



# Approach for Long-term Planning Accounting for Carbon Assessment

(ALPACA)

NIA Closedown Report

April 2023

**nationalgrid**

## Version Control

Issue	Date
Draft 1	27/02/2023
Draft 2	3/03/2023
Draft 3	30/03/2023
Final	28/04/2023

## Publication Control

Name	Role
Liza Troshka	Author
Ryan Huxtable	Reviewer
Jenny Woodruff	Approver

## Contact Details

For further information please contact:

**[nged.innovation@nationalgrid.co.uk](mailto:nged.innovation@nationalgrid.co.uk)**

## Postal

Innovation Team  
National Grid Electricity Distribution  
Pegasus Business Park  
Herald Way  
Castle Donington  
Derbyshire DE74 2TU

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# 1. Executive Summary

Approach for Long-term Planning Accounting for Carbon Assessment (ALPACA) project was a Network Innovation Allowance (NIA) funded project which commenced in January 2022 and finished within the following 15 months. While Distribution Network Operators (DNOs) currently report the carbon emissions relating to operational activities, there is significant carbon associated with the construction of infrastructure but without a standard framework to quantify this planners cannot compare the carbon impact of different options for construction. In RIIO-ED2 Ofgem also has puts additional emphasis on Scope 3<sup>1</sup> emissions and from April 2023 will require networks to identify most relevant Scope 3 emissions for the DNO networks and to increase coverage and quality of our annual Scope 3 emissions.

The main aim of the project was to develop a whole life carbon management framework underpinned by supporting tools which would allow Distribution Network Operators (DNOs) to baseline and make informed decision on most impactful carbon reduction activities on an individual project level. Special attention was given into understanding baselining of our Scope 3 emissions.

The key outputs of the project include:

- Whole Life Carbon Management Framework and calculation methodology report which outlines how the whole life carbon assessment should be implemented on a project level and a process map.
- Formal process of capturing carbon footprint of procured services/materials/ equipment/activities which includes considerations for procurement documentation by streamlining carbon reporting requirements and Supplier Carbon Calculator.
- Whole Life Carbon Measuring tool: a standalone Excel-based tool which allows a user to calculate a whole life carbon impact of a project through three main project development stages, including planning, detailed design and as built with an ultimate goal to consider and, where possible, realise carbon reduction potential.

The project was delivered in four sequential Work Packages (WP). These were:

- WP1: Completion of a literature review.
- WP2: Engagement with internal and external stakeholders.
- WP3: Development of a whole life carbon management framework and calculation methodology and supporting material.
- WP4: Development and testing of a whole life carbon measuring tool.

The project was delivered in collaboration with AECOM Ltd who provided an expertise in whole life carbon management and measuring and was responsible for delivery of all project outputs. The total project cost was £240,473.10.

The outputs of the project, namely material carbon database and Supplier Carbon Calculator, have been shared with ENA Carbon Working Group for consideration and potential adoption by all DNOs.

National Grid Electricity Distribution (NGED) ALPACA implementation includes wider testing of the tool on an entire licence area scale and integration of the tool within internal asset management system.

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<sup>1</sup> Scope 3 emissions are all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions (i.e. use of sold products).

## 2. Project Background

The infrastructure Carbon Review showed that infrastructure is associated with over half of UK greenhouse gas emissions, 30% of which are directly attributed to the construction, operation and maintenance of infrastructure assets (emissions that infrastructure has direct control of)<sup>2</sup>. During RIIO-1 National Grid Electricity Distribution (NGED) as a business has tracked and reported carbon footprint in terms of the impact of our operational activities on the environment<sup>3</sup> from:

- Office energy usage.
- Transport emissions (operational and business).
- Fuel combustion, and
- Release of greenhouse gases (SF6).

Positive results have been achieved to-date, specifically our business carbon footprint has been showing improvements year on year and overall reduction of 23%<sup>4</sup> since 2014/2015 (in compliance with our RIIO-ED1 targets).

The new RIIO-ED2 price control period and specifically annual environmental reporting requirements is now putting additional emphasis on Scope 3 emissions and require networks to identify most relevant Scope 3 emissions for the DNO networks and to increase coverage and quality of our annual Scope 3 emissions<sup>5</sup>.

