Our road to net zero by 2050

TransPennine Express
Publication Date: December 2023

Contents

Executive summary

At TransPennine Express (TPE), we are set to play a significant role in decarbonising travel in the north of England and in Scotland. The TransPennine Route Upgrade (TRU) will electrify the core of our network, enabling low-carbon travel for our customers. However, we are mindful that we must go further to reach our goal of net zero by 2050. We must decarbonise our rolling stock, the way we light and heat our buildings, and the emissions produced by our supply chain. This road to net zero outlines many of the steps we plan to take to reduce our greenhouse gas emissions (GHG), having received validation of our near-term science-based targets (SBTs) from the internationally recognised Science Based Targets Initiative (SBTi). Our approved targets are as follows:

- Reduce absolute scope 1 GHG emissions 54.6% by FY2032 from a FY2019 base year.*
- Reduce absolute scope 2 GHG emissions 54.6% within the same timeframe.
- Further commits that 67.08% of our suppliers by emissions covering purchased goods and services and capital goods will have science-based targets in place by FY2027.

Our approach

So, how could we achieve these targets and create an effective decarbonisation roadmap? We have developed two possible long-term approaches to achieving our SBTs: a standard decarbonisation scenario and an accelerated decarbonisation scenario. We projected the possible future emissions of each scenario and compared them against SBTi-based target lines and net-zero standard pathways (this initial scenario analysis was carried out prior to validation of our now approved near-term SBTs). The standard decarbonisation scenario involves a gradual application of traction, non-traction, and supply chain interventions to help spread out the investment and resources needed to reach our targeted emissions savings aligned to our net zero goal by 2050. The accelerated scenario reaches this goal by FY2040. Both scenarios include a substantial increase in electrified traction, which will lead to much of the forecast emissions reduction, taking advantage of both the government's commitment to net zero emissions in the power sector and the increased electrification of our rail network.

Both scenarios present a range of potential measures to decarbonise our operations, including the implementation of eco-driving training initiatives and modifying our trains to make them more fuel efficient, as well as measures such as building management systems, LED lighting, and rooftop solar technology installations that would help reduce energy consumption across our estate. We will also need to pay particular attention to the way we purchase goods and services and work with our supply chain to decarbonise in this area.

Our purpose

Our overarching goal is clear: to achieve net zero by 2050. These scenarios will help guide the approach we take to meet our near-term SBTs by FY2033, but the speed of rollout will depend on our financial and staff resources and will rely heavily on the government achieving some of its own key targets, such as decarbonising the electricity by 2035. This report outlines the measures that could help us achieve our goals and describes the first steps we are taking on our road to net zero. In addition, we will continue to measure our carbon impact using approved GHG reporting methodologies.

* The target boundary includes biogenic land-related emissions and removals from bioenergy feedstocks.
* FY2032 refers to the 2032/33 rail year, FY2027 refers to the 2027/28 rail year, and FY2019 refers to the 2019/20 rail year.

