR what the Network Rail or ORR policy is in relation to offsetting, and the role this could play (likely beyond CP7) in tackling Network Rail's residual Scope 1 and 2 emissions.

Low Priority Recommendation: Network Rail should develop a policy on the role of offsetting and how this can be investigated and used by Regions to offset residual Scope 1 and 2 emissions for CP8.

Key Finding 8: Scope 1 emissions from SF6 use in electrical switch gear and refrigerant losses from cooling systems have not been considered in Network Rail's CP7 decarbonisation forecasts. The focus of the CP7 decarbonisation forecasts is on car and van fleet fuel (the ZEV transition) and energy (electricity and natural gas) as these predominate Network Rail's Scope 1 and 2 carbon footprints. There is a further group of sources which are either not considered by Network Rail, or it is unclear to the IR whether they are included in the Scope 1 and 2 carbon footprint and CP7 forecasts.

Scope 1 emissions sources not considered by Network Rail in CP7 decarbonisation plans are SF6 (a greenhouse gas use in electrification systems) and gas oil (primarily used for emergency standby generators).

Scope 1 emissions source not accounted for anywhere in Network Rail's Scope 1 and 2 carbon footprints are refrigerant gases used in cooling systems and some fire suppression systems.

Low Priority Recommendation: Network Rail should commission a study to assess SF6 use and emissions on the network and undertake an optioneering study to identify potential strategies to reduce or eliminate SF6 gas use and release.

Low Priority Recommendation: Network Rail should work to assess and quantify refrigerant use in Network Rail assets, estimate annual emissions from refrigerant leakage and include these emissions in ongoing Scope 1 and 2 carbon emissions reporting.

APPENDIX A – NETWORK RAIL REGIONAL SCOPE 1 AND 2 DATA

A.1 REGIONAL SOURCE BREAKDOWNS

Eastern Scope 1 and 2 Emission Source Breakdown (TCO_2e)

	18/19		19/20		20/21		21/22		22/23	
Source	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**
Electricity	33,861	60%	30,579	58%	27,246	53%	23,389	50%	20,673	48%
Gas	5,050	9%	4,617	9%	4,269	8%	3,691	8%	3,069	7%
Fleet fuel	13,382	24%	13,421	26%	15,837	31%	15,259	33%	13,479	31%
LPG	28	0%	21	0%	24	0%	4	0%	23	0%
Gas Oil	2,311	4%	2,262	4%	2,328	5%	2,420	5%	4,376	10%
SF6	1,654	3%	1,654	3%	1,654	3%	1,654	4%	1,654	4%
TOTAL	56,286	100%	52,555	100%	51,358	100%	46,417	100%	43,273	100%

a. CO_2e emissions from electricity includes non-traction from traction electricity (NTfT).

b. CO_2e emissions from fleet fuel includes diesel, unleaded petrol and LPG.

North West & Central Scope 1 and 2 Emission Source Breakdown (TCO_2e)

	18/19		19/20		20/21		21/22		22/23	
Source	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**
Electricity	36,287	69%	33,378	66%	27,314	59%	25,800	59%	22,425	55%
Gas	2,051	4%	2,900	6%	2,376	5%	2,160	5%	1,940	5%
Fleet fuel	10,208	20%	10,640	21%	12,767	28%	11,651	27%	10,405	26%
LPG	53	0%	47	0%	26	0%	19	0%	21	0%
Gas Oil	2,082	4%	2,143	4%	2,205	5%	2,293	5%	4,146	10%
SF6	1,572	3%	1,494	3%	1,494	3%	1,494	3%	1,494	4%
TOTAL	52,253	100%	50,603	100%	46,182	100%	43,416	100%	40,431	100%

a. CO_2e emissions from electricity includes non-traction from traction electricity (NTfT).

b. CO_2e emissions from fleet fuel includes diesel, unleaded petrol and LPG.

Scotland Scope 1 and 2 Emission Source Breakdown (TCO_2e)

	18/19		19/20		20/21		21/22		22/23	
Source	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**
Electricity	12,729	63%	11,149	60%	9,896	54%	8,708	51%	8,578	53%
Gas	1,078	5%	1,238	7%	1,226	7%	1,125	7%	859	5%
Fleet fuel	4,496	22%	4,776	26%	5,648	31%	5,648	33%	4,722	29%
LPG	10	0%	7	0%	8	0%	51	0%	8	0%
Gas Oil	1,218	6%	782	4%	804	4%	836	5%	1,512	9%
SF6	718	4%	640	3%	640	4%	640	4%	640	4%
TOTAL	20,248	100%	18,593	100%	18,222	100%	17,008	100%	16,318	100%

a. CO_2e emissions from electricity includes non-traction from traction electricity (NTfT).

b. CO_2e emissions from fleet fuel includes diesel, unleaded petrol and LPG.

Southern Scope 1 and 2 Emission Source Breakdown (TCO_2e)

	18/19		19/20		20/21		21/22		22/23	
Source	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**
Electricity	30,975	74%	30,125	72%	28,432	68%	23,341	65%	19,460	60%
Gas	1,775	4%	1,854	4%	1,622	4%	1,424	4%	1,579	5%
Fleet fuel	6,404	15%	6,914	16%	8,754	21%	7,936	22%	6,692	21%
LPG	23	0%	17	0%	20	0%	0	0%	18	0%
Gas Oil	1,515	4%	1,831	4%	1,885	4%	1,959	5%	3,543	11%
SF6	1,412	3%	1,334	3%	1,334	3%	1,334	4%	1,334	4%
TOTAL	42,105	100%	42,076	100%	42,046	100%	35,994	100%	32,626	100%

a. CO_2e emissions from electricity includes non-traction from traction electricity (NTfT).

b. CO_2e emissions from fleet fuel includes diesel, unleaded petrol and LPG.

Wales & Western Scope 1 and 2 Emission Source Breakdown (TCO_2e)

	18/19		19/20		20/21		21/22		22/23	
Source	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**	**TCO_2e**	**%**
Electricity	25,594	70%	23,751	69%	18,810	63%	15,569	60%	14,164	57%
Gas	1,162	3%	1,264	4%	1,273	4%	1,049	4%	958	4%
Fleet fuel	7,399	20%	7,797	23%	8,178	27%	7,603	29%	6,667	27%
LPG	21	0%	17	0%	17	0%	6	0%	15	0%
Gas Oil	2,374	6%	1,488	4%	1,531	5%	1,592	6%	2,878	12%
SF6	213	1%	213	1%	213	1%	213	1%	213	1%
TOTAL	36,764	100%	34,531	100%	30,023	100%	26,031	100%	24,896	100%

a. CO_2e emissions from electricity includes non-traction from traction electricity (NTfT).

b. CO_2e emissions from fleet fuel includes diesel, unleaded petrol and LPG.

A.2 REGIONAL CONSUMPTION BREAKDOWNS

The tables below show the Regional consumption breakdown of Scope 1 and 2 energy sources for FY18/19 to FY22/23.

Eastern Scope 1 and 2 Consumption Breakdown

Source	Unit	18/19	19/20	20/21	21/22	22/23
Electricity	kWh	119,620,440	119,634,794	116,865,368	110,152,864	106,902,239
Gas	kWh	27,451,542	25,113,628	23,215,536	20,151,829	16,812,255
Fleet fuel	litres	5,119,599	5,125,494	6,188,348	6,035,387	5,325,794
LPG	litres	18,685	14,092	15,735	2,476	14,603
Gas Oil	litres	778,098	820,125	844,109	877,202	1,586,408
SF6	kg	73	73	73	73	73

a. Electricity consumption includes non-traction from traction electricity (NTfT).

b. Fleet fuel consumption includes diesel, unleaded petrol and LPG.

