

Capital Carbon Annex

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Introduction

The RIIO-T3 price control requires network companies to accelerate and expand the development of national infrastructure at an unprecedented scale to support the UK's Net Zero ambitions. However, this necessary increase in activity will inadvertently result in a greater environmental footprint, potentially impacting both the UK's overall Net Zero targets and the network companies' own sustainability commitments.

During the RIIO-T3 price control it is estimated that, for new towers only, we will use 63,000 tonnes of steel (based on 950km of new lines being added). For steel structures for electrical assets for new substations it is estimated that we will use 804 tonnes of steel (this is based on 60 new substations being built). These figures don't include the steel required for refurbishments and extensions. Therefore, for new assets alone SPT will need approximately 63,804 tonnes of steel.

One tonne of steel typically results in emissions of 1.85 tonnes of CO₂e. Therefore, from our steel usage alone it is estimated we will produce 118,037 tonnes of CO₂e. To put that into perspective, you would need 130,572 full grown trees to remove that impact from the atmosphere.

It is imperative that network companies are appropriately funded to reduce the carbon intensity of the materials and equipment they require to deliver the network development necessary to support the UK's decarbonisation targets.

In its RIIO-T3 Business Plan Guidance (18 July 2024), Ofgem set clear expectations for transmission operators to take efficient, cost-effective action to reduce controllable carbon emissions and align with science-based targets.

RIIO-T3 represents a pivotal investment period in the UK's net zero transition. SP Energy Networks is committed to reducing emissions in line with our science-based net zero target while delivering the infrastructure needed to enable decarbonisation.

Our driving commitment in this area (which has been accepted at draft determinations is):

“Deliver economically efficient actions to reduce our scope 1, 2 and 3 Greenhouse Gas (GHG) emissions in line with our Net Zero GHG target”

As our operations and supply chain expand, Scope 3 emissions are projected to become our most significant challenge. To address this, we will implement a **RIIO-T3 Capital Carbon Reduction Plan**, focused on reducing embodied carbon through investment in low-carbon materials, technologies and construction methods.

This Plan will be supported by an **uncertainty mechanism**, enabling additional funding where low-carbon alternatives incur a cost premium over traditional options, ensuring emissions reductions are achieved in a cost-efficient and transparent manner.

We envision the Capital Carbon Reduction Plan to be funded via a Use It or Lose It (UIOLI) flexible mechanism, comprising two categories or 'pots':

1. Low Carbon Materials & Construction (the 'knowns')

This fund will enable the deployment of low-carbon concrete, 'green' steel and diesel-free construction sites across all baseline RIIO-T3 projects. These measures are projected to deliver up to a 15% reduction (see Appendix A1) in capital carbon emissions, at an estimated cost of £1.23M (a 0.3% uplift on total project costs).

As baseline project costs have already been assessed without provision for this initiative, there is no mechanism to retrospectively incorporate these measures into project budgets, contrary to the approach suggested in Ofgem's Draft Determination response.

2. Emerging Low Carbon Opportunities (the 'unknowns')

This fund will support the adoption of emerging low-carbon materials and technologies beyond those covered in 1 above. Given the pace of innovation and the duration of the RIIO-T3 period (to 2031) this allocation will provide flexibility to be able to respond to new opportunities, thereby facilitating the level of carbon reductions necessary to maintain the required trajectory to our 2035 Net Zero Greenhouse Gas Target.

All proposals will be appraised to ensure they deliver value for consumers (as detailed in this Annex). These measures could deliver up to a 35% further

reduction in capital carbon emissions (see Appendix C), with funding capped at 1.1% of total project costs equating to £4.43M for the non-load investment programme.

Background Information

Terminology

For the purpose of this report, the following definitions are used:

Capital Carbon - Refers to the greenhouse gas (GHG) emissions associated with the construction and delivery of infrastructure assets. This includes emissions from:

- Materials: such as concrete, steel and other building components.
- Manufacturing: processes used to produce those materials.
- Transportation: of materials and equipment to site.
- Construction activities: including machinery use, site energy consumption, and waste.

It's distinct from operational carbon, which relates to emissions generated during the use or operation of the asset over its lifetime.

Embodied Carbon – refers to the emissions associated with materials and construction processes throughout the whole lifecycle of a building or infrastructure.

Whole Life Carbon - the combination of capital and operational carbon and is comparable to whole life cost.

Carbon Management – Assessment, Removal and Reduction of GHG emissions during the delivery of new, or the management of existing infrastructure assets and programmes.

Baseline Emissions - expected emissions under a Business-as-Usual scenario.

Our Greenhouse Gas Reduction Targets

We first published our business carbon footprint (BCF) in 2013/14. Our BCF includes key emissions which we directly control or have the most influence over (excludes losses).

In 2021, we set validated Science Based Targets for Scope 3 emissions. Since then, we have reported Scope 3 emissions in each Annual Environmental Report in line with GHG Protocol Technical Guidance for Calculating Scope 3 Emissions. Our reduction targets are aligned to what the latest climate science deems necessary to meet the goals of the Paris Agreement pursuing efforts to limit warming to 1.5°C. Our SBT includes all scopes outlined below:

- Scope 1: Direct emissions associated with fuel used, SF6 and other refrigerant gas leakage which occur from assets we own or control.
- Scope 2: Indirect emissions associated with either energy consumed in assets we own or control, and electricity lost as we transport electricity from supply to our customers.
- Scope 3: All other emissions which occur as a result of our activities. These are upstream emissions predominantly associated with our supply chain.

In RIIO-T3, we will go a step further by setting a **Science Based Net Zero Target of 2035**. We will track and monitor our progress towards our target, reporting progress annually.