Introduction

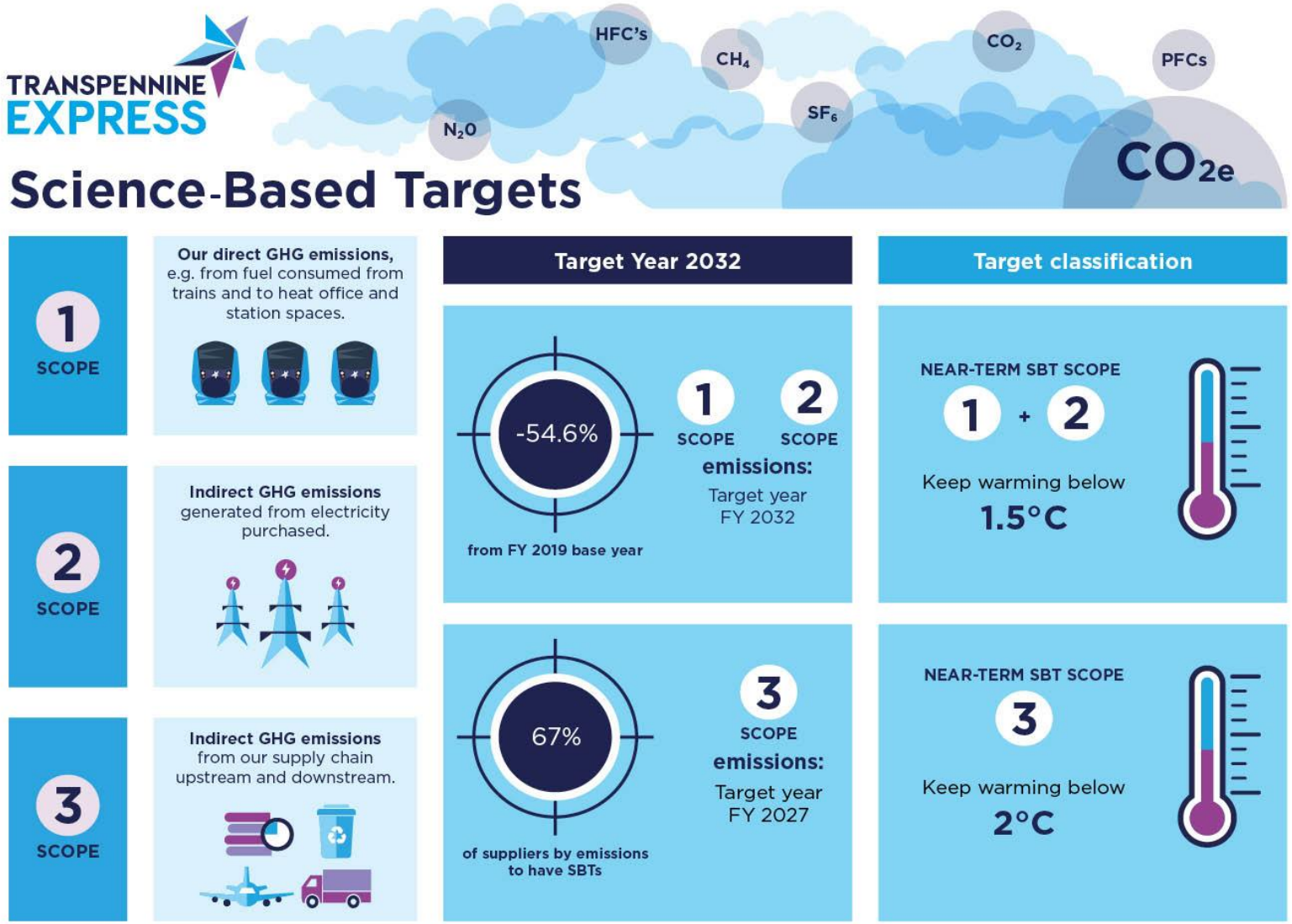
This roadmap outlines the emissions we could save by implementing selected measures. If we were to maintain our existing approach, emissions would gradually fall due to the greening of the National Grid, but these reductions would not be sufficient to meet our commitments. These two modelled scenarios show how we could decarbonise our operations more quickly:

The standard decarbonisation scenario

The standard scenario provides a phased approach to decarbonisation, with the interventions spread. It assumes the benefits realised through modern rolling stock and the government's delivery of a net zero power system. This steady approach would minimise the number of intervention projects running in parallel. It provides more time and less strain on resources. This scenario would achieve its potential by FY2050.

The accelerated decarbonisation scenario

The accelerated scenario outlines a more aggressive approach. It features parallel decarbonisation projects that will achieve their potential by FY2040. It assumes the same benefits as above.