North West & Central Scope 1 and 2 Consumption Breakdown

Source	Unit	18/19	19/20	20/21	21/22	22/23
Electricity	kWh	128,190,150	130,587,719	117,156,452	121,507,941	115,961,925
Gas	kWh	11,148,101	15,774,265	12,921,586	11,791,589	10,629,369
Fleet fuel	litres	3,903,265	4,071,446	4,994,763	4,604,761	4,094,453
LPG	litres	35,142	30,760	16,975	12,118	13,836
Gas Oil	litres	700,972	776,999	799,723	831,076	1,502,988
SF6	kg	69	66	66	66	66

a. Electricity consumption includes non-traction from traction electricity (NTfT).

b. Fleet fuel consumption includes diesel, unleaded petrol and LPG.

Scotland Scope 1 and 2 Emission Consumption breakdown

Source	Unit	18/19	19/20	20/21	21/22	22/23
Electricity	kWh	44,967,188	43,619,874	42,445,167	41,010,546	44,357,257
Gas	kWh	5,858,689	6,736,234	6,665,534	6,143,992	4,704,282
Fleet fuel	litres	1,716,209	1,834,320	2,214,562	2,242,429	1,857,430
LPG	litres	6,317	4,875	5,438	32,857	5,046
Gas Oil	litres	410,137	283,422	291,710	303,147	548,240
SF6	kg	32	28	28	28	28

a. Electricity consumption includes non-traction from traction electricity (NTfT).

b. Fleet fuel consumption includes diesel, unleaded petrol and LPG.

Southern Scope 1 and 2 Consumption Breakdown

Source	Unit	18/19	19/20	20/21	21/22	22/23
Electricity	kWh	109,424,709	117,860,343	121,951,885	109,928,081	100,630,896
Gas	kWh	9,651,431	10,085,120	8,822,799	7,772,297	8,650,318
Fleet fuel	litres	2,454,438	2,645,760	3,439,730	3,148,260	2,650,971
LPG	litres	15,121	11,413	12,737	243	11,824
Gas Oil	litres	510,180	664,010	683,427	710,222	1,284,428
SF6	kg	62	59	59	59	59

a. Electricity consumption includes non-traction from traction electricity (NTfT).

b. Fleet fuel consumption includes diesel, unleaded petrol and LPG.

Wales & Western Scope 1 and 2 Consumption Breakdown

Source	Unit	18/19	19/20	20/21	21/22	22/23
Electricity	kWh	90,416,160	92,923,132	80,679,069	73,323,284	73,243,136
Gas	kWh	6,318,748	6,875,979	6,923,983	5,725,173	5,246,747
Fleet fuel	litres	2,833,094	2,971,901	3,184,922	2,991,212	2,627,261
LPG	litres	14,086	11,069	11,241	3,699	9,608
Gas Oil	litres	799,076	539,427	555,205	576,971	1,043,441
SF6	kg	9	9	9	9	9

a. Electricity consumption includes non-traction from traction electricity (NTfT).

b. Fleet fuel consumption includes diesel, unleaded petrol and LPG.

APPENDIX B – ENVIRONMENTAL SUSTAINABILITY SBP CP7 GUIDANCE ISSUED

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Products – what needs to be submitted

Expected submissions for Strategic Business Plan (SBP)

Strategic Plan	Sustainable growth strategic narrative (content requirements for all objectives below including those where funding is not specifically being requested. This can be a link to an existing plan / strategy outlining BAU work plans)
	Table of associated initiatives and costs
	Forecasting methodology including assumptions and uncertainties (where relevant)
Financial template	Indication of which projects contribute towards resilience – method being considered
	Fully completed table of initiatives and costs
Evidence & analysis	Regional WRCCA plans
	Energy and Carbon reduction breakdown showing how energy and carbon targets will be achieved

Objectives – what plans need to deliver

The sustainable growth NSC strategic objectives are:

- **Reduce carbon:** Net-zero by 2050 (E&W) / 2045 (Scotland), phase out diesel trains by 2040 (E&W) / 2035 (Scotland)
- **Improve air quality:** Reduce harmful pollutants in managed stations by 25 % by 2030, dust suppression in place at all appropriate plant, worksites and depots by 2029
- **Non-traction energy reduction:** feed in 100% of our non-traction electricity from renewable sources by 2030
- **Weather Resilience and Climate Change Adaption (WRCCA):** Prepare the railway infrastructure to minimise the impacts of climate change by 2050
- **Improve biodiversity:** Positive impacts on biodiversity. Deliver biodiversity net gain by 2035
- **Minimal waste and use of materials:** Reuse, recycle, or redeploy all our non-hazardous infrastructure materials by 2029
- **Social Value:** Maximise positive impacts on people and manage or mitigate negative ones

In the funding scenario for CP7 planning round 5, the minimum sustainable growth outcome is to **contribute required initiatives towards meeting our net-zero commitments, deliver regional WRCCA plans, and deliver required biodiversity initiatives to meet legal biodiversity obligations, whilst maintaining CP6 performance for other areas.**

- Forecasts required under the CP7 regulatory framework are in bold below
- Contact details for central support (and modelling, where available) are provided for each metric.

	Key contact
Carbon emissions scope 1&2	
One Planet Indicator (OPI)	
Positive impacts on Biodiversity*	*Currently working with the ORR to understand expectations for biodiversity measurement in CP7. Will update Regional Sustainability leads once confirmed.
Carbon emissions scope 3	
Reduction in non traction energy use	
Air quality at stations	
% achievement of WRCCA plan milestones	
Waste (% diversion from landfill)	
Social value (£)	

A screenshot of Network Rail's PR23 Guidance on Sustainable Growth for CP7

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Plan content – what plans need to include

Content to include in plans is listed below. This is not exhaustive and region/function teams should build on this as appropriate.

Area	Requirement	Key contact
All	Consideration to how achievement of objectives will be driven through the supply chain	
Freight growth	Consider opportunities to enable freight growth (reducing carbon and contributing to economic growth)	
Technology	Provide commentary on region/function technology strategy and how technology will be applied/developed in CP7 and beyond	
R, D & I	Identify and prioritise opportunities with dependencies on the national RD&I submission, with linkage to industry strategic objectives. Integration of innovation in operating models and collaboration across regions, functions, and industry partners.	
WRCCA	Narrative outlining overarching approach to weather and climate change resilience for CP7, key risks, how investment will address these and consequences of funding challenges. Reference developing CP7 WRCCA plans. Include: • Long term adaptation pathways investment plans to be developed in CP7 • Implementation of Mair/Slingo recommendations through Weather Risk Taskforce • How asset work banks will enhance resilience e.g. drainage, earthworks, overhead lines etc. and additional climate change resilience projects • Inclusion of recommendations following the 'extreme heat task force' paper • Collaboration with third parties (e.g. Environment Agency) and partnership (indicate value of NR contribution)	
Social Value	Narrative outlining the overarching approach to: • Minimising negative impacts on people, from, for example: disruption, noise, poor air quality, vibration • Optimise positive impacts on people by doing business better e.g. community rail; involving passengers in design of assets and services; make socio-economic opportunities (jobs, skills, contracts) accessible in 'local'/ disadvantaged communities. • Monitoring and reporting social value performance, for example by using the Rail Social Value Tool, and explain key 'social partnerships'	
Low Emissions	Outline overarching approach to net-zero carbon emissions, improving air quality and reducing energy use. Include: • Implementation of energy / carbon reduction initiatives to support achievement of targets and air quality initiatives to achieve air quality targets	
Biodiversity	Outline overarching approach to sustainable land use and to maintain, protect, and enhance biodiversity, to consolidate our no net loss position and deliver legal biodiversity obligations as we move towards net gain. Include: • activity to maintain and protect biodiversity to meet legal biodiversity obligations • initiatives to deliver strategic commitments supported by outputs from the sustainable land use programme	
Circular Economy	Narrative outlining the overarching approach to: • implement circular economy and 'whole life cycle thinking' into business as usual • achieve zero waste to landfill through the reuse, recycling or redeployment of non-hazardous infrastructure materials and greater use of Surplus app	

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Assurance – what good looks like

Key findings from round 5 have been uploaded to the Periodic Review SharePoint site:

The assurance approach for round 6 is below. At this stage of planning we would expect plans to be at level 4 or 5, and to be showing improvement on previous assurance.