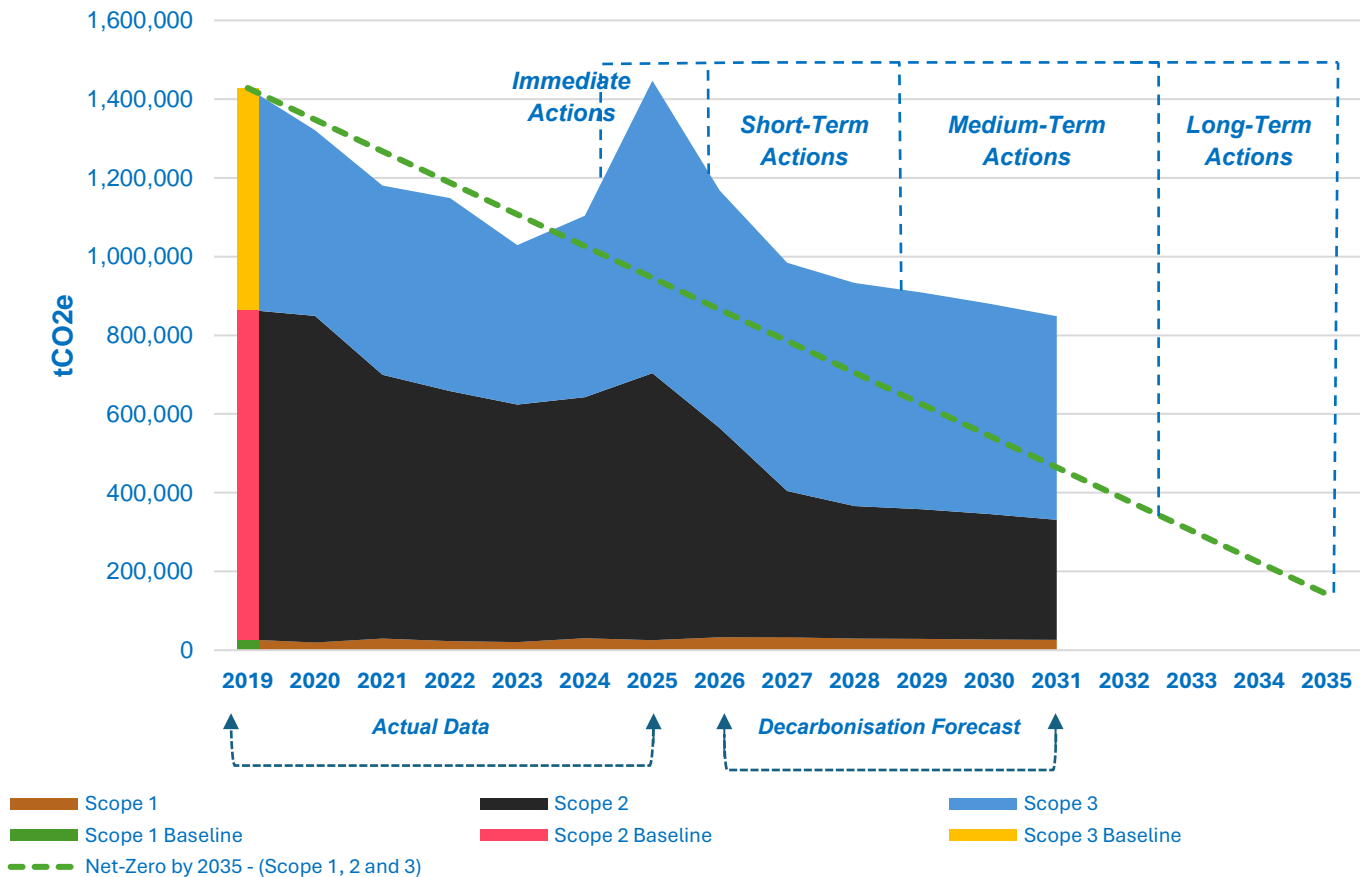
Our Net Zero Transition Plan

Our Net Zero Transition Plan brings together all work to date to set out SPEN's 2035 Net Zero ambition and the steps we will take to achieve it: evidencing the holistic thinking and strategic planning that ensures our targets are ambitious, achievable and backed by evidence and action.

It is aligned to the Transition Plan Taskforce (TPT) Disclosure Framework, which provides a structure to communicate how climate targets are supported by a delivery plan aligned with the overall business strategy. It also fulfils the requirement in the

draft v2 of the SBTi's Corporate Net Zero Standard for companies to develop detailed transition plans outlining the governance, actions, policies and resources necessary to achieve science-based targets and reach net-zero emissions.

SPEN's decarbonisation pathway (Scope 1, 2 & 3 Emissions Trajectory)



The peak in Scope 2 emissions shown in 2025 above is primarily due to increased network losses. These increased network losses also impact our Scope 3 fuel-and-energy-related activities, particularly those associated with the upstream production of electricity lost across our network. Additionally, emissions from purchased goods and services (Categories 1) and capital goods (Categories 2) also contributed significantly. In fact, 2025 recorded the highest emissions from these categories, accounting for 78% of total Scope 3 emissions. Ongoing analysis indicates that the majority of these emissions are linked to infrastructure development.

To address this, we are aligning our practices with the principles of PAS 2080 and deepening our understanding of embodied carbon, both critical to reducing emissions in this area. While emissions appear to have increased significantly, it is

important to note that Categories 1 and 2 are currently calculated using spend-based financial proxies. These proxies do not reflect investments in low-carbon materials and technologies, which often have higher upfront costs. Because financial proxies are based solely on expenditure, more expensive low-carbon solutions can appear to have a higher carbon impact, effectively penalising efforts to decarbonise.

Accurately reporting Scope 3 emissions remains complex, due to the diverse and intricate nature of our global supply chain. To improve accuracy, we are trialling several carbon measurement tools tailored to our construction activities. These tools are being customised to align with our operational processes and are currently being tested on selected projects. Once the trials are complete, we plan to adopt the most suitable tool to standardise our methodology and enhance the reliability and consistency of our emissions data.

Key Decarbonisation Solutions from our Net Zero Transition Plan.

Decarbonisation		Engagement		Governance		Policies	
Immediate (2025)							
<p>SF₆ free installations, leakage reduction and retrofitting.</p> <p>Reduce generator emissions intensity by 80%.</p> <p>Decarbonise our operational fleet by replacing 100% of our cars and vans with electric alternatives and install electric vehicle charging infrastructure for our operational fleet at our sites.</p>	<p>Continued use of Renewable Energy Tariffs.</p> <p>Implement processes for carbon management in relevant business activities, aligned with PAS 2080 Carbon Management in Infrastructure</p> <p>Reduce Business Travel emissions by at least 580 tCO₂e</p>	<p>Provide training to relevant staff members on Net Zero including, in relation to reducing carbon in every stage of network activity (all staff, executive team and the Board).</p>	<p>Engagement with all suppliers.</p> <p>Collaborate with stakeholders including the other Distribution and Transmission Network Operators to assess and manage capital carbon on our projects, driving efficiencies throughout our supply chain and sharing best practice.</p>	<p>Ensure relevant KPIs are in place to drive implementation of this Plan.</p> <p>Continue to ensure the quality of our sustainability data is maintained to a high standard through appropriate measures including external verification and transparent reporting of performance and progress.</p>	<p>Ensure that the Transition Plan implementation process is a standing point on the Board's and the Executive Team's agendas.</p> <p>Continue to give board-level prominence to the sustainability agenda within our business and engage with external organisations with strategic interests in sustainability in the license areas where we operate¹⁸.</p>	<p>Update Procurement Policies and supplier Code of Conduct to access better data quality for Purchased Goods and Services and Capital Goods.</p>	<p>Continue to require contractors and suppliers to become members of the Supply Chain Sustainability School and undertake relevant sustainability and environmental trainings.</p>
Short-term (2026 - 2028)							
<p>Minimise leakage of SF₆ and replace assets where repair of leaks prove ineffective.</p> <p>Reduce generator emissions intensity by 80%.</p>	<p>Pilot and monitor renewable generation at substation and/or depot sites to offset building energy demand.</p> <p>Implement Losses</p>	<p>Collaborate with suppliers to access low carbon materials and technologies to drive reductions from procurement; and 80% suppliers to set SBTi aligned</p>	<p>Agree mutual Net Zero action plans with key suppliers and engage with suppliers early in the development of projects to propose environmental improvements</p>	<p>Work with HR to ensure there is a process in place to review skills needed for the delivery of Net Zero.</p>	<p>Workforce engagement strategy on Net Zero.</p>	<p>Ensure all relevant policies are reviewed and updated where needed on regular basis to ensure they support the decarbonisation journey.</p>	