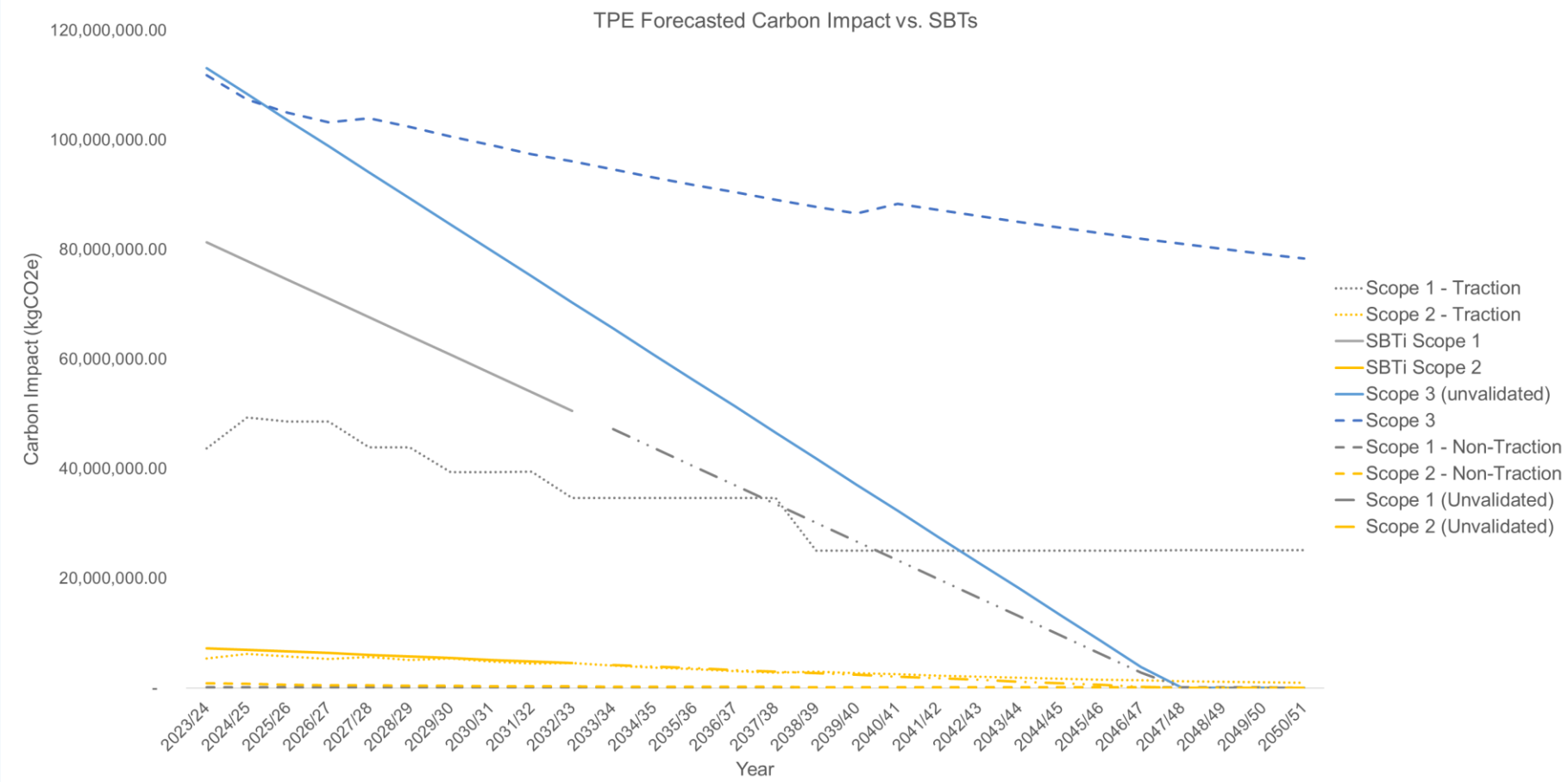


* FY2032 refers to the 2032/33 rail year, FY2027 refers to the 2027/28 rail year, and FY2019 refers to the 2019/20 rail year.

Carbon modelling

The two modelled scenarios are seen as an initial step on the road to net zero, as we develop our plans for decarbonisation. We must now move from this initial scenario analysis onto more in-depth modelling. To support this, we have developed a carbon model that we will use to forecast our energy consumption and carbon emissions until 2050. It enables us to track our actual progress against these targets. It will also allow us to compare a range of forecasted scenarios, including the two modelled scenarios described in this report, against each other. These comparisons will help to guide the actions we take and the decarbonisation interventions we implement as we move towards our near-term targets and net zero goal.

The model uses our current timetables and historical data to forecast our energy consumption. Sub-scenarios with detailed user inputs then allow for adjustment to this baseline according to our plans, allowing us to alter our forecasts with ease and assess how any changes will affect our performance on achieving our SBTs and progress on our road to net zero.



The chart on the left shows an example forecast projection as produced by the model, based on our current decarbonisation plans. The carbon reduction impacts of some of the planned changes, as per the key milestones section (p14), can be seen. While the model isn't a perfect predictor of future emissions, it clearly suggests there is much more to be planned and done if we are to achieve net zero by 2050, but it does suggest we are on the right track to achieving our near-term SBTs.

This model will prove an invaluable tool as we progress towards our targets and net zero goal.

Our commitment to science-based targets (SBTs)

TPE has solidified its commitment to decarbonisation by aligning with the Science Based Targets initiative (SBTi). The SBTi outlines the carbon reduction targets companies must achieve to remain below the crucial 1.5°C global warming scenario.

The SBTi has validated TPE's near-term science-based targets, with absolute reduction targets set for scope 1 and 2 emissions, and a supplier engagement target for scope 3 emissions.

The scope 1 and 2 targets both require a 54.6% absolute reduction in emissions by FY2032 from our baseline year of FY2019. For our scope 3 target, we opted for a supplier engagement target instead of an absolute reduction target, as is permitted by the SBTi for near-term targets if this target covers at least 67.08% of our total scope 3 emissions.

Our science-based targets are ambitious and challenging, but they are achievable, and achieving them will illustrate progress to net zero by 2050.

We will use our carbon model to track progress against our near-term targets, as well as using it to guide the decision on whether to submit net zero targets for validation with the SBTi.

What are Scope 1, 2, and 3 emissions?

Emissions scopes are a way to categorise environmental impacts in different areas:

Scope 1 emissions refer to TPE's direct emissions. These include the combustion emissions produced by our diesel trains and from the fuel used to heat spaces.
Scope 2 emissions cover the indirect emissions from our purchased energy, such as the emissions produced by the electricity that powers our buildings.
Scope 3 emissions are not directly produced by us – they refer to the indirect emissions produced from our wider activities. These include the emissions produced by our supply chain (upstream and downstream), and the way we use and dispose of materials.