	Criteria	1	2	3	4	5
R, D & I		No reference to RD&I and no recognition that 'different ways of working' are critical to region/function, industry and governmental strategic objectives.	Includes reference to RD&I however no/limited attempt to link to region/function, industry and governmental strategic objectives, such as a financial benefit.	Clear recognition of RD&I contributing to strategic objectives, some reference to specific initiatives.	RD&I opportunities identified and prioritised supporting objectives with a commitment to lead and embed an innovation culture.	RD&I opportunities identified and prioritised, linked to wider CP7 RD&I and industry objectives. Innovation integrated in operating models and collaborative approach
Technology		No reference to technology in CP7 plans	Some reference to technology in CP7 plans with limited reference to benefits	Emerging strategy with clear narrative on initiatives and activities	Complete strategy with emerging narrative on the associated benefits	Mature technology strategy with credible plans and associated benefits for CP7
Sustainability	Alignment to sustainability strategies	No alignment to NRs sustainability strategies	Little alignment to NRs sustainability strategies	Some alignment to NRs sustainability strategies	Good alignment to strategies demonstrated throughout the submission.	Demonstrate and clearly articulate full alignment to strategies throughout the submission
	Quality of narrative	Narrative shows little to no understanding of the objective areas.	Narrative shows some understanding the objective areas.	Narrative shows satisfactory understanding of objective areas.	Narrative shows a good understanding of the objective areas.	Narrative shows deep understanding and is well articulated.
	Content of narrative	Narrative does not cover all objective areas.	Narrative covers some of the objective areas.	Narrative covers minimum objective areas.	Narrative covers most of the objective areas.	Narrative covers all of the objective areas.
	Outcomes and initiatives	Outcome forecasts with very weak justification or explanation of sustainability activities and initiatives.	Outcome forecasts have weak justification with limited explanation of sustainability initiatives.	Outcome forecasts are satisfactory and linked to sustainability initiatives and costs.	Outcomes forecasts have good justification and initiatives and costs are clearly identified.	Outcome forecasts are credible with strong evidence and line of sight to a comprehensive set of initiatives and costs.

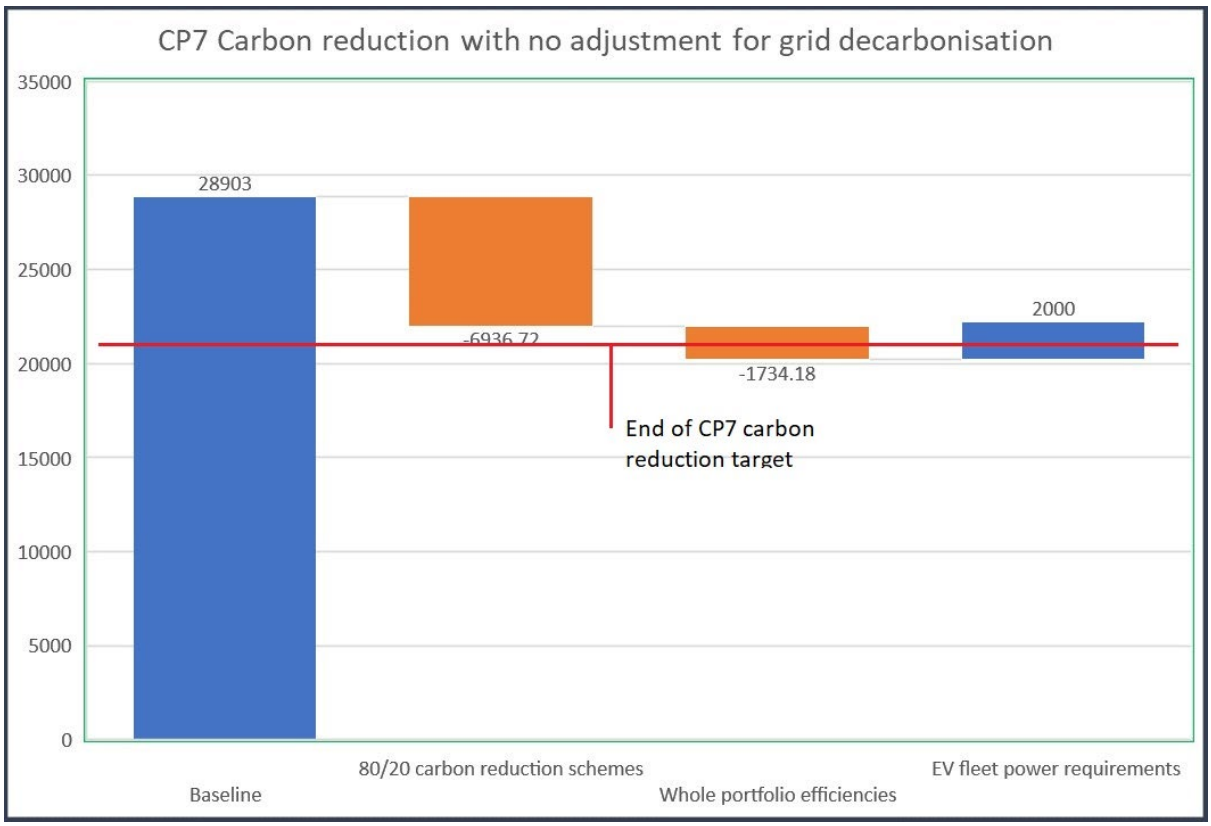
3

APPENDIX C – REGIONS CP7 FORECAST INFORMATION AND DATA

Regional CP7 Waterfall Forecasts

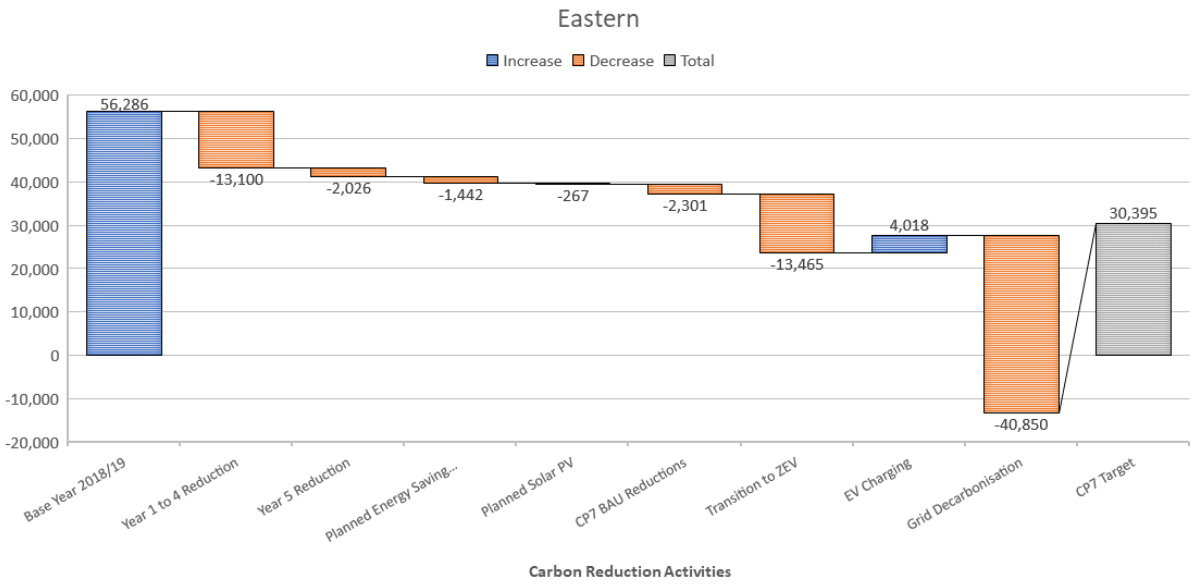
Each of the Regions has prepared a waterfall chart to demonstrate the predicted Scope 1 and 2 carbon emissions reductions resulting from planned or expected decarbonisation measures. These waterfalls and supporting data behind them where available have been used by the IR for this review, in particular the summary in Section 9.3. The Regions waterfall charts are presented below.