<p>100% electric operational fleet (cars and vans).</p> <p>Reduce Business Travel emissions by at least 580 tCO₂e.</p> <p>Adoption of SP Wide Position statement which aims to limit the use of CEM 1 concrete.</p> <p>Continue refurbishing and improving energy efficiency of substations.</p>	<p>Reduction Strategy to reduce network losses.</p> <p>Continue to implementing processes for carbon management in relevant business activities, aligned with PAS 2080 Carbon Management in Infrastructure.</p>	<p>Net Zero targets.</p> <p>Continue to collaborate with stakeholders including the other Network Operators to assess and manage capital carbon on our projects, driving efficiencies throughout our supply chain and sharing best practice.</p>	<p>at concept and design stages.</p> <p>Develop RIIO-ED3 Environmental Action Plan to deliver next stage of carbon reductions from 2028-2033 (Distribution).</p>				
Medium-term (2029 – 2031)							
<p>SF₆ filled equipment will only be installed if a viable SF₆ free solution is not available.</p> <p>100% of vans and cars will be decarbonised.</p> <p>Buy and use 50% low emission steel.</p>	<p>Reduce energy consumption by refurbishing SPEN buildings.</p> <p>Continued implementation of Losses Reduction Strategy to reduce network losses.</p> <p>Obtain Certification to PAS 2080 Carbon Management in Buildings and Infrastructure.</p>	<p>Further collaboration with some key suppliers on innovative materials and solutions.</p> <p>Develop RIIO-T4 Environmental Action Plan to deliver next stage of carbon reductions from 2031-2036 (Transmission).</p>	<p>Set a cutoff date and put in place an escalation process for supplier reengagement as required.</p>	<p>Consider linking net zero targets with annual bonuses.</p>	<p>Review existing processes and structures to ensure they remain fit for purpose to lead Net Zero.</p>	<p>Continue to update Supplier Code of Conduct and the Procurement Policy to help guide supplier expectations.</p>	<p>Review the need for any additional policies that would support Net Zero ambition.</p>
Long-term enablers (2032 – 2035)							
<p>Testing and piloting new innovative solutions focused on hard to abate GHG hotspots in our direct emissions (e.g., SF₆ and EV 4x4s) and value chain.</p>	<p>Continue working with low carbon steel producers.</p> <p>Deliver 10% offsetting of baseline emissions by 2035.</p>	<p>Develop RIIO-ED4 Environmental Action Plan to deliver next stage of carbon reductions from 2033-2038 (Distribution).</p>	<p>Only work with suppliers that align with SPEN's Net Zero requirements.</p>	<p>Ensure that the leadership team has skills to drive the ambition beyond Net Zero.</p>	<p>Ensure that existing Net Zero governance structures enable achievement of the target and are also already looking beyond net zero.</p>	<p>Actions on policies to be determined closer to the timescale reflecting the need.</p>	

PAS 2080 Carbon Management in Infrastructure

During RIIO-T3, we will continue to align our carbon management approach with the principles of PAS 2080: Carbon Management in Infrastructure. This standard

highlights the importance of whole-life carbon management and collaboration across the value chain.

Our Capital Carbon Emissions Plan supports PAS 2080 by establishing a carbon baseline, identifying emissions hotspots, and promoting low-carbon solutions through active engagement with our supply chain.

Our commitment to this in our EAP is:

“Achieve PAS2080 certification, validated by an external company by 2028”

ROCCIT

Recognising the impact of embodied and capital carbon in transmission infrastructure, SP Transmission, National Grid Transmission, and SSE Transmission jointly established the ROCCIT (Reduction of Capital Carbon in Transmission) Working Group.

This collaboration focuses on aligning approaches to capital carbon management by:

- Sharing embodied carbon emissions factors
- Developing and harmonising carbon reduction tools
- Delivering consistent messaging to the shared supply chain

The group aims to drive efficiency and consistency in reducing carbon across the sector.

RIIO-T2 Capital Carbon Emission Assessments

In RIIO-T2, SP Energy Networks reported capital carbon emissions annually across major transmission projects. Analysis shows that capital carbon—including embodied emissions—accounts for over 50% of total Scope 3 emissions.

In 2023/24, we undertook two projects to explore opportunities for reducing whole-life carbon in typical network infrastructure. One of these, the **‘Truly Sustainable Substation’** project, delivered by SWECO, focused on improving substation sustainability through:

- Minimising whole-life carbon emissions
- Embedding circular economy design principles
- Identifying Nature-Based Solutions for deployment at substation sites

The project provided a baseline assessment of current substation design practices and identified opportunities to enhance sustainability across SPEN's network.

Figure 1 below illustrates a key output from the *Truly Sustainable Circuits* project—a roadmap of low-carbon opportunities for 132kV substation construction.

The 'Baseline' bar represents capital carbon emissions under a business-as-usual scenario. Each opportunity along the X-axis shows a potential intervention to reduce

For example, switching to HVO fuels during construction could reduce capital carbon emissions by approximately **28%**.

Figure 2 illustrates the same for 275kV substation construction.