About the SBTi

The Science Based Target Initiative (SBTi) is a globally recognised organisation that enables businesses to set emission reduction targets that adhere to the latest climate science. It aims to accelerate companies' efforts to halve their emissions before 2030 and reach net zero by 2050.

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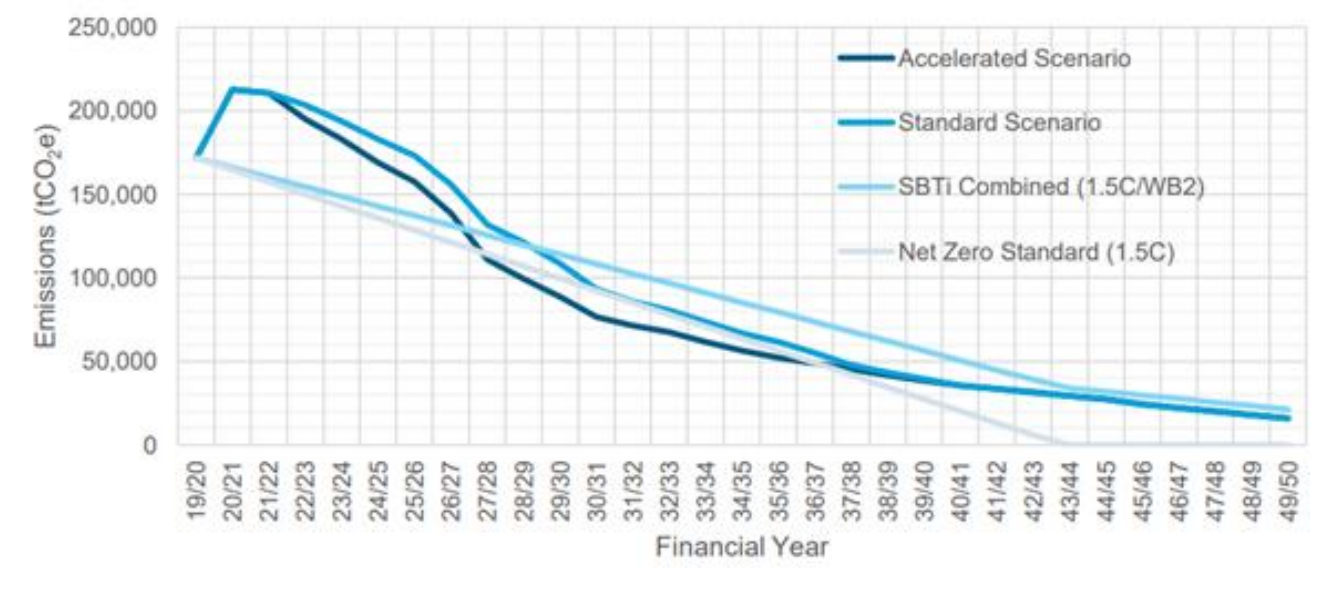
Decarbonisation pathways



Left: Projected future TPE emissions under standard and accelerated scenarios against SBTi (Scope 1-2 at 1.5˚C and Scope 3 at WB2) and net zero requirements.

WB2 was still an accepted target boundary at the time this scenario analysis was done. 1.5˚C is the only accepted boundary now for scope 3 emissions reductions.

Both the standard and accelerated decarbonisation scenarios enable substantial emissions cuts, but over different time frames.

The standard decarbonisation scenario

In the standard scenario, our emissions reduction rate would remain consistent until FY2031, with the biggest fall in emissions occurring from FY2026 to FY2031. The pace would slow until FY2038, before falling even more gradually until FY2050.

Successfully following this approach would still mean we produce 15,702 tCO2e by 2050, due to the gradual phasing out of our diesel traction. Meeting our scope 2 science-based targets by FY2033 will be challenging, mainly due to the increased use of our Class 802 fleet as we shift our emissions from scope 1 to scope 2 through an increase in use of electric traction as we phase out diesel traction. This may require additional efforts or a combined scope 1 and 2 emissions target ratio, which we can measure through greater electric traction versus less diesel traction.

The accelerated decarbonisation scenario

This approach would require considerable short-term investment and staff resources. In this scenario, we would make rapid progress until FY2031 after implementing a range of interventions in parallel. The rate of decarbonisation would be more gradual from FY2031 to FY2038, before entering its most gradual phase until 2050.