North West and Central



NW&C Region reports to being at a relatively early stage with CP7 energy consumption and decarbonisation planning and forecasting and has not included fleet fuel in their decarbonisation waterfall chart for CP7, which it has reported is due to insufficient resource at a regional level to research and estimate emissions reductions. This means its CP7 forecast is incomplete and cannot be compared to the 21% target which will include the ZEV rollout. Based on the estimated energy savings in the NW&C forecast, it seems probable that the target can be met, but this would need confirmation through completion of a full CP7 decarbonisation forecast.

Eastern

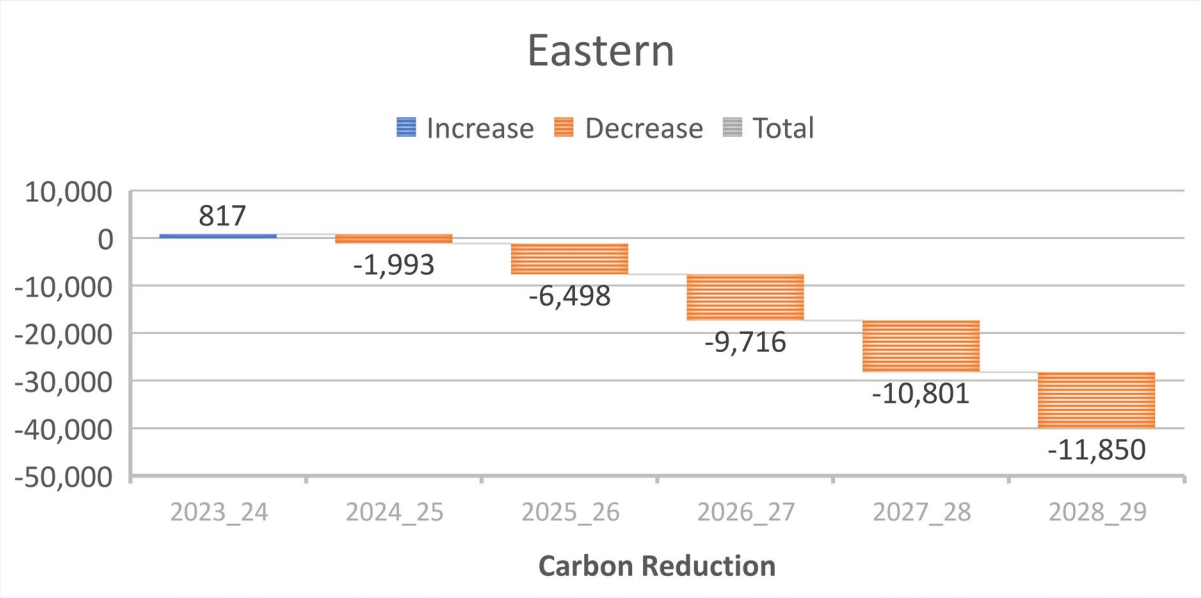


Eastern Region has planned energy saving projects at its three managed stations (Liverpool Street, Kings Cross and Leeds) and its 19 largest energy consuming assets. The approach described by Eastern to developing the trajectory seems robust, with known energy efficiency plans being evaluated in terms of energy savings and therefore carbon reductions as part of cost planning and funding exercises.

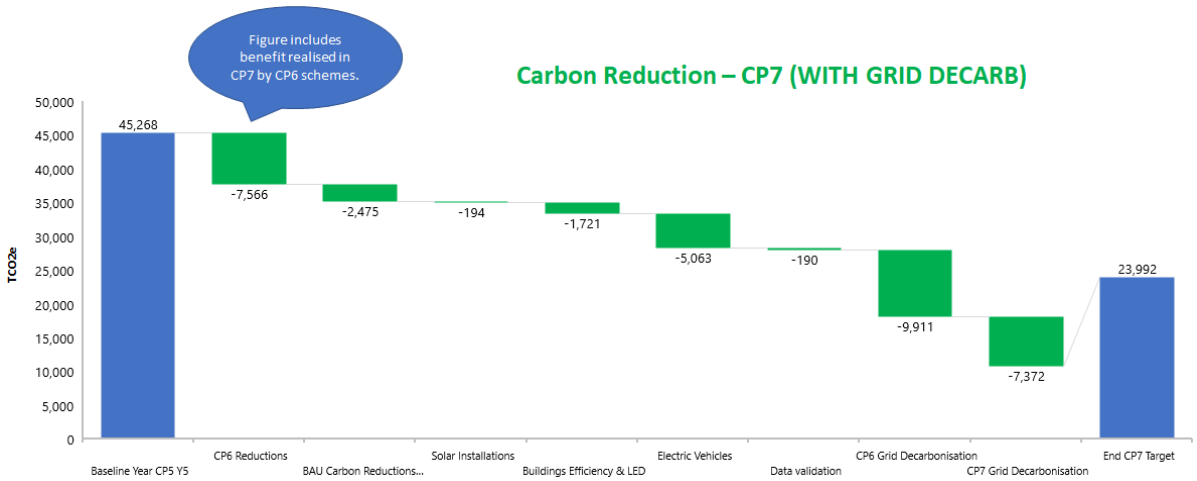
Eastern acknowledge uncertainty in the 2% per year BAU energy efficiency reductions. The 2% per year reduction is conservatively based on the improvement through CP6 which has been close to 4% per year, however, Eastern expect that continued improvements will taper at some point or reach a limit beyond which further reductions are harder to achieve, but it is not known where this limit will be reached.

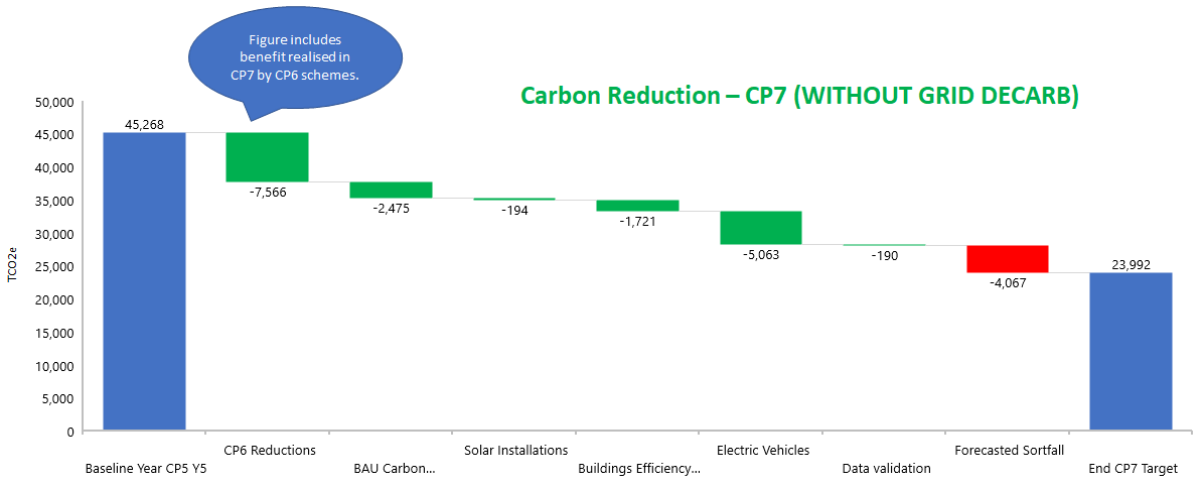
Eastern waterfall charts show that the Region expects to meet the CP7 carbon reduction target of 21% with or without grid decarbonisation (and are therefore on track to meet the 46% target if the CP6 exit target of 25% reduction is met).

Eastern has also included a year-by-year trajectory through CP7 for the reduction in carbon emissions anticipated from grid decarbonisation, which shows the considerable potential effect of grid decarbonisation based on the Government's[viii] forecast decarbonisation trajectory.