Project ALPACA, therefore, has focused on developing a methodology, process and tool to measure and report carbon values on the various activities we deliver as a business with a whole life vision at heart.

ALPACA aimed to establish a whole life carbon vision across all relevant business units to enable NGED and other DNOs to accurately measure and report our carbon footprint and ultimately realise full carbon reduction potential through a fully integrated value chain by involving designers, constructors and product/material suppliers.

During the course of the project, the ENA Carbon Working Group was established and the outputs of the ALPACA projects are expected to lay a foundation to a DNO wide embodied carbon reporting.

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<sup>2</sup> <https://www.gov.uk/government/publications/infrastructure-carbon-review>

<sup>3</sup> In accordance with Ofgem Environmental Reporting guidance.

<sup>4</sup> This reduction figure excludes losses, more details in Environment and Innovation Ofgem Report 2018/2019 [www.westernpower.co.uk/downloads-view/65827](http://www.westernpower.co.uk/downloads-view/65827)

<sup>5</sup> [riio-2 environmental reporting guidance v 1 final.pdf](#)

### 3. Scope and Objectives

ALPACA's aim was to develop a whole life carbon management framework and accompanying tools to ensure a DNO can have a solid understanding of a carbon footprint of our activities including establishing a baseline for our embodied carbon.

The scope of works have included an extensive literature review of existing processes and tools that could have been applicable in a DNO context for carbon reporting. An internal and external stakeholder engagement was also completed as part of the project activities. The ENA Environment Committee and ENA Carbon Working Groups for DNOs were consulted at the beginning of the project and regular catch-ups with the chair of the latter group were carried out. Engagement with the British Electrotechnical and Allied Manufacturers' Association (BEAMA) supplier group was also performed to test a carbon supplier tool with some feedback provided. Combining the outputs of literature review and stakeholder engagement, a whole life carbon management methodology, presenting the structure and underlying calculation methodology for the reporting tool and carbon databases, were prepared. On the basis of the aforementioned methodology a whole life carbon management tool was developed in a standalone Excel format, enabling NGED users to calculate whole life carbon emission at a project level at key design stages: planning, detailed design and as built.

Table 3-1 below presents the original project objectives and their status

**Table 3-1: Status of project objectives**

<b>Objective</b>	<b>Status</b>
Whole life carbon management and measuring methodology developed	✓
Whole life carbon measuring tool developed	✓
Formal process of capturing carbon footprint of procured services/materials/equipment/activities finalised and approved	✓

## 4. Success Criteria

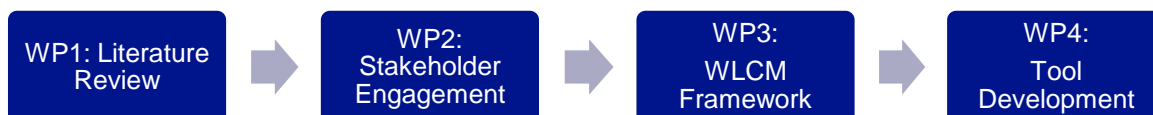
The success criteria for ALPACA are given in the table below. An explanation for the assessed status is given in Section 6 (Performance Compared to Original Aims, Objectives).

**Table 4-1: Status of project success criteria**

<b>Success Criteria</b>	<b>Status</b>
Whole Life Carbon Management Framework/methodology for application in a power distribution sector is developed and verified	✓
Sufficient guidance and methodology is developed for integrating of the framework into business as usual	✓
Fully functioning whole life carbon measuring tool is developed and trialled	✓

## 5. Details of the Work Carried Out

Figure 1 presents the tasks undertaken as part of the project. Work was carried out in line with the original scope with minor modifications made to the planned approach as detailed in Section 7. The key activities and deliverables of each task are summarised in the sub-sections below.



**WP1: Literature Review:** The literature review was a desk-based activity completed by the AECOM project team. The report summarises the external requirements (existing Government legislation, regulations and policy) and ambitions around the power sector decarbonisation targets. It also outlines best practices in terms of the standards and specifications governing carbon accounting and reporting, as well as existing whole-life carbon reporting tools and emission factor data sets available.

The review concluded that there were no readily available carbon emission factor data sets available for adoption by DNOs and the work progressed to develop missing carbon factors.