Scope 1 and 2 emissions would plateau by FY2041, with scope 3 emissions passively decarbonising during this period. If we were to follow this scenario, we would meet the science-based target for all scopes by FY2032. Overall, this approach would result in 15,958 tCO2e residual emissions by FY2050, with 71% of this due to the remaining diesel miles covered by the Class 802 fleet. As both scenarios suggest, there will be residual emissions by FY2050, so we will need to consider additional decarbonisation methods and, potentially, carbon offsetting.

Traction interventions – decarbonising our trains

We will implement various measures to reduce our emissions. Some measures will involve modifications to our fleets, focussing on making them run more efficiently, using less energy and producing less emissions. TPE has already committed to significant low-carbon traction measures.

The transformational TransPennine Route Upgrade will electrify the core of our network, enabling us to cover more distance using electricity from the grid instead of burning diesel.

In addition, there are many other ways we can improve our performance in our drive towards decarbonisation. Improvements to energy efficiency include everything from eco-driving techniques, measures to reduce engine idling, and replacing the diesel-hydraulic systems in some of our fleet with hybrid setups. We have considered various interventions (see box on the right) to decarbonise our rolling stock.

These interventions are used heavily in our modelled approaches. It is likely that the actual implementation of these interventions may vary. Implementation of interventions are dependent on many variables, and some may take longer than estimated within the model scenarios. Going forward with the risks and dependencies being considered, we will build on these two models and plan actions that we will take as we work towards our near-term SBTs and net zero goal.

Improved rolling stock hotel management: Efficient management through enhanced monitoring and maintenance. Estimated energy savings: 0.5% of total traction energy.

Automatic switch off procedures and shutdown for hotel loads: Automated shutdown of different appliances across the train when not in use, including lighting and air conditioning. Estimated energy savings: 7% of traction energy.

On-board energy storage for our diesel-electric passenger trains: Using double-layer capacitors for peak power shaving and to maximise regenerative braking energy.
Estimated energy savings: 10% in bi-mode and electric fleets.

Energy-efficient driving: Incorporating a Connected Driver Advisory System (C-DAS) and eco-driving training to enable more efficient driving. Estimated energy savings: 7.5% (C-DAS) and 5% (eco-driving).

Selective engine control for diesel-mechanical passenger fleet: Modifying controls to modulate online engines with demand (as in our Class 185 fleet). Estimated energy savings: 5% across diesel fleet.

Use of auxiliary power unit (AUP) on diesel locomotive fleet: Employing a smaller engine for auxiliary services during no-use situations. Est. energy savings: 5% across diesel fleet.

Use of start-stop technology across fleet: Avoiding engine idling when stationary, reducing energy use. Estimated energy savings: 10%.

Diesel fleet hybridisation retrofitting: Enhancing the efficiency of our diesel trains by replacing diesel-hydraulic systems with hybrid setups that combine diesel engines, alternators, traction motors, and batteries. Est. energy saving: 10% across diesel fleet.

Active heating, ventilation, and air conditioning (HVAC) controls: Adaptive HVAC controls respond to environmental conditions, reducing energy output. Estimated energy saving: 2% in our Class 185 fleet.

Traction interventions – proposed rolling stock initiatives

TPE has three different train fleets operating post December 2023, which use electric traction and diesel traction. As such, we cannot adopt a one-size-fits-all approach to the initiatives we roll out.

Some measures, such as eco-driving training, are relevant to all vehicles. The implementation of other initiatives will depend on vehicle traction type and when the fleet in question will be phased out of operations (such as our diesel-only trains).

The table on the right outlines our proposed traction interventions by fleet type in the standard and accelerated decarbonisation scenarios.

Train type	Standard scenario	Accelerated scenario
Class 185 fleet (diesel)	Eco-driving, rolling stock hotel management, stand-alone driver advisory systems (DAS).	Eco-driving, rolling stock hotel management, active HVAC controls, start stop technology, diesel fleet hybridisation, use of Auxiliary Power Unit (AUP).
Class 802 fleet (bi-mode)	Eco-driving, rolling stock hotel management, stand-alone DAS.	Eco-driving, rolling stock hotel management, stand-alone DAS, on-board energy storage, diesel fleet hybridisation, selective engine control, start stop technology, use of AUP.
Class 397 fleet (electric)	Eco-driving, rolling stock hotel management.	Eco-driving, rolling stock hotel management, stand-alone DAS, on-board energy storage, automatic switch-off procedures for hotel loads.
Future fleet: Modelled with Class 331 fleet (electric to take TRU benefits forward)	Eco-driving, rolling stock hotel management, stand-alone DAS, on-board energy storage, start stop technology.	Procure new electric train fleet.

Non-traction interventions – building energy efficiency

We have identified many ways to make our non-traction assets – such as our stations, staff depots and office buildings – more energy efficient. These measures include installing LED lighting and building management systems, changing the way we heat our buildings, and reducing waste. We will introduce some, or all, of the following measures to further reduce emissions:

Lighting
Replacing old light bulbs with energy-efficient LEDs is a quick win that saves up to 13% of lighting energy (Rapid Transition Alliance, 2021). Lighting controls can be rolled out across our facilities to ensure lighting is only turned on when needed, while de-lamping reduces unnecessary station lighting and improves energy efficiency.