Southern



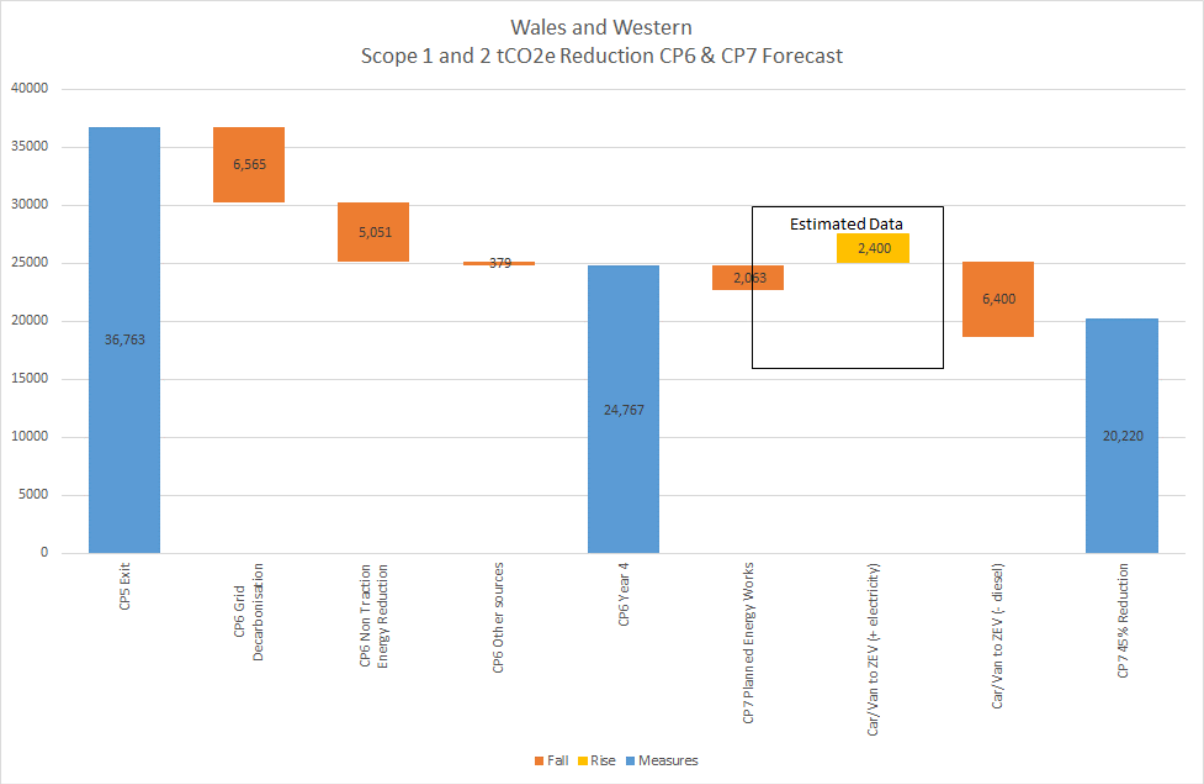


Southern Region has assumed a 2% per annum reduction from BAU energy savings, in line with the assumption for Eastern Region. CP6 data for Southern (Section 5.5) shows that they have not

managed such reductions during CP6. However, during interviews, Southern has explained that they have much greater confidence in energy efficiency improvements moving forward and have identified an energy shortfall in their FY18/19 baseline which means performance during CP6 is thought to be better than shown in the ESI reports.

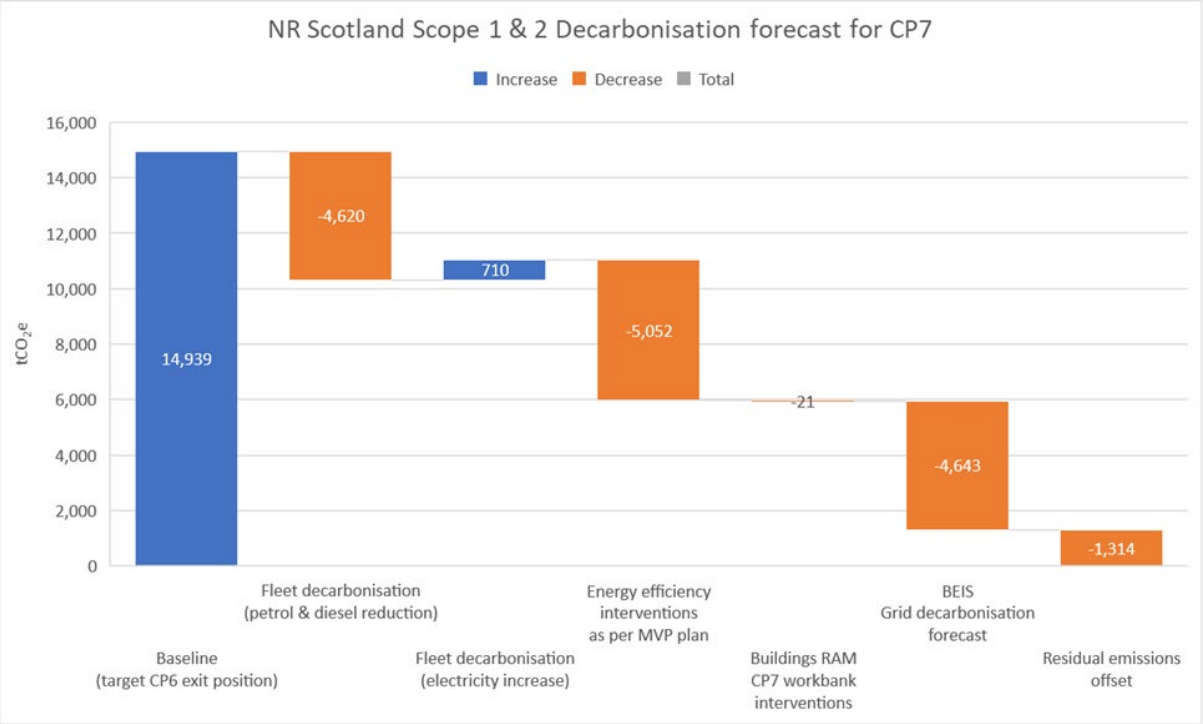
There is a difference between the FY18/19 baseline emissions presented in Southern's waterfall chart (45,268 tonnes CO_2e), and the baseline in the central carbon reporting tool (42,105 tonnes CO_2e), which reflects the energy shortfall in the baseline identified by Southern Region. The IR understands that Southern Region has been working with the TA to re-calculate the Scope 1 and 2 emissions baseline and the revised baseline is reflected in the waterfall but does not appear to have been used in ESI reporting.

Wales and Western



Wales & Western Region has accounted for grid energy decarbonisation during CP6 in its waterfall but has not accounted for decarbonisation in CP7. The Region predicts that the 46% target will be met without taking account of grid decarbonisation and therefore the reduction if grid decarbonisation is taken into account will extend well beyond the target.

Scotland's Railways



Scotland's Railways stands out from the other Regions in that their CP7 forecast, and trajectory goes beyond the 46% CP7 target and aims to achieve net zero Scope 1 and 2 carbon emissions by CP7 exit. This will be achieved using £0.13M of emissions offsetting, which has secured funding in the SoFA. The intention is for Scotland to use the funding to pump-prime local offsetting projects delivered in partnership during CP8, rather than spent on commercial offsets.

Scotland's approach to estimating emissions reductions from energy projects appears robust and procedural without reliance on broad BAU improvement assumptions as applied by some of the other Regions. Scotland's Railways obtain ideas and suggestions for energy efficiency improvements from a wide network of individuals within the business, which are recorded centrally within a Projects and Opportunities register. An initial go/no go evaluation is undertaken by the carbon and energy team and then those measures selected are taken forward to quantitative analysis. This is relatively high-level, except where detailed third-party data or audits are available, but is granular, so a wide number of interventions are assessed. The assessment considers Opex and Capex costs, energy savings and associated carbon savings. These all feed into the anticipated carbon savings in the CP7 waterfall chart. Only some of the identified measures in the Projects and Opportunities register secured funding in CP7 and these are the ones which link to the forecast savings in the waterfall chart.