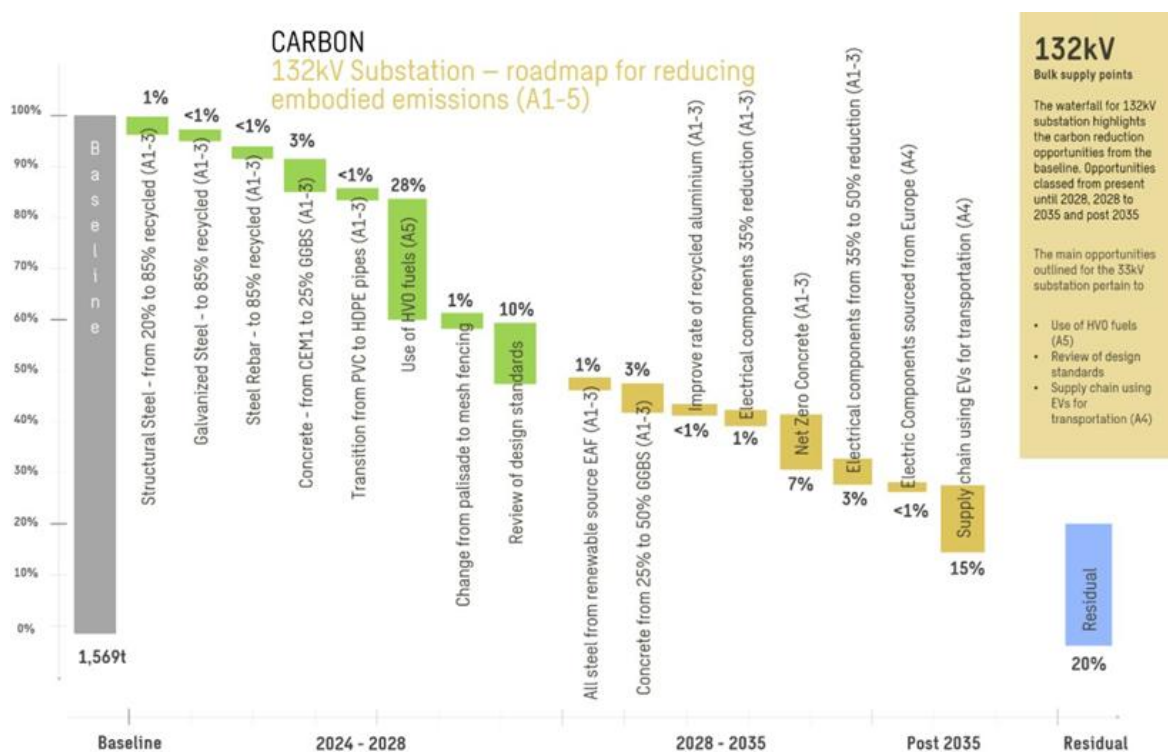


Figure 1 Truly Sustainable Substation Project 132kV Summary

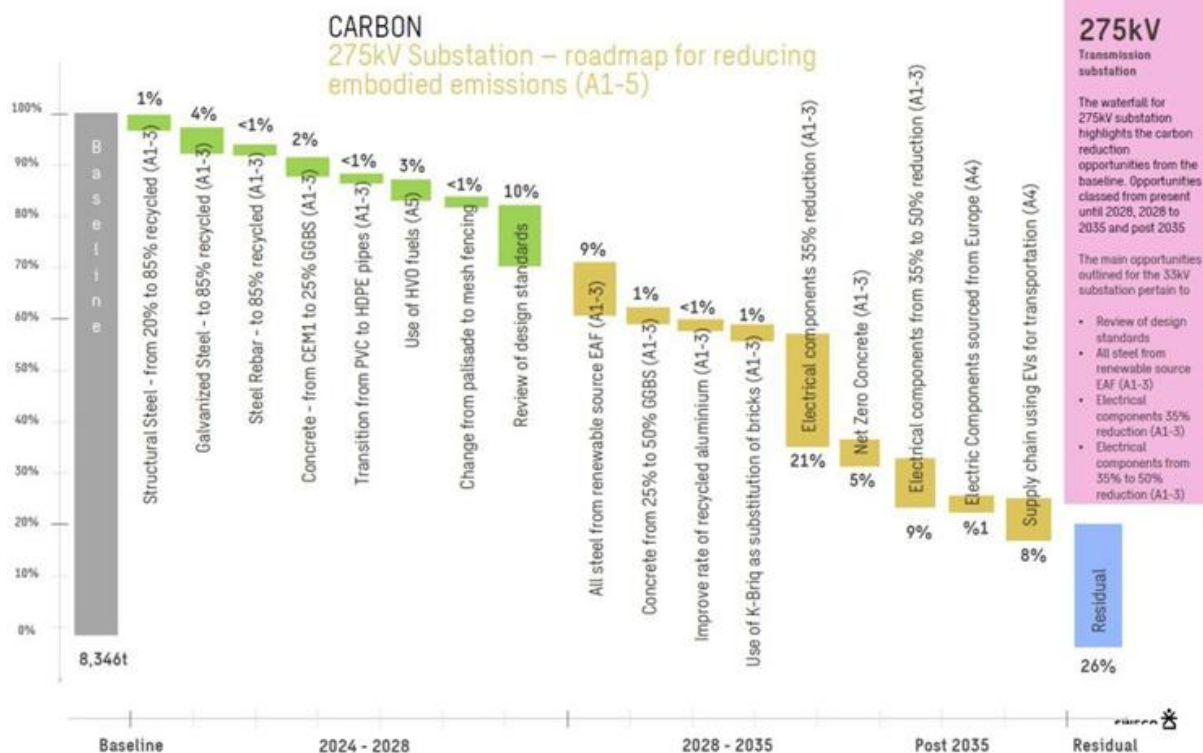


Figure 2 Truly Sustainable Substation Project 275kV Summary

The second project, “Truly Sustainable Circuits”, was delivered by WSP between August 2023 and March 2024. It critically assessed the environmental impacts of current practices across the lifecycle of transmission and distribution overhead line (OHL) and underground cable (UGC) infrastructure.

The project developed conceptual models for 1 km of OHL and UGC, analysing whole-life carbon impacts, identifying carbon reduction opportunities, and embedding circular economy principles. It also proposed measurable sustainability metrics to inform both current and future project delivery.

Figure 3 below shows one of the key outputs from the Truly Sustainable Circuits Project detailing the major carbon hotspots associated with transmission overhead line development and opportunities to reduce emissions.

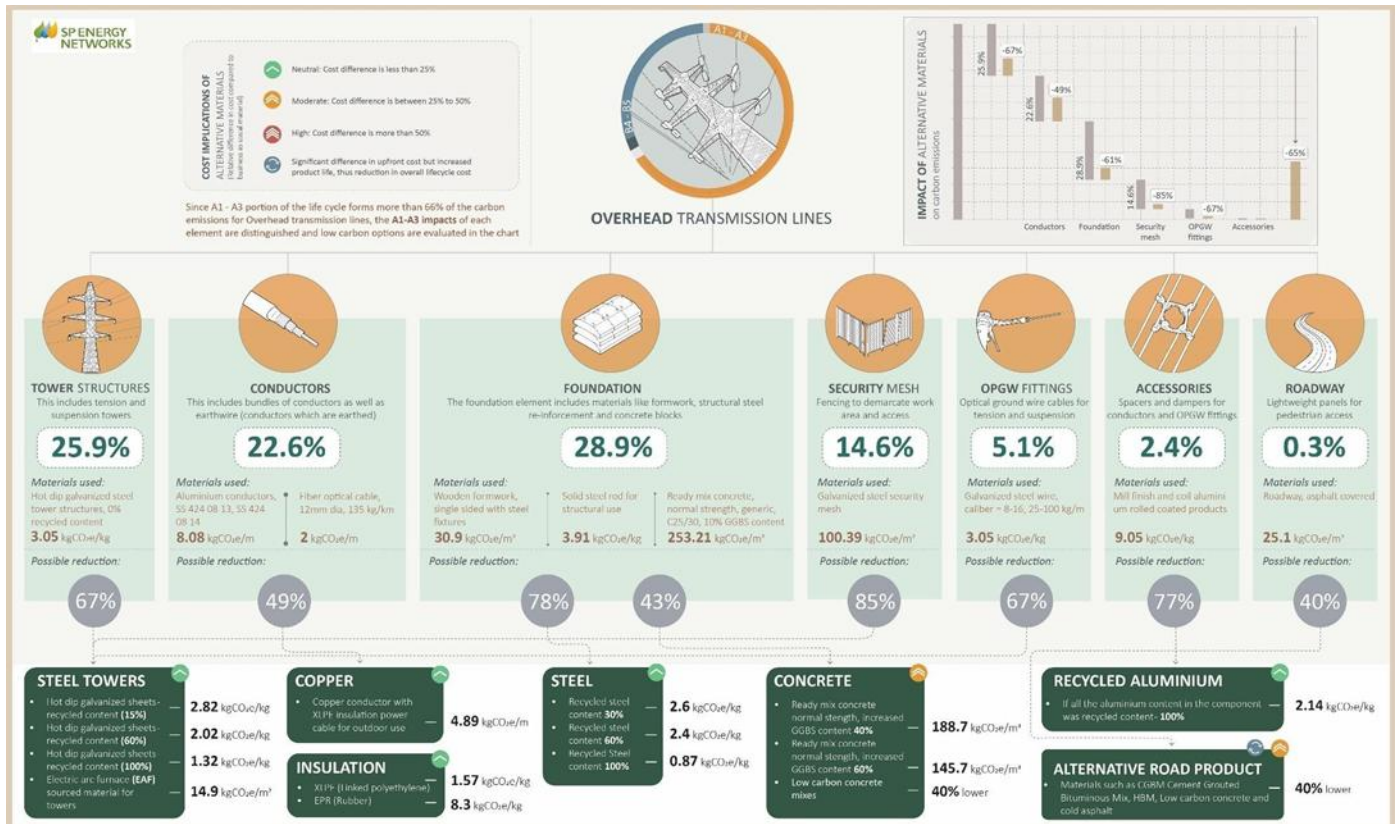


Figure 3 Truly Sustainable Circuits Project Summary

The Truly Sustainable Circuits project identified tower structures, conductors, foundations, and fencing as the most significant sources of emissions in overhead line construction. The study estimated that up to 65% reduction in capital carbon could be achieved through the use of low-carbon materials and products—particularly low-carbon steel, low-carbon concrete, and improved cable conductor design.

Both the Truly Sustainable Substation and Circuits projects demonstrated that substantial capital carbon reductions are achievable through currently available technologies such as low-carbon concrete, low-carbon steel, and HVO fuels. However, some opportunities remain more challenging to implement due to external constraints, including supply chain readiness, cost, and regulatory alignment.

Non-Load and Baseline Projects

,Capital Carbon Emissions Baseline – Non-Load projects only

Needs Case:

OFGEM have set expectations that Networks should commit to establishing an embodied carbon baseline on new projects during RIIO-T3.

Scope:

In order to set a baseline for new projects in RIIO-T3, we have estimated emissions associated with our non-load infrastructure development projects in RIIO-T3 under a 'business as usual' scenario.