**WP 2: Stakeholder Engagement:** Stakeholder engagement was conducted over a 4-month period, through a series of one-to-one meetings and workshops. Through this engagement the project team developed an understanding of the existing processes with NGED within project design and individual requirements for the tool. Internal teams engaged included Environment, Major Projects, Network Services, Primary System Design, Engineering Design, Procurement, Senior Management, Policy, Data and Digitalisation, Innovation and Regulatory.

In addition to engaging with internal stakeholders, the project team attended an ENA workshop (March 2022) to brief the wider DNOs on the project and seek broader understanding of DNO activity applicable to the project. Regular engagement with a chair of an ENA Carbon Working Group for DNOs was also part of the project activities. BEAMA<sup>6</sup> association was also consulted for the feedback on the Supplier Carbon Calculator which is aimed to allow our supply chain to report their carbon figures to DNOs in a consistent manner (Figure 1).

nationalgrid	Supplier Carbon Calculator - Products					Nov-22
National Grid Contract number						v2.0
National Grid Contract name						
Supplier name						
Product name						
Type (if applicable)						
Units of production						
If "Other" please specify						
Size (if applicable)						
Year of manufacture						
Country of origin						
Inputs used per						
	Input	Activity data	Units	Confidence grade	Embodied Carbon (kg CO <sub>2</sub> e)	User comments (optional)
	Grid electricity		kWh			
	Mains water		m <sup>3</sup>			
	Waste water		m <sup>3</sup>			
	Material 1					
	Material 2					
	Material 3					
	Material 4					
	Material 5					
	Material 6					
	Other materials 1					
	Other materials 2					
	Other materials 3					
	Fuel 1					

<sup>6</sup> BEAMA is the UK trade association for manufacturers and providers of energy infrastructure technologies and systems.



Figure 1 Snapshot of the Supplier Carbon Tool

**WP 3: WLCM Guidance and Methodology:** Combining the outputs from WP1 and WP2, the project team developed a WLCM methodology, presenting the structure and underlying calculation methodology for the reporting tool and carbon database, as well as an understanding to how reporting can be integrated into NGED’s existing project processes. The whole-life carbon calculation methodology, which is aligned with GHG Protocol and the Defra emission factors guidance, follows the modular structure outlined in the PAS 2080 guidance, as shown in Figure 2.