IR Summary of CP7 Waterfall Forecasts

A summary of the Regions' CP7 Scope 1 and 2 emissions forecasts, developed from the waterfall charts provided in the earlier sections of this appendix is shown in the table below.

Regional CP7 Scope 1 and 2 Carbon Emissions Forecast Summary

Region	Baseline Scope 1 and 2 Carbon Emissions (TCO_2e)		Savings from Energy Efficiency Measures		Savings from Renewables		Savings from ZEV Transition		Savings from Grid Decarb		Savings from Other Measures		CP7 Savings without Grid Decarb		CP7 Savings with Grid Decarb	
	Cp5 Exit	CP6 Exit	TCO_2e	%	TCO_2e	%	TCO_2e	%	TCO_2e	%	TCO_2e	%	TCO_2e	%	TCO_2e	%
NW&C	52,253	28,903[a]	8,671	16.6	0	0.0	-2,000[b]	-3.8	0	0.0	0	0.0	6,671	12.8	n/a	n/a
Eastern	56,286	45,212	3,743	6.6	267	0.5	9,447	16.8	15,510	27.6	0	0.0	28,967	51.5	13,457	23.9
Southern	45,268	33,951	4,178	9.2	194	0.4	5,063	11.2	7,372	16.3	190	0.4	16,997	37.5	9,625	21.3
Wales and Western	36,763	24,768	2,063	5.6	0	0.0	4,000	10.9	0	0.0	0	0.0	6,063	16.5	n/a	n/a
Scotland	19,939	14,939	5,073	25.4	0	0.0	3,910	19.6	4,643	23.3	1314	6.6	14,940	74.9	10,297	51.6

a. NW&C estimate excludes fleet fuel emissions.

b. NW&C estimate only includes increase in emissions from electric vehicle charging and excludes fuel savings from ZEV transition.

CP7 Grid Decarbonisation Summary

A large proportion of Network Rail's Scope 1 and 2 carbon emissions are from electricity consumption, which is expected to result in decreases in emissions through CP7 due to continued decarbonisation of the UK electricity grid (i.e. from new renewable energy projects and reduction in the use of gas and other fossil fuels for power).

The data shown in the grid decarbonisation waterfall provided by Eastern Region shows the considerable benefit in terms of carbon emissions reductions that could be brought by grid decarbonisation during CP7. Eastern Region, Southern Region and Scotland's Railways have all forecast the benefits of grid decarbonisation, but have done so using two separate datasets:

Dataset 1: Data from HM Treasure Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal[viii] (applied by Eastern Region); and

Dataset 2: Data from the Department of Energy Security and Net Zero's Energy and Emissions Projections 2021 to 2040[ix] (applied by Southern Region and Scotland's Railways).

A comparison of the Scope 1 and 2 carbon emissions reductions forecast from grid decarbonisation using both of these datasets is provided in the table below.

Regional CP7 Scope 1 and 2 Carbon Emissions Forecast Summary

Region	Baseline Emissions (TCO_2e)		Forecast CP7 Grid Decarbonisation		Forecast Emissions from Electricity at CP7 Exit		% Savings from Grid Decarb (relative to CP5 Exit Baseline	
	CP5 Exit	CP6 Year 4 Electricity	Dataset 1	Dataset 2	Dataset 1	Dataset 2	Dataset 1	Dataset 2
NW&C	52,253	22,425	58%	37%	9,418	14,128	25%	16%
Eastern	56,286	20,673	58%	37%	8,683	13,024	21%	14%
Southern	42,105	19,460	58%	37%	8,173	12,260	27%	17%
Wales and Western	36,764	14,164	58%	37%	5,949	8,923	22%	14%
Scotland	19,939	8,578	58%	37%	3,603	5,404	25%	16%

APPENDIX D – ZEV TRANSITION ANALYSIS

Scotland Decarbonisation Strategy

To facilitate meeting the Department for Transport's national target of a zero-emission light duty vehicle (cars and vans) fleet by 2027, Scotland Rail has prepared a Stage 1 decarbonisation strategy[xii]. The Stage 1 strategy will be followed by subsequent updates in the future.

The strategy details three key tasks to enable the transition, comprising:

- fleet rationalisation;
- the rollout of charging infrastructure; and
- the process for transitioning the fleet.

The strategy is underpinned by costs and milestone dates and outlines the risks and challenges that face Scotland in meeting the DfT target. To enable the development of the strategy, Scotland audited the data held on the national database, highlighting that one third of the data was erroneous.

The target may be met using electric, hydrogen fuelled or other novel technology vehicles. Scotland's priority is, however, not to compromise the operations of the fleet. To this end, Scotland's strategy is based on the transition to a fully electric fleet as their technology is most advanced, however, acknowledges that some of the fleet may incorporate hydrogen-fuelled, or other novel fuel technology, vehicles in the future.

Fleet Rationalisation

The strategy recognises that consolidating the fleet is a critical step; to this end, fuel consumption data were analysed to identify any underused vehicles (such as those with below-average fuel consumption). The value of removing vehicles that are not utilised to their full potential is twofold; firstly, there are fewer vehicles to transition, and secondly, there are financial implications relating to reduced lease and fuel costs, which are quantified within the Stage 1 strategy, as shown below.

Table 7: Annual Lease Cost Savings from removing Least Used Vehicles

Vehicle Type	No. Least Used	Fuel Cost 21/22 (£)	Average Annual Lease Costs	Annual Savings
4X4 Pick-Up	2	£829.38	£7,018.99	£14,867.35
CAR	20	£7,061.41	£4,290.00	£92,861.41
CAR - ULEV	9	£2,720.51	£5,287.44	£50,307.46
HGV	3	£866.22	£14,580.05	£44,606.37
LCV	8	£2,581.20	£6,888.84	£57,691.90
Small Van	7	£2,707.46	£3,921.29	£30,156.52
Grand Total	**49**	**£16,766.19**	**£41,986.60**	**£290,491.00**

Charging Infrastructure

Currently, a large proportion of NR's vehicles are leased (for example, 85% in Scotland), rather than owned outright. As such, the Stage 1 strategy seek to balance lease expiry dates on the current internal combustion engine vehicles and the installation of infrastructure to ensure new electric vehicles can be operated. If leases are terminated, early exit fees may apply, whilst if the number of electric vehicles outstrips the availability of charging stations, then vehicles risk being unusable; this may then require

short-term leases of alternative vehicles to ensure ongoing operations, resulting in additional costs. These factors have informed the Scotland infrastructure plan, which is divided into four phases, as shown below.

Table 1: Number of sites, vehicles and charging points per Phase

Phase	Completion Date	No. sites	No. Vehicles	No. EVCP
Phase 1	2024/25 Q2	12	504	340
Phase 2	2025/26 Q2	16	314	216
Phase 3	2026/27 Q2	8	66	47
Phase 4	2027/28 Q1	7	20	21
TOTAL				622

The capital expenditure and operating expenditure costs of the infrastructure plan have been itemised within the strategy for each year and covering CP6 and CP7, based on costs incurred for previous installations and accounting for conservative estimates relating to the number and type of charge points required, as shown below. Itemised costing, including estimated charge point costs, survey and enabling works, substation upgrades and management costs are included as part of the strategy.