Heating
Heating controls such as thermostatic radiator valves (in which radiator output is controlled) optimise heating and minimise energy waste. We will also look to move to using heat pumps to replace conventional heating systems with a system powered by low-carbon electricity, so that we can one day remove all our gas supplies.

Building fabric
We can enhance the thermal performance of our buildings with improved insulation in our walls, windows, doors, roofs and plant, making a heat energy saving of about 10% (Rail Safety and Standards Board, 2017). Double-glazing, triple glazing and draught elimination will improve the thermal performance of our facilities.

Low-carbon energy
Rooftop solar panel arrays enable us to generate low-carbon electricity at our stations. Other measures such as hydrogen or methane fuel cells provide an alternative means of decarbonisation; electric vehicle chargers promote eco-friendly commuting; and battery storage helps optimise our renewable energy use.

Energy efficiency
Building management systems will help us control and monitor building performance and make an energy saving of around 10% (Rail Safety and Standards Board, 2017). Power factor correction improves power quality and, therefore, energy efficiency by at least 8% (SMARTech energy, 2022); and behavioural change campaigns will help make our employees switch devices off and not leave them on standby.

Decarbonising non-traction – reducing electricity consumption

We have a big opportunity to significantly reduce our electricity and gas consumption by retrofitting our offices and buildings with energy-efficient systems and materials.

Some of the measures to reduce electricity consumption, such as replacing older lightbulbs with LEDs, provide quick wins and significant savings. Other measures, such as installing heat pumps to replace boiler heating systems, will take longer.

Both modelled scenarios make use of most interventions (as seen in the table to the right). We will use the results of the modelling to help guide which interventions are prioritised as part of our station improvement plans.

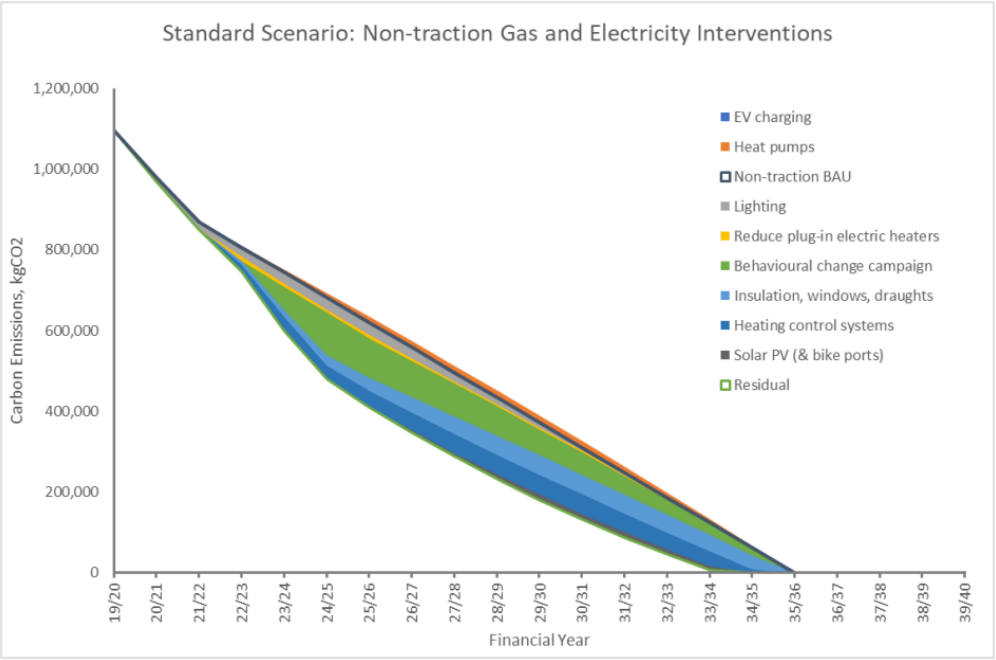
Decarbonisation intervention	Action	Standard	Accelerated
LED lighting	Rollout will yield big emissions savings.	✓	✓
De-lamping	Low-cost solution to reduce energy consumption and emissions.	✓	✓
Review plug-in electric heater use	To be reviewed as heat pumps deliver three times the efficiency.	✓	✓
Double/triple glazing	Retrofitting all windows over nine years will significantly reduce consumption.	✓	✓
Insulation (loft, cavity wall and internal wall)	Retrofitting existing buildings over nine years will increase energy efficiency.	✓	✓
Draught elimination	Retrofitting existing buildings over nine years will increase energy efficiency.	✓	✓
Building management system	A quick win. Installed over two years.	✓	✓
Thermostatic radiator valves	A quick fix. Valves installed over 2 years.	✓	✓
Upgrading heating control systems (e.g. optimisers)	Retrofitting all buildings over nine years will increase energy efficiency.	✓	✓
Heat pumps	Replacing gas boiler heating systems will increase energy efficiency.	✓	✓
Behaviour change	Campaigns are a quick win.	✓	✓
Lighting controls	Adds to energy savings.	✓	✓
Power factor	Low-cost installation over four years.	✗	✓

Decarbonising non-traction – reducing gas consumption

We have identified a range of measures we could roll out to reduce gas consumption in our offices and buildings.