The scope of projects included in the assessment is limited to Non-Load Projects included in RIIO-T3 baseline funding. The types and number of projects are summarised below:

- 13 Major Refurbishment OHL Projects
- 12 Minor OHL Projects
- 19 Transformer Replacement Projects
- 22 Circuit Breaker Disposal / Replacement Projects
- 14 Disconnecter and Earthing Switch Replacement / Refurbish Projects
- 12 smaller projects

The scope of the assessment included:

- Calculating the estimated baseline capital carbon emissions for the RIIO-T3 Non-Load investment program.
- Identifying initiatives that can reduce capital carbon in the RIIO-T3 period.
- Undertaking a feasibility analysis for such initiatives and develop and propose commitments/targets that could be included in the Environmental Action Plan.
- Determining indicative costs for the baseline and for the low carbon materials modelled to reduce capital carbon; and

- Building a spreadsheet with baseline and forecast models and the reduction plan for capital carbon emissions of the non-load program over the RIIO-T3 period.

Emissions Factors:

Suitably authoritative emissions factors were used to calculate the carbon impact across lifecycle stages of the Non-Load programme. Sources include OneClick LCA EPDs, the ICE Database (v3.0), and the Department for Energy Security and Net Zero (DESNZ).

Baseline emissions were calculated by assigning relevant factors to the materials comprising each asset. Forecast emissions for low-carbon interventions were similarly derived using appropriate emissions factors.

Results:

The baseline forecast represents a scenario in which the RIIO-T3 Capital Carbon Plan is not implemented.

To estimate A1–A3 emissions, material volumes required for the RIIO-T3 Non-Load programme were forecasted based on a business-as-usual approach. Assumptions included the use of materials with low or no recycled content, resulting in higher embodied carbon.

Emissions for stages A4 (transport), A5 (construction), B4–B5 (replacement/refurbishment), and C1–C4 (end-of-life) were derived using proportional lifecycle data from the Truly Sustainable projects. Emissions contributions varied depending on asset lifespan:

- Long-life assets (e.g. OHL towers, wooden poles) align with the full project life (100 years)
- Shorter-life assets (e.g. conductors) require replacement, resulting in higher B4–B5 emissions

The full baseline carbon impact assessment for the Non-Load programme is provided in **Appendix A**. The blue bars show the total estimated emissions. (Capital

Carbon Emissions are primary associated with the construction / refurbishment of towers, transformers and conductors.)

The total estimated baseline emissions associated with the non-load investment program under a business-as-usual scenario **is c.44.8ktCO₂e.**

Low Carbon Materials and Construction Fund (Pot 1)

Needs Case:

Under Business-as-Usual forecasts, capital carbon emissions from the Non-Load investment programme are expected to account for approximately 5% of total emissions during RIIO-T3. When Load and Strategic projects are included, this share is projected to grow significantly becoming the largest contributor to overall emissions by 2031.

This reinforces the need for a robust Capital Carbon Reduction Plan as a critical component of our RIIO-T3 strategy.

Optioneering:

A feasibility analysis was conducted to assess the potential deployment of 10 low-carbon opportunities during RIIO-T3, across four categories: low-carbon concrete, low-carbon steel, diesel-free sites, and other technologies.

The analysis combined desk-based research with targeted supplier engagement and assessed each opportunity based on:

- Technical applicability
- Availability
- Cost implications

WSP's civil and electrical engineers evaluated the applicability of each opportunity within SPEN's transmission infrastructure. External stakeholders consulted included:

- WSP
- Institute of Civil Engineers

- Institute of Structural Engineers
- Cleveland Steel
- Kenoteq
- Crown Oil
- Queen's University Belfast
- Mineral Products Association

The analysis also considered supplier availability, geographic location, and current vs. projected supply-demand dynamics. Full results are provided in **Appendix B**.

Following the feasibility study, four key opportunities were selected for inclusion in the Capital Carbon Reduction Plan, based on their material impact and feasibility within RIIO-T3. These include:

- Concrete in OHL foundations
- Steel in OHL foundations
- Steel in OHL towers
- Steel within asset structures within substations
- Diesel use during construction

Baseline specifications were compared with low-carbon alternatives to estimate potential emissions reductions. Figure 4 presents example emissions factors for these low-carbon materials.

Material	Asset Applicability	Baseline Specification	Baseline Carbon Emissions Factor	Low Carbon Material Specification	Low Carbon Emissions Factor
Concrete	OHL - foundations	Ready-mix concrete, normal strength, generic, C25/30 with CEM I, 0% recycled binders	270.88 kgCO ₂ e/m ³	Concrete (60% GGBS content)	172 kgCO ₂ e/m ³
Steel	OHL foundations	Reinforcement steel (rebar), generic, 15% recycled content, A615	2.03 kgCO ₂ e/kg	Steel (90% recycled content)	0.67 kgCO ₂ e/kg
Steel	OHL towers	Hot-dip galvanized steel sheets	3.05 kgCO ₂ e/kg	EAF galvanised steel panels	2.61 kgCO ₂ e/kg
Diesel	-	100% mineral diesel	3.2 kgCO ₂ e/Litre	Biodiesel HVO	0.6 kgCO ₂ e/Litre

Figure 4 Emission Factors for Low carbon alternatives

Proposal:

To support the adoption of low-carbon concrete, green steel, and diesel-free construction sites across baseline RIIO-T3 projects, we propose a dedicated Low Carbon Materials & Construction Funding mechanism.

This fund will cover the cost differential where low-carbon alternatives exceed traditional material costs. Feasibility will be assessed on a case-by-case basis, ensuring practical implementation. It is proposed that the mechanism operates on a 'Use it or Lose it' basis, encouraging timely and efficient deployment of low-carbon solutions.

Costs and Benefits:

Indicative costs for each low-carbon opportunity were identified through desk-based research and engagement with suppliers and industry bodies.

Table 2 summarises the estimated cost increases associated with adopting:

- Low-carbon concrete
- Low carbon steel
- HVO fuel (as a diesel alternative)

These figures provide a basis for assessing the financial impact of implementing the Capital Carbon Reduction Plan.

Material	Asset Applicability	Opportunity	Cost Uplift
Concrete	OHL - foundations	Low carbon concrete	3% to 20%
Steel	OHL foundations	Green steel	5% to 20%
Steel	OHL towers	Green steel	5% to 20%
Diesel	Construction	HVO	0% to 45%

Figure 5 Cost Uplift for each low carbon solution

To ensure maximum decarbonisation potential, the higher-end cost estimates have been applied to our plan. The total fund requested is £1.23M, operating on a ‘use it or lose it’ basis to support low-carbon solutions where cost premiums exist.

This represents a cost increase of 0.3% relative to the total capital investment in the non-load programme.

The costs for this can be found in BPDT ‘8.12 Net Zero’.

	Non-Load Costs (Before Initiative)	Non-Load Cost (After Initiative)
Total Estimated Cost of Non-Load	£404.707m	£405.937
Total Estimated Carbon Impact	44,800tCO ₂ e	38,600tCO ₂ e
Carbon / Cost –	110 tCO ₂ e/£m	95 tCO ₂ e/£m
% Reduction in Carbon / Cost		14.2 %

The forecast emissions for the non-load investment programme, with the Low Carbon Materials Fund applied, are presented in **Appendix B**.

The orange bars in the graph represent total estimated emissions under this scenario, amounting to 38,6000 tCO₂e. This reflects a reduction of 62,000 tCO₂e, or approximately 14%, compared to the baseline.