Table 2: Infrastructure Programme Costs (£m) Distribution

CP6			CP7				
21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
0	0	£2.69	£6.48	£3.68	£1.52	£0.36	£0.00

CP6	CP7
£2.69	£12.04

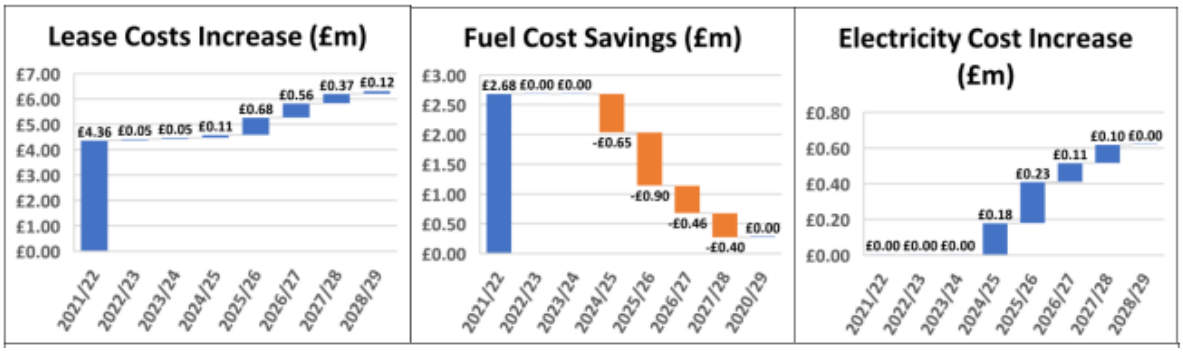
Overall, the strategy estimates that the installation of 622 charge points would amount to £14.73 million in capital expenditure costs, whilst annual operating expenditure costs would be approximately £0.3 million.

Fleet Transition Plan

The Scotland fleet transition plan relies on the installation of the necessary charge point infrastructure prior to the vehicle transition phase. The transition is then coupled with lease expiry dates; in some instances, leases may expire before the necessary infrastructure can be installed, in which case the strategy accounts for short extensions and contingency requirements. As such, since the majority of infrastructure will be installed in 2024-25, the majority of vehicles will be transitioned in 2025-26. Scotland has prepared a suite of 'Vehicle Order Principles' to ensure that the transition plan is followed and minimise the number of unnecessary vehicle orders.

The fleet transition plan is supported with costs and waterfall graphs that distribute savings and expenditure across each year, as shown below.

Figure 2: Fleet Transition Waterfall Graphs and Net Costs (£m)



Route Services

Separate to each of the Regions, Route Services has developed a number of internal documents and tools to assist with the transition to a zero-emission fleet; these documents are available to each of the Regions to support the nationwide achievement of the plan. Notably, these include:

- Detailed analysis relating to each vehicle within NR's fleet (9,791 in total), including, for example, vehicle location, odometer readings, Euro emission standard, number of days in use and vehicle lease details;
- Compilation of depot details (450 in total), including the number of vehicles stored at each depot, electricity demand for forecasted electric vehicles, and the charging infrastructure currently, or planned to be, installed;
- Delivery plans for the necessary infrastructure installations and fleet turnover, including carbon emissions and savings, and consideration of:
    - a 'recommended' scenario (i.e., a coordinated approach to consolidating and updating the fleet with the intention of meeting the 2027 deadline). This involves concentrating on the delivery of charging infrastructure in 2023 to 2024, with the bulk of vehicles exchanged to electric between 2025 and 2027;
    - a 'Do Minimum' scenario (i.e., business as usual, and updating the fleet as and when leases terminate);
    - an 'Accelerated' scenario (i.e., striving to meet the DfT target as soon as possible). Whilst an accelerated delivery scenario would be beneficial from a carbon reductions perspective, it is understood that funding constraints from DfT reduce the likelihood of this scenario being adopted; and
- Estimates of CO_2 tailpipe emissions, apportioned by Region and vehicle type.

As part of the review of the vehicle fleet, Route Services identified that a number of vehicles (~8%) were classified as 'home start' vehicles rather than stored in depots overnight. As such, Route Services set up a working group to explore home starts further, and the feasibility of incorporating private home vehicle charging infrastructure. As discussed below, whilst home charging may offer a more lucrative solution than depot charging, there are a number of challenges that need to be overcome. Route Services are keen to investigate the possibility of trialling a Pilot scheme in a Scotland.

In partnership with Novuna Vehicle Solutions (NVS, one of the main leasing companies used by Network Rail), electric vehicle charging facilities (22 kW 3-phase AC chargers) were installed at two depots in Swindon (six chargers) and Bristol (three chargers) in 2022[xiii]. Prior to delivering the infrastructure, a

depot feasibility assessment was completed by Novuna Vehicle Solutions, which evaluated electricity demand and usage across the sites. The review also considered the number of chargers that could be installed and where smart charging would be needed. The latest iteration of Route Services' audit demonstrated that in addition to Bristol and Swindon, there are 11 depots with charging infrastructure; that is not, however, to say that this meets the future demand that may be required with the acquisition of electric vehicles within these depots.

The trial at Bristol and Swindon supported 25 electric small vans, which were able to charge fully within eight hours. It is understood that NR has currently ringfenced 400 electric vehicles to assist with the transition. Scotland's strategy also identified that the current contract with NVS is due to expire in 2024, however it is not currently clear whether the contract will be extended or retendered.

Risks and Challenges to Meeting the 2027 Target

Route Services and Regions have outlined a number of risks and challenges associated with meeting the DfT's 2027 target, as outlined in the sections below. Given the challenges, there is the potential for NR to operate on a 'reactive' basis, however, a better approach involves consolidation of the current situation, and thorough planning to accomplish the transition in the timescales required resulting in a 'proactive' solution.

Depot Infrastructure

A key risk expressed by Route Services and Regions relates to the ability to install the necessary infrastructure in advance of lease expiry date; to meet the 2027 deadline, tangible progress in available infrastructure needs to be made over 2023-24. It is anticipated that during that period, particular focus will be given to the depots where the most vehicles are located and stored. Whilst zero emission vehicles are currently available to Regions, they are of little value as the infrastructure is not in place to guarantee their continued operation.

Timescales

Whilst the pilot at Swindon and Bristol demonstrated the feasibility of installing infrastructure across the two depots, a major concern of Route Services was the time (18 months) that it took from conception to realisation. Following internal sign-off, installations can take between 40 and 50 weeks per site. Subsequently, to meet the 2027 target will require a coordinated approach and effective communication and cooperation across all tiers of management at NR and sharing of data to reduce resource pressures.

Regions have also expressed that for timescales to be met requires infrastructure upgrades to commence immediately, as part of CP6. However, the funding distributed as part of CP6 did not account for this requirement, leading to a sizeable gap in funding (estimated by Scotland to be in the Region of £3 million).

Planning Permission

The installation of multiple charge points within depots may require planning permission (e.g., if overhead lines, cables or substations) are needed. Such requirements may not only incur additional costs but may lead to a protracted timeline if not engaged at an early stage.

Energy Supply

There are two types of Power Network (PN) available for electric charging infrastructure: the distribution network and the transmission network[xiv]. Most households and businesses connect to the local low

voltage distribution network, but if a large connection is needed (e.g., high number of charge points or groups of rapid charge points), it can be more efficient and cost effective to connect to the transmission network. As such, a key element of all Region's infrastructure plans will involve engagement with the relevant District Network Operator (DNO) to identify the requirements on a depot-by-depot basis. For each depot, where DNO upgrades are required, the main costs associated with connecting to the PN will depend on:

- the existing supply;
- the size of connection required; and
- the distance from the existing network.

Within Scotland's strategy, it stated costs for infrastructure upgrades alone can vary from £5,000 to £300,000 per site; Route Services has estimated that across the whole of NR, infrastructure costs could sum to £100 million. A study by the UK Electric Vehicle Supply Equipment Association (UKEVSEA) indicated the potential costs involved in upgrading DNOs and also timescales involved as part of a procurement guide intended for public sector organisations[xv]. The guidance notes that the largest cost elements are associated with the capital costs from the installation (DNO and hardware), as shown below.

Table 3.0 – Illustrative example of DNO costs and timescales

Small (up to 70kVA)	Medium (200kVA - 1,000kVA)	Large (above 1,000kVA)
Number of charge points		
1-3 Fast or 1 Rapid	10-50 Fast, 4-20 Rapid or 1-6 Ultra-Rapid	50+ Fast, 20+ Rapid or 6+ Ultra-Rapid
Approximate Connection Time		
8-12 Weeks	8-12 Weeks	6 Months +
Approximate Connection Cost		
£1,000 - £3,000	£4,500 - £75,000	£60,000 - £2 million
Other Consideration Affecting Cost		
- Street work costs	- Street work costs - Legal costs for easement and wayleaves	- Street work costs - Legal costs for easement and wayleaves - Planning Permission - Space for a Substation

UKPN has also developed a '*Site Planning Tool*' (as part of the Optimise Prime project[xvi]) for depot based businesses to assess how to make the transition at the lowest cost[xvii]; as part of the process, the tool performs a check to determine whether a site would require a connection upgrade, or whether the existing connection would suffice.