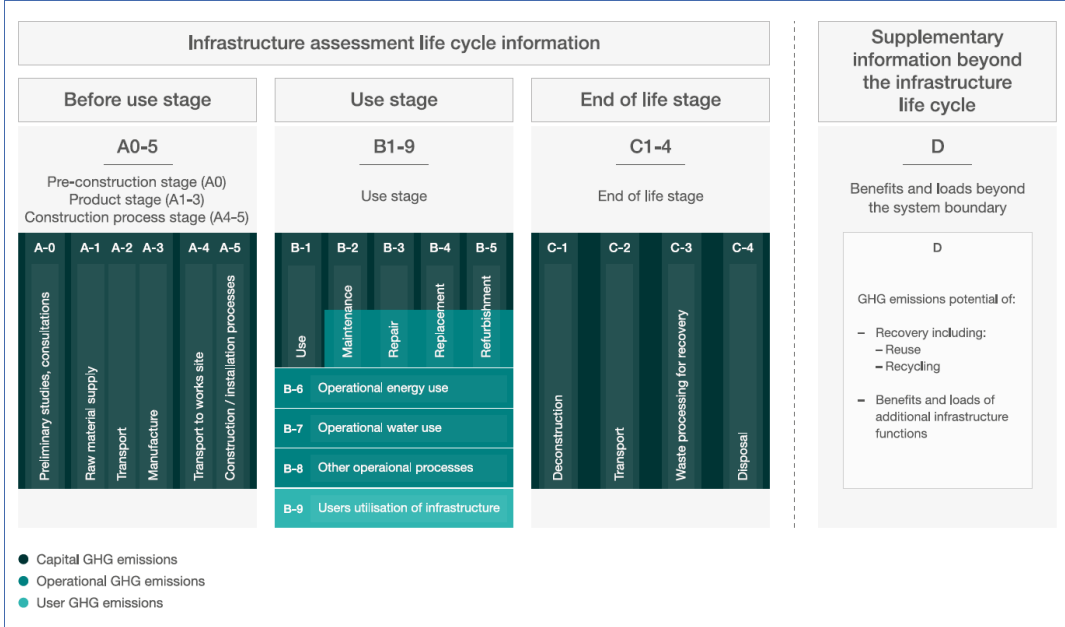
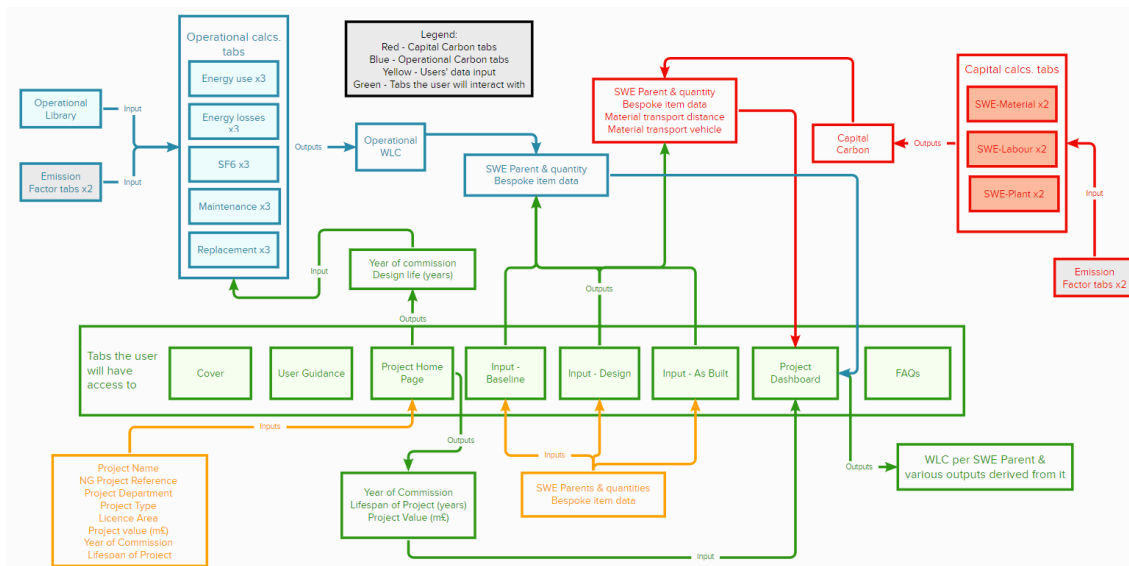


Figure 2 PAS 2080 modular approach showing the life cycle stages and individual modules for infrastructure carbon emission quantification

Further detail on the calculation methodology, input data and outputs are provided in the Whole Life Carbon Framework document available here: [National Grid - Approach for Long-term Planning accounting for Carbon Assessment \(ALPACA\)](#).

**WP4: Tool Development:** The tool has been developed in Excel, enabling users to calculate whole life carbon emissions at a project level at key design stages: planning, detailed design and as built. The tool has a project level dashboard and is supported by a PowerBi dashboard enabling NGED to collectively report on projects.

Refer to Figure 3 for full detail on the data flow and calculation within the tool.



*Figure 3 Whole life carbon tool data flows, including inputs and outputs of each tab*

The key part of the whole life carbon management tool development was population of carbon emission factor databases which are based on the standard work elements (SWE) extracted from NGED asset management system (CROWN). The following databases are the foundation of the tool that allows the calculations to be performed:

- Material carbon emissions database
- Plant usage carbon emissions database
- Labour carbon emissions database
- Operational carbon emission database

Assumptions applied and resources used for the population of the abovementioned databases are captured within accompanying material.