Further tables and calculations to this can be found in BPDT 9.17 Environment (Embodied carbon)

Emerging Low Carbon Opportunities (the ‘unknowns’)

Needs Case:

In order to meet our Science-Based Net Zero Target, we are pursuing further reductions in capital carbon emissions.

Given the RIIO-T3 price control runs to 2031, we recognise that not all future technologies and innovations can be predicted. As low-carbon solutions in the construction sector continue to evolve rapidly, it is essential to support the supply chain in developing and adopting emerging opportunities.

Proposal:

To support further reductions in capital carbon emissions, we propose a flexible funding mechanism for emerging low-carbon materials and technologies, where a clear cost-effective benefit can be demonstrated.

This approach recognises the rapid evolution of low-carbon solutions and the need to support supply chain innovation beyond currently available options. To assess cost-effectiveness, we will apply a carbon valuation aligned with the Department for Energy Security and Net Zero (DESNZ) Carbon Values.

DESNZ guidance highlights the importance of early investment in clean technologies, despite higher upfront costs, to drive long-term cost reductions. The central carbon value is £256/tonne in 2024, rising to £378/tonne by 2050, with a recommended $\pm 50\%$ sensitivity range to account for uncertainty.

Assuming RIIO-T3 delivery between 2026–2031, we propose using an average carbon value of £274/tonne to appraise future opportunities. Based on findings from the Truly Sustainable Substation and Circuits projects, up to a 50% reduction in capital carbon may be achievable during RIIO-T3 (15% from low carbon materials, and 35% from new emerging technologies)

Costs and Benefits:

Assuming that:

- Total embodied CO₂e from new projects pa (before initiatives) = 7,714 tCO₂e
- Total **target** embodied CO₂e from projects pa (with initiatives) = 4,480 tCO₂e
- Therefore, the total carbon reduction is (7714-4480) = 3234 tCO₂e

To convert this into a financial cost we multiply the total carbon reductions by the average carbon value as described above (£274 per tonne of carbon)

Total Additional Cost on Non-Load Spend

$$\frac{(7714-4480)tCO_2 * \frac{£274}{tonne}}{1000000} = £0.89m \text{ per year (Total Additional Cost on Non-Load Spend)}$$

Over 5 years this spend will be £4.45m which is a 1.1% uplift of the total project spend.

	Non-Load Costs (Before Initiative)	Non-Load Cost (After Initiatives)
Total Estimated Cost of Non-Load	£404.707m	£410.387m
Total Estimated Carbon Impact	44,800tCO ₂ e	22400.81tCO ₂ e
Carbon / Cost –	110 tCO ₂ e/£m	54.5 tCO ₂ e/£m
% Reduction in Carbon / Cost		50%

Further working for this can be found in the BPDT 9.7 Environment and can also be found in **Appendix C**.

External Engagement and Assurance

UK Transmission Network Operators

Our capital carbon plan has been developed in close collaboration with NGET and SSET through our RIIO-T3 Carbon Working Group. The initiative has been agreed as a common commitment between the three Transmission Operators (note wording might differ slightly between TOs). Furthermore, due to the close link between carbon emissions and sustainable resource use, the Capital Carbon strategy, this plan will also support targets for Circular Economy.

Our commitments in this area are

“Deliver economically efficient actions to reduce our scope 1, 2 and 3 Greenhouse Gas (GHG) emissions in line with our Net Zero GHG target”

“Implement cost-effective sustainable materials and solutions in our construction programmes”

External Stakeholders

The forecast emissions, feasibility analysis and costs have been developed by an external consultant, supported by SP Energy Networks.

Our capital carbon reduction plan has been reviewed by our Sustainability Stakeholder Working Group (SSWG) and (INZAC) Group.

Appendix A – Capital Carbon Emissions Forecast

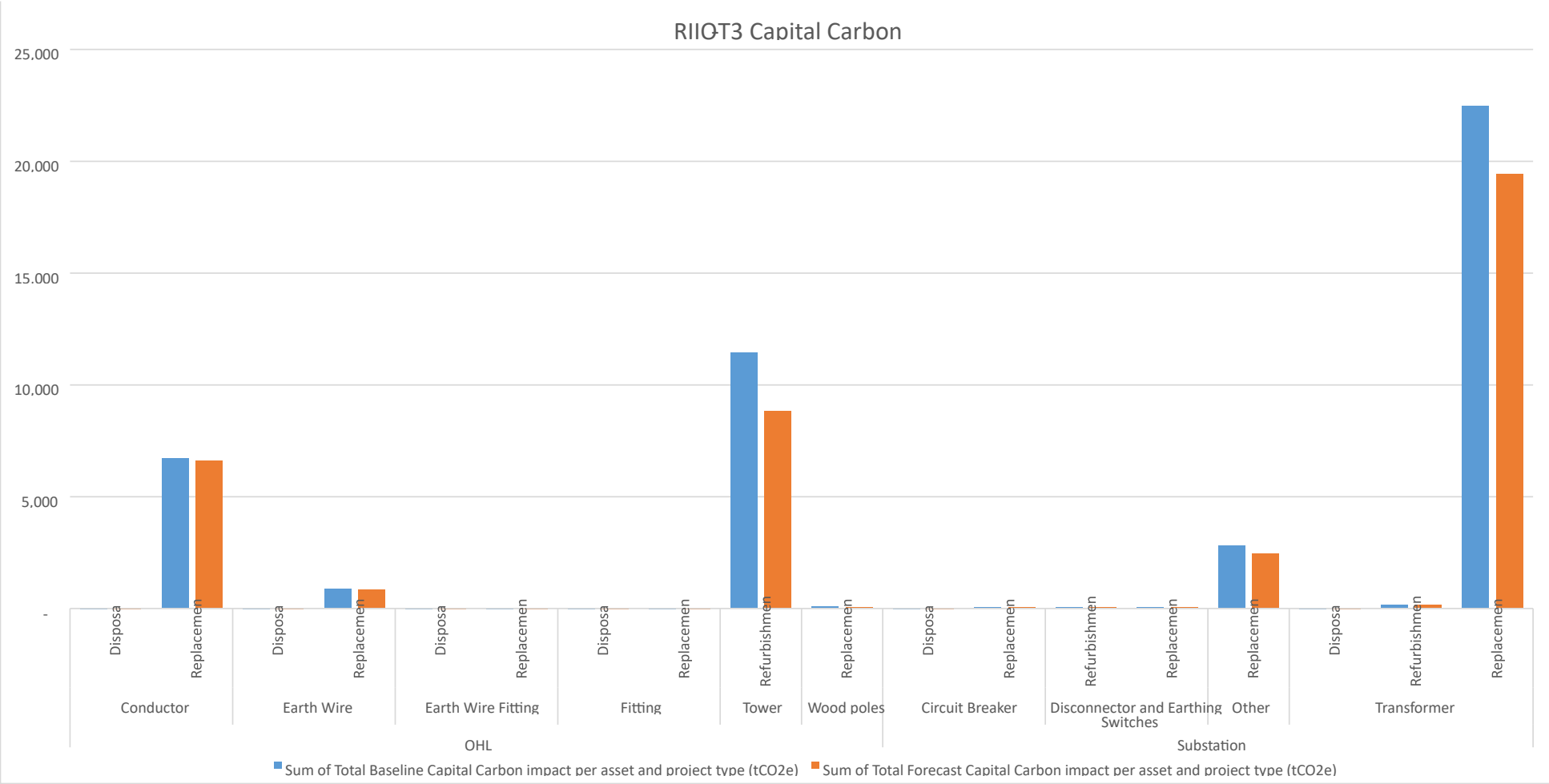


Figure 6 The blue bars show the total estimated emissions. (Capital Carbon Emissions are primary associated with the construction / refurbishment of towers, transformers and conductors.)