Maintenance

The charging infrastructure will require maintenance by suitable personnel; this either involves provision of training to existing staff, or outsourcing maintenance to external contractors.

Infrastructure Type

Choosing the correct infrastructure will also be vital for a successful transition; depending on the vehicle types at each depot, different charging speeds may be necessary[xviii] (for example, heavier vehicles will have a greater energy consumption and require faster charging than a car).

More efficient chargers will be more expensive than smaller chargers, as demonstrated by UKEVSEA's cost approximations for different charger types. It should, however, be noted that the price of charge points is reducing, with continued reductions projected over the coming years as the technology develops and supply increases.

Similarly, if the infrastructure cannot be installed at the same pace as vehicle uptake, reliance on public vehicle charging points is not a viable long-term solution for NR.

Table 8.0 - Chargepoint types, brief specification and indicative cost

*Variability in costs of a given charger type is due to supplier differences in business model, construction materials, components and component costs.

Chargepoint Type	Typical Specification	Cost Range (£ Ex VAT, Delivery and Installation)
Fast Type 2 Wall Mount 7kW 	▸ Display + LED Status Indicators ▸ GPRS Modem ▸ 7kW, Mode 3 Charger	£750 - £1,500
Fast Type 2 Dual Wall Mount 7kW 	▸ RFID Card Reader ▸ Display + LED Status Indicators ▸ GPRS Modem ▸ 7kW, Mode 3 Charger	£1,700 - £2,700
Fast Type 2 Dual Ground Mount 7kW 	▸ RFID Card Reader ▸ Display + LED Status Indicators ▸ GPRS Modem ▸ 7kW, Mode 3 Charger	£1,700 - £5,000
Fast Dual Type 2 Wall Mount 22kW 	▸ RFID Card Reader ▸ Display + LED Status Indicators ▸ GPRS Modem ▸ 22kW, Mode 3 Charger	£1,800 - £4,000
Fast Dual Type 2 Ground Mount 22kW 	▸ RFID Card Reader ▸ Display + LED Status Indicators ▸ GPRS Modem ▸ 22kW, Mode 3 Charger	£3,000 - £5,000
Rapid Dual Outlet, Type 2 and JEVS G105 	▸ RFID Card Reader ▸ Display ▸ LED Status Indicators ▸ GPRS Modem ▸ 43kW AC or 50KW DC, Mode 3 or 4 Charger	£15,000 - £25,000
Rapid Triple Outlet, Type 2, CCS and JEVS G105 	▸ RFID Card Reader ▸ Display ▸ LED Status Indicators ▸ GPRS Modem ▸ 50KW DC, Mode 3 or 4 Charger	£15,000 - £30,000

Vehicle Availability

Volumes

Data from the Society of Motor Manufacturers and Traders (SMMT), tabulated below[xix], indicate that new battery electric vehicle (BEV) car registrations are in the hundreds of thousands per year and increasing. The number of new light commercial vehicles (LCVs) (including vans to 3.5 tonnes, 4x4s, and pickups) were at 17,000 in 2022, and forecasted to increase sharply in 2023, and more than double to 39,000 in 2024.

Within the LCV category, however, there are limited data on the composition of the registrations; Route Services have commented that there are not commercially available 4 x 4 vehicles, which could hamper progress with the vehicle roll out, as they constitute ~10% of the whole fleet.

Year	BEV cars registrations (thousands)	BEV LCVs registrations (thousands)
2016	10	1
2019	38	3
2020	108	5
2021	191	13
2022	267	17
2023 (f)	*337*	*24*
2024 (f)	*444*	*39*

Timescales

Lead times have been reported as long for BEV LCVs due to interest in a number of sectors in electrifying their fleets ahead of 2030[xx]; this could affect delivery of the target, particularly if supplier and manufacturer schedules are periodically changing. Lead times for electric cars peaked at 35 weeks in October 2022 and have since come down to 21 weeks in May 2023[xxi].

It will be important that vehicles are ordered in advance to minimise the risk that vehicle leases expire. In these circumstances, short-term leases would be required, which can result in significant costs. To mitigate the need for short-term leases, as part of the fleet consolidation process, the opportunity to pool under-utilised vehicles in centralised depots is being explored by Route Services. Equally, early exit fees can be substantial, often up to 50% of the remaining lease fee, requiring careful timetabling of future vehicle orders.

Technological Advances

Scotland commented that NVS has ringfenced approximately 1,000 vehicles for NR, however it is not clear whether these will be retained indefinitely, or whether they must be adopted within a certain timeframe. With electric vehicle technology rapidly evolving, there is a risk that taking vehicles before

the necessary infrastructure is available will not only lead to underused vehicles, but also outdated technology by the time that their full potential can be realised.

Costs

There is a cost differential between internal combustion engines and electric vehicles. Total cost ownership modelling can be used to determine the viability of the transition and to identify cost (e.g., considering funding method, fuel/energy cost, servicing, taxes and duties).

Whilst the initial outgoings for an electric vehicle may be higher than the equivalent combustion engine vehicle, electric vehicles are more cost effective across the operational lifetime, particularly if they are travelling significant distances[xxii] or used over a number of years.

Zero emission vehicles will also be exempt from Clean Air Zone (such as in Bristol, Bath and Birmingham) or Low Emission Zone (such as London, Glasgow) as well as congestion charges. There are also various tax incentives available for businesses.

Working Practices and Cultural Transitions

Home Starts

Whilst there may be benefits to installing charging points at employee's private dwellings, including reduced installation costs and eligibility for variable rate electricity tariffs, there are a number of hurdles associated with this approach, namely the need for:

- robust data relating to the true number of home start vehicles;
- clarification relating to the ownership of any installed infrastructure, including the implications for situations when employees move house, or leave Network Rail;
- planning permission in some circumstances;
- operatives to have a private driveway for infrastructure to be installed legally;
- permission from the homeowner or landlord to install equipment; and
- a mechanism to ensure that NR only pay for electricity needed for its own vehicles, such as through a card system.

Training

Drivers are likely to require training to ensure the correct operation of the vehicle, safeguard the battery life and operation of any charging infrastructure.

Increased Mileage

If home charging is not an option for an employee, there is the potential for increases in employees' mileages due to travel between the depot and the place of residence.

APPENDIX E – GLOSSARY OF TERMS

Acronym	Definition
BAU	Business as Usual
BEIS	Department of Business, Energy and Industrial Strategy
CO2e	Carbon Dioxide Equivalent Emissions
CP	Control Period
DESNZ	Department of Energy Security and Net Zero
DfT's	Department for Transport
DNO	Distribution Network Operator
DU	Delivery Unit
ESI	Environmental Sustainability Index
EVs	Electric Vehicles
FY	Fiscal Year
GHG	Greenhouse Gas
HGV	Heavy Goods Vehicles
HLOS	High-level Output Specification
HVAC	Heating, Ventilation & Air Conditioning
LEDs	Light-Emitting Diodes
LPG	Liquefied Petroleum Gas
MDU's	Maintenance Delivery Units
MVAC	Mechanical Ventilation & Air Conditioning
NTfT	Non-traction From Traction
NW&C	North West & Central
OPI	One Planet Indicator
ORR	Office of Rail and Road
PPAs	Power Purchase Agreements
PR	Periodic Review
PV	Photovoltaics
SBP	Strategic Business Plan
SBTi	Science Based Targets
SF6	Sulphur hexafluoride
SoFA	Statement of Funds Available
SoS	Secretary of State (for Transport)
TA	Technical Authority
TOC	Train Operating Companies
TS	Transport Scotland
YR4	Year 4 (FY22/23)
ZEV	Zero Emission Vehicles

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