As with the proposed electricity measures, the gas-related measures vary – from everyday best practice, such as draught elimination, to more ambitious measures, such as installing heat recovery systems.

Decarbonisation intervention	Action	Standard	Accelerated
Building management system	A quick win. Installed over two years.	✓	✓
Behaviour change	Campaigns are a quick win.	✓	✓
Double/triple glazing	Retrofit all windows over nine years.	✓	✓
Insulation (loft, cavity/internal wall)	Retrofit existing buildings over nine years.	✓	✓
Draught elimination	Retrofit existing buildings over nine years.	✓	✓
Thermostatic radiator valves	A quick fix. Valves installed over 2 years.	✓	✓
Upgrading heating control systems	Retrofit all buildings over nine years.	✓	✓
Heat recovery	Retrofit all gas boilers with insulation over 9 years.	✓	✓



The graph on the left illustrates just how quickly non-traction measures can reduce our gas and electricity consumption, even in the less aggressive standard decarbonisation scenario.

These interventions account for a significant carbon saving across the period from FY2020 to FY2050. However, these savings are relatively small compared to the impact of decarbonising the grid.

Decarbonising scope 3 emissions

We can actively reduce many of our scope 3 emissions, but we will need to collaborate with our entire value chain on some initiatives. We plan to adopt a range of measures to reduce our scope 3 emissions including some, or all, of the following:

Purchased goods and services & capital goods
We will engage with our largest suppliers by emissions and have them attain validated SBTs with the SBTi. We will also work with suppliers to specify low-carbon products.

Fuel and energy-related activities
The mentioned traction and non-traction decarbonisation interventions will significantly reduce the energy we consume and, therefore, the upstream emissions that would have been produced during the extraction, processing and transportation of fuel and energy.

Upstream transportation and distribution
Using EVs for rail-replacement services would reduce emissions, and specifying diesel coaches that are at least Euro 6 diesel compliant would also reduce emissions.

Waste and recycling
We aim to reduce waste and increase recycling. We will engage with suppliers to reduce packaging and promote recyclable materials. We would also look to incorporate a circular economy model into operations.

Business travel
The fall in business travel post-Covid-19 provides the opportunity to challenge its necessity. We will encourage the shift to low-carbon travel and could stipulate a travel policy that minimises emissions.

