RICA Project

Project Progress Report (PPR)

December 2021

nationalgrid

Executive summary

The Retrofit Insulated Cross Arm (RICA) Project commenced in December 2020, funded via Network Innovation Competition (NIC) reference NGEN05/V1, with a completion date of March 2026.

The aim of the RICA Project is to develop a novel method to upgrade the voltage rating of existing 275kV Overhead Line (OHL) towers on the routes across GB to operate at 400kV by replacing the metallic cross arms with insulated cross arms (ICA) or Retrofit ICAs (RICAs) solution achieving increased clearance to earth and hence operating voltage. .

The project will accelerate a lower carbon future by allowing quicker removal of network constraints, resulting in earlier connection of renewable generation.

The solution will allow an increase of the overhead line rating by over 45% with minimal construction activities and deliver faster increase of the network capacity access when compared to a new build.

RICA also provides the potential for cost savings and better visual amenity compared with conventional investment options.

This project will provide a pathway for the GB's first full-scale implementation of RICA technology, by mitigating technology risks and accelerating its adoption onto transmission investment schemes. The project will remove the current process, technology, and specification hurdles that have prevented licensees from adopting RICA as Business as Usual (BaU) previously.

The Project has adhered to the relevant governance and met the milestones and deliverables within the Project Plan, with the exception, of the Contract Award (CA) to the successful partner\consortium. The two-month delay (December 2021 to February 2022) in CA to the successful "partnership\consortium" has also had a subsequent effect on the lower expected budget spend in 2021. Both the delay and expenditure will be recovered through acceleration of works in 2022 when the Research and Development (R&D) partner to deliver the RICA solution is selected.

Two packages of work have been delivered as per the Project Program.

D.S1.1 – Detailed requirement definition

The deliverable comprises a set of reports with all the information required for potential suppliers to accurately gauge the level of work that will be involved in developing full scale RICA solution in Stage 2 of the project.

D.S1.2 – Preliminary investment case

The Preliminary investment case demonstrated that RICA solution can deliver benefits on the selected route allowing the project to pass the "Gate1: Valid investment case, ready to procure supplier"

The RICA risk register has been reviewed and appropriate "controls" included in the tender process. No additional risks have been identified at the time of reporting.

During this reporting period Stakeholder communications have been conducted through regular Technical Advisory Board (TAB) meetings, conferences, a dedicated website and in relevant technical articles.

No risks to the delivery of the RICA Project are envisaged in the forthcoming reporting period, 2022.

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Project managers summary

RICAs offer several benefits such as the compaction of transmission line dimensions which minimises the right-of-way requirement, reduces visual impact and electromagnetic radiation at ground level. More importantly, RICAs allow the uprating of existing overhead transmission lines to higher voltages improving their power transfer capabilities and therefore reducing the costs, disruption, and environmental impact associated with the erection of new lines. The summary principals and advantages are shown graphically, below in Figure 1.

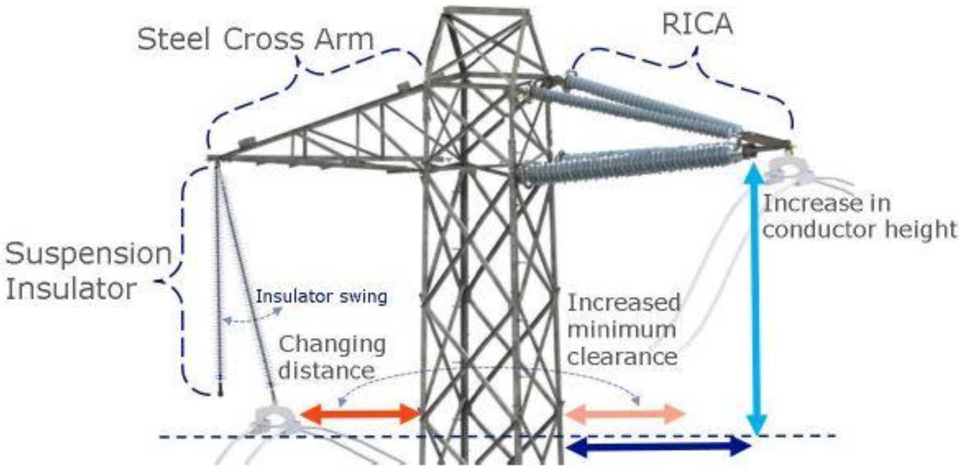


Figure 1 Summary of RICA concept

The initial focus of the RICA Project is aimed at uprating from 275 to 400kV, the L3 and L66 suite of OHL constructed routes, of which NG has 1135 towers ranging in age of construction from 1954 to 1976. Shortlisted RICA routes are shown on the map below, in Figure 2.