Appendix A1

Investment Summary	Category	Project	Amount of assets per Project type	Units (km or no.)	Type of Project	Carbon Impact of Project as Share of Non-load Baseline (%)	Baseline Carbon Hotspot Material (where feasible low carbon opportunity exists)	Feasible Opportunity to Reduce Capital Carbon (associated with hotspot)	Total Baseline Capital Carbon impact per asset and project type (tCO2e)	Total Forecast Capital Carbon impact per asset and project type (tCO2e)	Change in Capital Carbon per Project type from Baseline to Forecast (%)	Indicative Baseline Cost of Carbon Hotspot Material (£)	Indicative Forecast Cost of Feasibility Carbon Reduction Opportunity (£)	Potential Cost of Carbon Reduction per Project (£/tCO2e)
Non-Load	OHL	Conductor	306.2	km	Replacement	14.28%	Diesel used in construction (100% mineral diesel)	HVO used in construction	6714.00	6,594	-1.80%	£41,573	£60,420	£157.57
Non-Load	OHL	Conductor	199.3	km	Disposal	0.05%	-	-	24.00	24	0.00%	-	-	-

Non-Load	OHL	Earth Wire	83.9	km	Replace ment	1.85 %	Diesel used in construc tion (100% mineral diesel)	HVO used in constru ction	872.00	856	- 1.80 %	£5,397	£7,844	£157. 57
Non-Load	OHL	Earth Wire	83.9	km	Disposal	0.01 %	-	-	5.00	5	0.00 %	-	-	-
Non-Load	OHL	Earth Wire Fitting	345	no.	Replace ment	0.02 %	Diesel used in construc tion (100% mineral diesel)	HVO used in constru ction	11.00	11	- 1.80 %	£67	£98	£157. 57
Non-Load	OHL	Earth Wire Fitting	345	no.	Disposal	0.00 %	-	-	0.06	0.06	0.00 %	-	-	-
Non-Load	OHL	Fitting	760	no.	Replace ment	0.02 %	Diesel used in construc tion (100% mineral diesel)	HVO used in constru ction	9.00	9	- 1.80 %	£56	£81	£157. 57
Non-Load	OHL	Fitting	760	no.	Disposal	0.00 %	-	-	0.00	0	0.00 %	-	-	-
Non-Load	OHL	Wood poles	102	no.	Replace ment	0.21 %	Ready-mix concrete , 10% recycled binders	Concre te with 60% GGBS conten t	99.00	66	- 33.9 0%	£15,31 3	£18,37 6	£168. 45

Non-Load	OHL	Wood poles			Replace ment		Reinforc ement steel (rebar), 15% recycled content	EAF steel (97% Recycle d Conten t)				£11,63 2	£13,95 9	
Non-Load	OHL	Wood poles			Replace ment		Diesel used in construc tion (100% mineral diesel)	HVO used in constru ction				£615	£894	
Non-Load	OHL	Tower			Refurbis hment	24.3 3%	Hot-dip galvaniz ed steel sheets	EAF galvani sed steel panels				£1,731, 840	£2,078, 208	
Non-Load	OHL	Tower	410	no.	Refurbis hment		Ready mix concrete , 0% recycled binders	Concre te with 60% GGBS conten t	11441.00	8,815	- 22.9 0%	£628,5 35	£754,2 42	£208. 73
Non-Load	OHL	Tower			Refurbis hment		Steel, 30% recycled content	EAF steel (97% Recycle d Conten t)				£219,0 71	£262,8 85	

Non-Load	OHL	Tower			Refurbishment		Diesel used in construction (100% mineral diesel)	HVO used in construction				£70,844	£102,961	
Non-Load	Substation	Circuit Breaker	40	no.	Replacement	0.10 %	Diesel used in construction (100% mineral diesel)	HVO used in construction	48.00	41	- 14.90 %	£2,481	£3,606	£157.57
Non-Load	Substation	Circuit Breaker	18	no.	Disposal	0.00 %	-	-	0.00	0	0.00 %	-	-	
Non-Load	Substation	Disconnect and Earthing Switches	5	no.	Replacement	0.10 %	Diesel used in construction (100% mineral diesel)	HVO used in construction	45.00	38	- 14.90 %	£2,341	£3,403	£157.57
Non-Load	Substation	Disconnect and Earthing Switches	82	no.	Refurbishment	1.57 %	Diesel used in construction (100% mineral diesel)	HVO used in construction	740.00	629	- 14.90 %	£38,399	£55,807	£157.57

Non-Load	Substation	Transformer	26	no.	Replacement	47.76%	Diesel used in construction (100% mineral diesel)	HVO used in construction	22457.00	19,102	-14.90%	£1,165,890	£1,694,443	£157.57
Non-Load	Substation	Transformer	2	no.	Refurbishment	3.67%	Diesel used in construction (100% mineral diesel)	HVO used in construction	1727.00	1,469	-14.90%	£89,684	£130,342	£157.57
Non-Load	Substation	Transformer	1	no.	Disposal	0.03%	-	-	13.00	13	0.00%	-	-	-
Non-Load	Substation	Other	1204	no.	Replacement	5.99%	Diesel used in construction (100% mineral diesel)	HVO used in construction	2819.00	2,398	-14.90%	£146,339	£212,681	£157.57
TOTALS									47,024	40,070	-14.8%	£4,170,078	£5,400,249	

Note: (40,070-47024)/ 47024 = -14.8% reduction

Appendix B – Feasibility Assessment

Category	Asset System Category	Opportunity	Benefits	Availability - Supply vs demand	Risks and Constraints
Low Carbon Concrete	OHL, Substation	Procure low carbon concrete (40% GGBS)	Indicative carbon reduction (21% A13) Reduces raw material extraction	Availability of GGBS and Fly Ash continues to decline. There is a limited supply as the processes of which it is a byproduct of are used less but the frequency and quantity of its use increases.	See 'Supply vs demand' - risk of dramatically increased cost. Overuse of GGBS (a finite resource - increase in use in one location reduces its use elsewhere) can increase binder content and in turn increase demand on CEM-1 which is counterproductive to decarbonisation ambitions and the need to reduce production of CEM-1 overall. Some studies indicate LCC cost may increase to 70% more expensive in the future.
Low Carbon Concrete	OHL, Substation	Procure low carbon concrete (60% GGBS)	Indicative carbon reduction (37% A1-3) Reduces raw material extraction	Availability of GGBS and Fly Ash continues to decline. There is a limited supply, the processes of which it is a byproduct of are used less but the frequency and quantity of its use increases.	Pre-cast concrete is unlikely able to meet specific GGBS or grade rating targets due to the method of production. Suppliers may be unable to provide verified EPDs to inform meeting embodied carbon intensity requirements.
Low Carbon Concrete	OHL, Substation	Procure concrete with at least 60% recycled content	Indicative carbon reduction (51% A1-3). Reduces raw material extraction	Availability (GGBS and Fly Ash) continues to decline. There is a limited supply, the processes of which it is a byproduct of are used less but the frequency and quantity	

				of its use increases.	
Low Carbon Steel	OHL, UGC, Substation	Procure Electric Arc Furnace steel	Indicative carbon reduction (14% A13) Reduces raw material extraction	Global demand could exceed supply as EAF steel only accounted for 18% of UK production in 2022 and current steel demand is 3 times higher than scrap supplies.	See 'Supply vs Demand' - EAF steel only accounted for 28% of global production in 2022 The UK exports most of its scrap (8.2 million tonnes in 2022 compared to 0.2 million tonnes imported). Therefore, vulnerable to volatility in scrap prices.
Low Carbon Steel	OHL, UGC, Substation	Procure steel with at least a 90% recycled content	Indicative carbon reduction (59% A13 for 97% EAF produced); Reduces raw material extraction	Turkey is largest national seaborne importer of ferrous scrap and produces mainly via EAF (2022, EAF was 71.5%). China aiming to increase EAF supply to 15% of production. Plans for new Scottish plants set out by Zero Waste Scotland. Recycled scrap steel production accounts for about 30% of global production currently.	The UK exports most of its scrap (8.2 million tonnes in 2022 compared to 0.2 million tonnes imported). Therefore, vulnerable to volatility in scrap prices. Steel is already highly recycled (> 95% for structural steel). Specifying steel with high recycled content could distort the market, driving up prices, and have negative effects on wider sustainability considerations such as supporting the UK economy and