## 6. Performance Compared to Original Aims, Objectives and Success Criteria

**Table 6-1: Performance compared to project objectives**

Objective	Status	Performance
Whole life carbon management and measuring methodology developed	Complete	<p>The initial project activities were aiming to identify whether the whole life carbon methodology and suitable carbon emission factors are readily available. Through project activities and engagement with wider industry PAS 2080 was confirmed as the best structure for the whole life carbon measuring methodology. There were no directly applicable carbon emission databases for DNOs and therefore, the ALPACA project focused on developing suitable databases to allow whole life carbon measuring calculations.</p> <p>Literature review has summarised the key findings of the initial research and was supplemented by the Whole Life Carbon Framework which detailed underlying calculation methodology behind the reporting tool and carbon database being developed. Both documents available on the ALPACA webpage: <a href="#">National Grid - Approach for Long-term Planning accounting for Carbon Assessment (ALPACA)</a></p>
Whole life carbon measuring tool developed	Complete	<p>A number of considerations were given into the format and integration of the tool with business activities. During the stakeholder engagement sessions it was determined that there are three key project stages that the carbon reduction can be realised: planning, detailed design and as built stages; and therefore, the tool implemented this approach. Integration of the whole life carbon impact into existing asset management system along with costing elements was identified as the most useful business integration solution, however, due to the short timeframe of the project and complexity of the existing asset management system it was deemed unachievable during the project timeline. An Excel based solution was developed as an alternative solution.</p> <p>Further information about NGED whole life carbon management tool is available upon request.</p>
Formal process of capturing carbon footprint of procured services/materials/equipment/activities finalised and approved	Complete	<p>Accuracy of whole life carbon assessment is heavily reliant on the accuracy of Scope 3 figures which are expected to be made available by supply chain. To allow consistent approach for our supply chain in reporting to us a supplier carbon tool was developed. It is a stand along Excel-based tool which has been shared with ENA Carbon Working group chair for potential wider industry adoption.</p> <p>Considerations were given into streamlining the net-zero vision among our suppliers. A series of questions to assess the current and future ability of our suppliers to actively support net-zero transition were drafted separately for large organisation and SMEs for integration to tender documentation.</p>

**Table 6-2: Status of project success criteria**

<b>Success Criteria</b>	<b>Achieved</b>	<b>Performance</b>
Whole Life Carbon Management methodology for application in a power distribution sector is developed and verified	Yes	As discussed above, the development of a whole life carbon management and measuring approach was developed in a highly collaborative manner, including views of internal and external stakeholders. The whole life carbon framework and methodology was shared with relevant internal teams and SPEN who is a project partner with their representative heading up ENA Carbon Working group for DNOs.
Sufficient guidance and methodology is developed for integrating of the framework into business as usual	Yes	Following extensive stakeholder engagement three defining stages for project carbon assessment were identified: planning, detailed design and as built and this is reflected within the structure and functionality of the whole life carbon measuring tool. Additional tools, such as supplier carbon tool and supplier engagement questionnaires, were developed to ensure consistent and as accurate as possible reporting.
Fully functioning whole life carbon measuring tool is developed and trialled	Yes	The whole life carbon tool was developed in staged and tested out internally for functionality, performance and outputs. The final product was developed as a standalone Excel-based solution which poses some challenges regarding version control and keeping embedded databases up to date.  PowerBI dashboard has been developed to allow streamlined data gathering and ease the reporting.

## 7. Required Modifications to the Planned Approach during the Course of the Project

ALPACA was carried out in line with the original scope of works with minor modification as detailed below:

- During the stakeholder engagement it was decided to hold a combination of one-to-one and workshop style sessions due to availability of stakeholders and time constraints of the project.
- Additional engagement sessions were scheduled with external stakeholders (relevant ENA working groups and BEAMA) to ensure their views were fed into the final products.
- Even though the project didn't specify the format of the final product (i.e. whole life carbon measuring tool), an integrated solution within asset management system would have been the best option due to 1) integration with internal costing tool; 2) easier methods of version control and carbon database management; and 3) saving of time for individuals required to make the assessment. However, due to time constraints and resource unavailability, the decision was made to develop a stand-alone Excel-based tool. There are some benefits to an Excel-based solutions in that it is easier to share with other networks. Also, supporting whole life carbon measuring methodology and the tool's specification document provide sufficient detail shall other network want to recreate the tool's functionality.

## 8. Project Costs

**Table 8-1: Project Spend**

	<b>Budget (£)</b>	<b>Actual (£)</b>	<b>Variance(£)</b>
AECOM ltd	£178,000	£178,000	£0
SPEN (partner contribution time in-kind)	£6,899.10	£6,899.10	£0
NGED Project Management	£34,340	£55,574	£21,234
<b>Total before contingency</b>	<b>£219,239.10</b>	<b>£240,473.10</b>	<b>£21,234</b>
Contingency	£21,234	Included in actuals £21,234	Remaining £0
<b>Total</b>	<b>£240,473.10</b>	<b>£240,473.10</b>	<b>£0</b>

The contingency released to ensure sufficient project management time was allocated to facilitate additional stakeholder engagement, testing of the tools and dissemination.