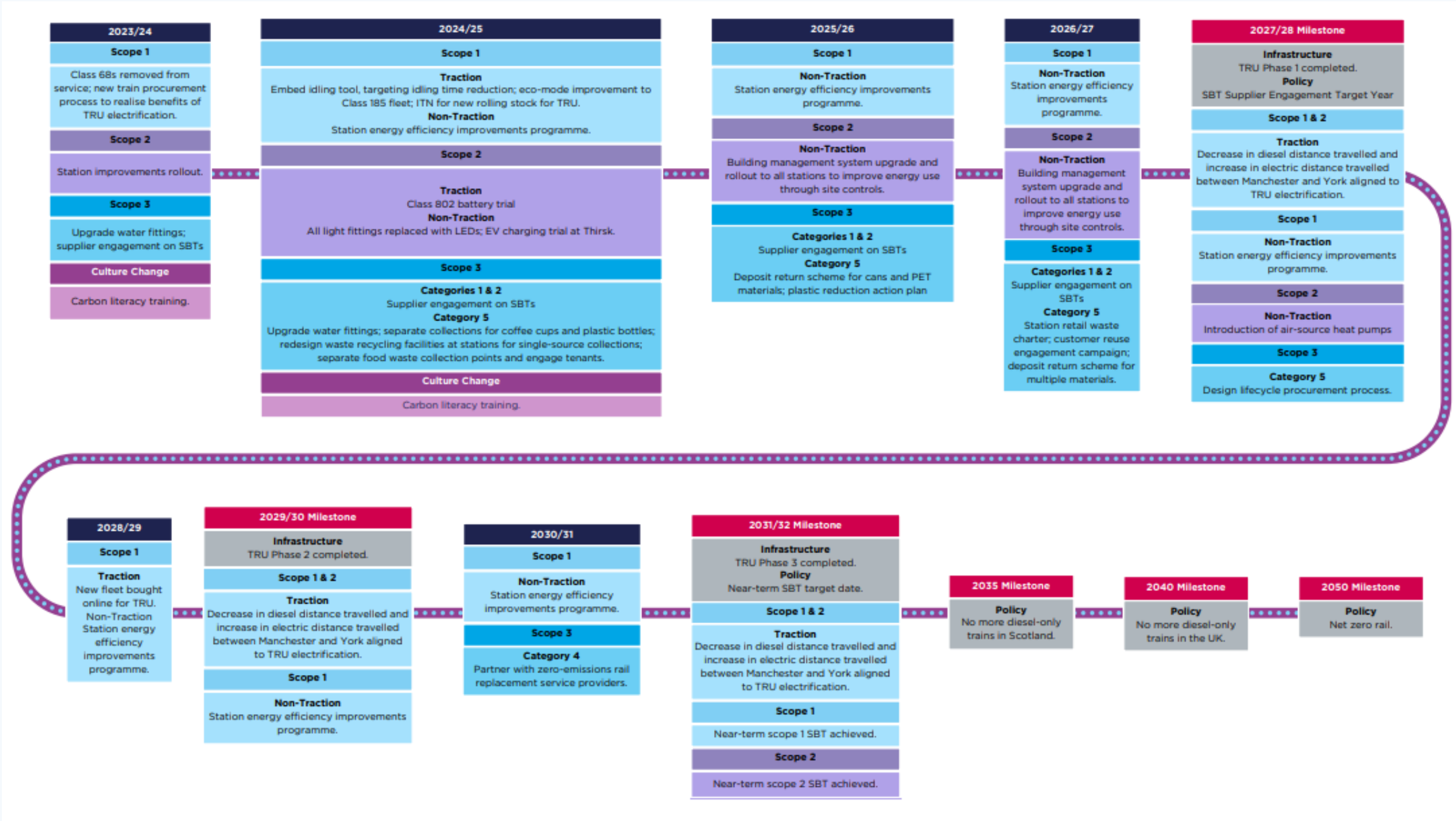
Processing sold products
As digital ticketing increases, fewer people will use paper tickets, thereby reducing the emissions generated from paper processing.

Employee commuting
It is essential that we encourage low-carbon commuting. EV chargers at our facilities and Cycle to Work schemes would make sustainable commuting more attractive.

Leased facilities
Our leased facilities' electricity consumption will passively decarbonise and could help us reach net zero emissions by FY2036. We should support landlords to accelerate the rollout of energy-efficient measures before then.

Downstream leased assets
The third parties renting our downstream leased assets use the existing energy systems at our stations. As we decarbonise our non-traction emissions, the emissions associated with third parties will fall at the same rate.

Key milestones



Conclusion

As we seek to decarbonise our operations, we have developed two potential long-term scenarios that we will use to guide our actions as we progress towards achieving our near-term SBTs and net zero goal. The standard decarbonisation scenario would lead to a more gradual GHG reduction, but this scenario would not meet our near-term Scope 2 SBTs. The accelerated decarbonisation scenario plots a swifter route to achieving our targets and net zero goal. This approach would enable us to meet our SBTi targets, but it would require substantial investment and the rapid rollout of interventions such as diesel fleet hybridisation, active HVAC controls, on-board energy storage, and building management systems.

Whichever path we follow, one thing is clear: immediate action is key for us to make significant emission cuts and meet our commitments. Despite the differences in net zero delivery, both scenarios are similar in many ways. Both involve the prompt decarbonisation of our rolling stock and facilities, and both underline the importance of collaborating with the supply chain and working towards achieving our scope 3 supplier engagement targets.

In the coming years we will make major emissions cuts by decarbonising our vehicle fleet, energy supply, and buildings. However, after we make these gains, a significant obstacle will remain: the supply chain. We must ensure our entire value chain implements carbon reduction measures (especially Network Rail and the rolling stock companies) or we will not meet our commitments.

Unfortunately, this will be partly beyond our control, and achieving full net zero for scope 3 emissions will be challenging and may require carbon removals. But that is a future goal to review. For now, opting for the pathway outlined by the accelerated scenario would help us meet our near-term SBTs and reduce emissions rapidly. The traction and non-traction measures outlined in the report demonstrate that all the technology we need is available to us – but success will depend on prompt action and resource allocation.

Our SBTi commitment is an important step, but each step that follows will be equally significant. We must focus on priority interventions and the measures that make the greatest difference. Indeed, we must take both time and impact into account to ensure we meet evolving sustainability standards and stay on target.

Decarbonisation is a daunting challenge, but it is exciting too. The measures we put in place today will make tomorrow better. We look forward to delivering a net zero railway for future generations.