				Forecast to rise to 50% by 2050.	
Diesel Free Sites	All	Procure HVO as a diesel alternative	Indicative carbon reduction (90%); Reduced air particulates. Reduced noise; Encourages CE principles	<p>The UK already has the infrastructure to facilitate increased demand - depots around the UK</p> <p>Currently enough HVO for the marketplace as HVO is more expensive than diesel, demand is still not exceeding supply</p> <p>Crown Oil has 60 million litres of reserves (all fuels)</p> <p>HVO uses used cooking oil (finite resource)</p>	<p>Transparent procurement - environmental and social implications (use of palm oil PFAD)</p> <p>Whole life carbon reporting in line with SBTi guidance - land use change if HVO contains PFAD.</p> <p>Rebate is not applied for stationary engines so use in generators would not receive the rebate (price would be higher)</p> <p>Finite resource means increased demand for input product which could place more demand on the supply chain and encourage opaqueness of input materials.</p> <p>Some supply chain are not promoting HVO - e.g. Balfour Beatty's Nov 2022 positioning paper outlines its stance for not adopting HVO.</p>
Category	Asset System Category	Opportunity	Benefits	Availability - Supply vs demand	Risks and Constraints
Diesel Free Sites	All	Install onsite renewable generation	Indicative carbon reduction (31-81% Scope 1); Reduced noise pollution. No idling;	Demand could exceed supply as companies start to transition to net zero - hydrogen	<p>Smaller scale projects may not allow for onsite generation as they require more space</p> <p>Supply may be limited as demand increases</p>

			Reduced maintenance	supply has not scaled to that of diesel	
Other	Substation	Procuring alternative fencing to palisade	Mesh fencing Indicative carbon reduction (40% A1-3)	Steel can be recycled repeatedly so no indicated issues with supply	-
Other	Substation	Procuring low carbon bricks for substation buildings	Indicative carbon reduction (95% A1A3); CE approach - almost 100% recycled content and fully recyclable at end of life. Locally produced; Increased visual amenity	3-5 million bricks produced annually (60 bricks per m2 = 50,000-83,000m2 coverage)	Façade material (29 mega pascals per mm2) rather than structural engineering brick Innovative product, still undergoing certification and testing. Smaller scale production and application
Other	UGC	Procure cables with recycled copper/aluminium content	Reduces raw material extraction	Innovative products	Cutting edge - not yet testing in UK markets

Appendix C

Embodied Carbon Working data from SPEN BPDT 9.7 Environment

To reach our Net Zero 2035 target it was estimated that we need to reduce our capital carbon emissions by 50%.

If we already proved that we get a 15% reduction from initiative 1 (low carbon material 'knowns') then we still need a further reduction of 35% to meet our target. Therefore, doing a top down approach, we worked out how much capital carbon we needed to save and then applied that to the DESNZ green book carbon price to get our 1.4% figure.

Business as Usual Emissions from Non Load Investment Programme:

		RIIO-T3					
<i>Breakdown by source:</i>	Units	2027	2028	2029	2030	2031	T3 End Total
Manufacture	%	70.91%	70.91%	70.91%	70.91%	70.91%	70.91%
Transport	%	8.64%	8.64%	8.64%	8.64%	8.64%	8.64%
Construction	%	10.29%	10.29%	10.29%	10.29%	10.29%	10.29%
End of life	%	1.19%	1.19%	1.19%	1.19%	1.19%	1.19%
Average embodied CO2 per £m expenditure (new projects)	tCO2e / £m	110.70	110.70	110.70	110.70	110.70	110.70
Total embodied CO2 from new projects	tCO2e	8,960.32	8,960.32	8,960.32	8,960.32	8,960.32	44,801.62
Total Non-Load Project Spend	£m	80.94	80.94	80.94	80.94	80.94	404.71

EAP - Calculation to determine the capital carbon savings from low carbon concrete, low carbon steel and use of HVO instead of diesel (Implementing Low Carbon Materials & Construction (the 'knowns'))

<i>Breakdown by source:</i>	Units	2027	2028	2029	2030	2031	T3 End Total
Average embodied CO2 per £m expenditure (new projects)	tCO2e / £m	95.02	95.02	95.02	95.02	95.02	95.02

Total embodied CO2 from new projects	tCO2e	7,714.83	7,714.83	7,714.83	7,714.83	7,714.83	38,574.15
Cost of Initiative		0.25	0.25	0.25	0.25	0.25	1.23
Updated Non-Load Project Spend	£m	81.19	81.19	81.19	81.19	81.19	405.94

		RIIO-T3					
		2027	2028	2029	2030	2031	Total avoided by end of T3
Embodied CO2 from new projects avoided from our plan to eliminate the most carbon intensive steel products, concrete products and phase out fossil fuels	tCO2e	1,245.49	1,245.49	1,245.49	1,245.49	1,245.49	6,227.47

		RIIO-T3					
		2027	2028	2029	2030	2031	Total cost by end of T3
Costs	£m	0.25	0.25	0.25	0.25	0.25	1.23

EAP - Calculation to determine the capital carbon savings from Our plan to procure for low carbon and circular construction materials and provide incentives in our contracts - in addition to the savings from low carbon construction low carbon concrete, low carbon steel and use of HVO instead of diesel calculated above (Implementing both Initiatives)

		RIIO-T3					
<i>Breakdown by source:</i>	Units	2027	2028	2029	2030	2031	T3 End Total
Average embodied CO2 per £m expenditure (new projects)	tCO2e / £m	54.59	54.59	54.59	54.59	54.59	54.59

Assumes a 42% further reduction from non costed initiatives

Total target embodied CO2 from new projects	tCO2e	4480.16	4480.16	4480.16	4480.16	4480.16	22400.81
Total Additional Cost Non-Load Project Spend		0.89	0.89	0.89	0.89	0.89	4.43
Total Cost Non-Load Project (£m	£82.07	£82.07	£82.07	£82.07	£82.07	£410.37

Assumes £274/tCO2e

		RIIO-T3					
		2027	2028	2029	2030	2031	Total
Total embodied CO2 from new projects avoided from our plan to procure for low carbon construction and provide incentives in our contracts	tCO2e	3234.67	3234.67	3234.67	3234.67	3234.67	16173.34

		RIIO-T3					
		2027	2028	2029	2030	2031	Total
Costs	£m	0.89	0.89	0.89	0.89	0.89	4.43

**EAP - Total Summary for Capital Carbon Reduction Plan
BCF with T3 Initiatives - Our plan Capital Carbon Strategy – Total**

		RIIO-T3					
		2027	2028	2029	2030	2031	Total avoided by end of T3
Total embodied CO2 from new projects avoided	tCO2e	4480.16	4480.16	4480.16	4480.16	4480.16	22400.81

		RIIO-T3					
		2027	2028	2029	2030	2031	Total Estimate Fund Value

Costs	£	1.13	1.13	1.13	1.13	1.13	5.67
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