## 9. Lessons Learnt for Future Projects and outcomes

The leaning from the ALPACA project has been captured and shared in a variety of ways as follows:

- 1) Carbon Accounting and Management in Infrastructure – Literature review<sup>7</sup> detailing current and available information, guidance and legislation surrounding carbon accounting in infrastructure, standard emission factor data sets and existing whole-life carbon reporting tools.
- 2) Internal and external stakeholder engagement report detailing ambition and requirements for whole life project carbon reporting; process flow and key data requirements. Briefing packs for all stakeholder groups accompany the report.
- 3) Whole Life Carbon Framework report which includes information about carbon reporting requirements, the structure and underlying calculation methodology behind the reporting tool, as well as how whole life carbon reporting can be integrated into NGED's existing processes at a project level
- 4) NGED' Supplier Carbon Calculator that allows assessment and management of carbon emissions resulting from our purchased goods and services. The tool is accompanied by procurement questionnaires which are recommended for embedment into ITT documentation.
- 5) Whole Life Carbon Assessment tool designed to allow for the carbon footprint of NGED projects to be calculated; this covers planning and design stages, construction, operation and maintenance of assets throughout of their lifetime. The functionality of the tool is underpinned by four carbon emission databases for materials, labour, plant and operations which form the basis of the tool and allow for whole life carbon calculation on a project level. The tool is accompanied by the tool's specification document and a user guidance.

Learning from the project undertaking is presented in Table 9-1

Work Package	Learning Detail
WP1	Literature review identified a number of existing carbon tools which were generally specific to different sectors. An initial consideration was given to an approach of combining existing tools to allow whole life carbon reporting for DNOs. But identified tools were compliant with different standards and used different databases with varying level of data quality standards which would make carbon reporting inconsistent and incompatible.
WP1-2	During the literature review (WP2) and then verified and confirmed with ENA Environmental Committee it was agreed that PAS 2080 would be the best whole life carbon reporting framework to follow. Some transmission networks use PAS2080 structure for their capital carbon reporting already and therefore, the vast majority of ENA Environmental Committee members agreed that PAS2080 is the right framework to base the assessment on.
WP2	Energy transmission companies (NGET, SPEN and SSEN transmission) have formed a collaborative group called UK ROCCIT (Reduction of Capital Carbon in Infrastructure: Transmission) in order to address and manage the capital carbon emissions associated with developing and maintaining their

<sup>7</sup> [www.nationalgrid.co.uk/downloads-view-reciteme/626428](http://www.nationalgrid.co.uk/downloads-view-reciteme/626428)

Work Package	Learning Detail
	network. During ENA Environmental Committee engagement exercise it was highlighted that carbon management approach developed during ALPACA project should take into consideration work done as part of ROCCIT. There is a potential that some carbon emission factors and life cycle stages can be unified within both transmission and distribution.
WP2	As part of the ROCCIT effort the UK Transmission Operator Carbon Product calculator has been developed to consistently collaborate with supply chain. The calculator allows suppliers to quantify the carbon emissions associated with the transmission losses, and the manufacture and supply of electrical equipment used within the UK Transmission Network. The tool relies on a supplier to fill in detail correctly and doesn't require to indicate confidence level. This has been taken into account and ALPACA Supplier Carbon Calculator for DNOs provides a functionality for a supplier to indicate the level of confidence of their inputs. It also allows to provide figures separately for procured material/equipment and services.
WP3	During the discussion regarding sustainable procurement protocol it was highlighted that different suppliers (especially depending on their size and resource availability) may be at different level of their net-zero preparedness. Therefore, it was agreed to adopt tiered approach with the following defined tiers: SMEs and large organisations. Large organisations (to be defined by DNOs individually) would face more strict commitment requirements initially but all requirements should align at a later stage.
WP4	The best solution for whole-life carbon calculation/reporting is integration into existing asset management systems and costing tools so that easy comparison between carbon and cost on a project level is provided. It was impossible to implement during ALPACA project timeframes however is considered for implementation post completion.
WP4	ALPACA whole life carbon tool is based carbon emission factors assigned to each individual standard work elements as defined in CROWN (NGED's internal asset management system) and therefore, provides the highest granularity level.
WP4	To be able to populate material, labour, plant use and operation carbon databases a list of assumptions have been made and needs to be reviewed and potentially updated when 'real' data from suppliers become available. Assumptions are available on request.
WP4	The best source of capital carbon data (especially associated with electrical equipment) are environmental product declarations (EPDs), which were limited at the time of database development. Regular review of new EPDs should be part of the whole life carbon tool update.
WP4	NGED does not make commitment for carbon emissions associated with network losses reduction due to complexity of calculations. ALPACA tool includes network losses carbon figure based on assumptions.
WP4	ALPACA whole life carbon tool exclude end of life stage (C1 to C4 as per PAS 2080) as most of the assets have a lifespan in excess of 60 years and it is challenging to accurately estimate the future decommissioning impacts.