Figure 2 Shortlisted RICA Routes

A dedicated National Grid (NG) RICA project manager was appointed on the 1 June 2021.

The Project has adhered to the relevant governance and met the milestones within the Project Plan, thus far, with the exception of CA. The delay in the CA by two months, is currently not deemed critical and without financial implication. The project team is confident that this time delay will be able to be recovered over the duration of the Project. The delay was primarily caused by contractual Terms and Conditions (T&Cs) negotiations.

Significant effort has been directed at the selection of a R&D partner, proportionate for a Project of this monetary value and time frame. Further "value for money" and "effective and robust" contractual conditions are required from the outset of the Project, leading to delivery of a satisfactory OHL Route "end to end" solution.

Technical Questions (TQ) and Additional Detailed Questions (ADQ) have been raised in accordance with NG internal policy, procurement, and tender processes and in line with governance. At the time of this report ADQ are being answered and addressed as part of the Contract Award (CA) process. Significant technical input has been provided in support of the Procurement R&D partner selection and CA process.

Two Technical Advisory Board (TAB) Meetings have been held in 2020, the inaugural kick off meeting on the 23 February 2021 and the Second meeting on 19 July 2021 where project deliverables (D.S1.1 and D.s1.2) were discussed and approved. Organisations that make up the TAB members are shown below in Figure 3.

Figure 3 Technical Advisory Board Members

Additional Project Communication, Representation and Stakeholder Engagement has been conducted through presentations at the Energy Networks Innovation Conference (ENIC) in October 2021, a standalone NG RICA website.

Significant effort has been undertaken to prepare for RICA testing at the NGET Deeside Centre for Innovation (DCI). These preparations are important to fully understand the risks and requirements for RICA technology. The developed testing plan goes beyond standard NG Asset Design and Development (ADD) and Type Registration processes used for conventional technologies.

Deliverables

D.S1.1 Detailed requirement definition

The deliverable comprises a set reports with all the information required for potential suppliers to accurately gauge the level of work that will be involved developing a full-scale RICA solution in Stage 2 of the project.

The reports were presented and discussed with other GB licensees over a number of development sessions and TAB meeting in July 2021.

The report included the following work packages (WP).

WP1 - Literature Review

The report summarises the existing literature on ICA technology for both new built and retrofitting existing transmission lines, with emphasis on the latter. The report listed where ICA technology has been successfully used for uprating as well as for compaction of transmission lines. Case studies from around the world are presented demonstrating the application of ICAs on conventional lattice structures, monopoles and other non-conventional arrangements.

WP2 - Standards and Specifications:

The report reviews a set of National Grid Technical Specifications and international standards to identify issues and gaps that may need to be addressed when developing the functional specification prior to Business as Usual (BaU) adoption of RICA on the NGET and other GB Networks.

A high-level review of the National Grid Technical Specifications is initially carried out before a more detailed analysis is performed on several specific documents that are likely to need specific application guidance to be included in the functional specification.

WP3 - Design Considerations

The report presents currently known design issues and design related considerations associated with the introduction of RICA equipment on the existing towers. This knowledge base is from smaller related feasibility projects looking at different aspects of RICA technology.

WP4 - Asset Design and Development (ADD)

The report lists the requirements for demonstration of the long-term safe and reliable operation of the proposed RICA solution through testing. Also the report provides insight into the full range of implications associated with the introduction of RICAs on the NG Network.

WP5 – Interim Functional Specification

The report provides an initial functional specification that outlines all RICA specific requirements that are not covered within existing NG Technical Specifications. This initial functional specification provides the fundamental information required to set requirements for future RICA design works and selection of the R&D partner. This document will be superseded by a new more detailed Technical Specification that will be produced as a deliverable during the project, scheduled for September 2022.

D.S1.2 – Preliminary investment case

The Preliminary investment case demonstrated that RICA solution can deliver benefits on the selected route allowing the project to pass the “Gate1: Valid investment case, ready to procure supplier”

The initial investment case produced, had to make various assumptions for unknown parameters. Examples of these assumptions and unknowns are the final cost of a RICA unit per phase or tower, conductor system to be utilised and additional tower steel work required for strengthening. The preparation of this Initial Investment Case forms part of the dynamic investment case to be added and developed as the project progresses and detailed costs are understood.