## 10. The Outcomes of the Project

The outcomes of the report are as follows:

- Fully functioning whole life carbon measuring tool is developed and tested (small scale) internally by NGED with plans in place to test it on one licence area scale. Once the testing is complete and required modification implemented (if required), further considerations will be given into best approach for wider BAU roll-out.
- This whole life carbon measuring tool allows carbon calculations to be performed through three phases of the project development: planning, detailed design and as built so that full carbon reduction potential is considered and realised.
- Accompanying material such as Supplier Carbon Calculator and Procurement questionnaires developed to enable data input and engagement with suppliers.
- On the basis on NGED material database, a DNO-wide database is developed and shared with ENA Carbon Working Group (for DNOs) for consideration and use by all distribution networks.
- The final deliverable (whole life carbon measuring tool) is now TRL 7.
- ALPACA project have created very detailed carbon emissions databases for various DNOs material/activities on the basis of NGED standard work elements with a recommendation for the database and carbon calculation to be integrated into internal asset management system.

## 11.Data Access Details

The data generated through this project is available on ALAPACA Innovation webpage:

[National Grid - Approach for Long-term Planning accounting for Carbon Assessment \(ALPACA\)](#)

Some of the material including whole life carbon reporting tool is not publicly available, however, further information can be requested by submitting a request on the website.

## 12. Foreground IPR

The foreground IPR for the following material/product is developed through ALPACA project:

- Whole life carbon management framework and Supplier Carbon Calculator (Excel-based).
- NGED whole life carbon measuring tool and embedded carbon emission databases (Excel-based).

### **13. Planned Implementation**

The current version of the products and tools developed through ALPACA project will be initially tested within one licence area to fully establish practicalities of data handling and potential limitations of the tool (i.e. data gaps). Following the internal trial considerations will be given into best option for rolling the tools out to wider business. On the basis of resource availability and internal requirements, integration of the ALPACA carbon emission databases within NGED asset management system is recommended.

Material carbon emission factors is shared with ENA Carbon Working Group (for DNO) for potential industry adopted by all DNOs.

## **14. Contact**

Further details on this project can be made available from the following points of contact:

[nged.innovation@nationalgrid.co.uk](mailto:nged.innovation@nationalgrid.co.uk)

### **Innovation Team**

National Grid  
Pegasus Business Park,  
Herald Way,  
Castle Donington,  
Derbyshire  
DE74 2TU

## 15. Glossary

Abbreviation	Term
ALPACA	Approach for Long-term Planning Accounting for Carbon Assessment
BEAMA	British Electrotechnical and Allied Manufacturers' Association
DNO	Distribution System Operator
DEFRA	Department for Environment, Food & Rural Affairs
ENA	Energy Network Association
EPD	Environment Product Declaration
GHG	Greenhouse Gases
NIA	Network Innovation Allowance
NGED	National Grid Electricity Distribution
RIIO	Revenue = Incentives + Innovation + Outputs
SPEN	Scottish Power Energy Networks
TRL	Technology Readiness Level
SWE	Standard Work Element
WP	Work Package
WLCM	Whole Life Carbon Management
UK ROCCIT	UK Reduction of Capital Carbon in Infrastructure