All of the assumptions will be reviewed over the course of the project and the final investment case (D.S2b.2) will be delivered in February 2025.

To reach the highest level of the results accuracy the investment case was developed against a real project, the Yorkshire GREEN project. The investment case assessment considers the implications of using RICA to uprate the existing 275kV line from Poppleton to Monk Fryton to 400kV. The results demonstrate the costs, benefits, programme, planning considerations and other aspects of implementing RICA on a real project.

Where quantitative data is not yet available, the RICA option is qualitatively compared to the option that was selected for the Yorkshire GREEN project.

Figure 4, Shows the Monk Fryston to Poppleton OHL Route.

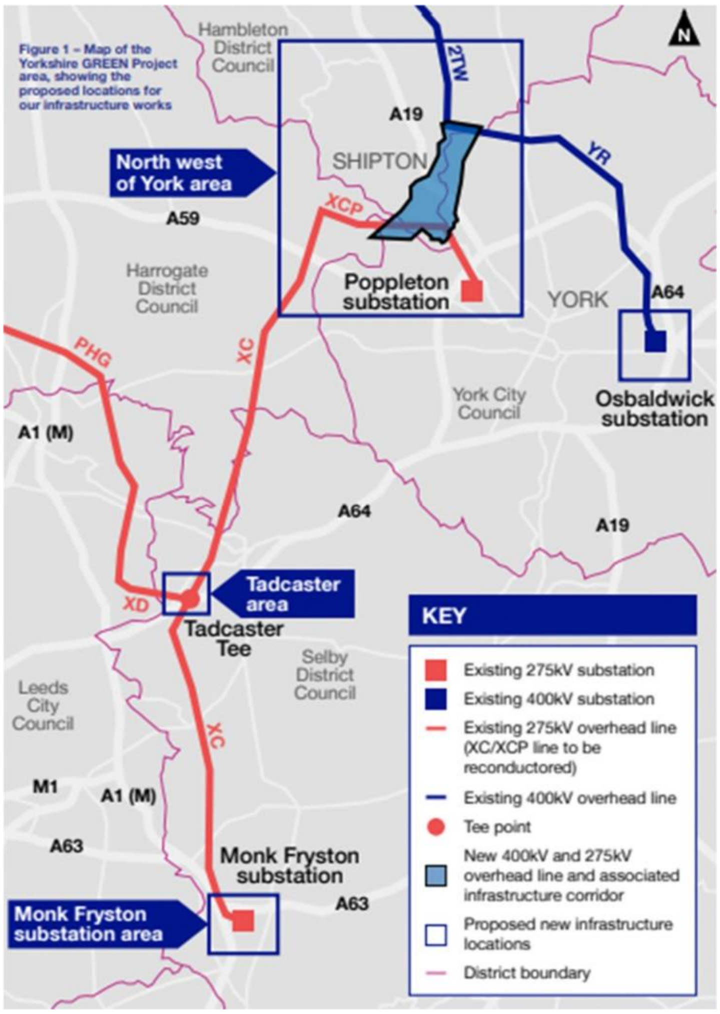


Figure 4 The Monk Fryston to Poppleton OHL Route

Project Risks

There are currently no foreseen major risks or challenges to the RICA Project outside of the identified in the risk register.

Business case update

In addition to the cases listed in the FSP document, applications of RICA in Visual Improvement Provision (VIP) projects have been explored.

An initial VIP feasibility study has been undertaken to examine two specific sections of an L2 constructed overhead line route running through an Area of Outstanding Natural Beauty (AONB), with a view to reduce tower height and hence reduce visual impact. The study revealed that in principal a reduction of crossarm height of 3.32 metres (approx.8% of tower height) was achievable without re-stringing conductors, however the earthwire shielding angle requires further engineering design for a reliable solution.

Currently there are no clearly defined financial implications on the business case from RICA use in VIP schemes as the feasibility study only covered the technical aspects of the solution. Further discussions will be undertaken with stakeholders to understand effects on the project benefit case.

Progress against plan

Overall, the project is progressing on plan and to budget, with the exception of the afore mentioned two months, CA delay and lower spend impact, to be recovered in 2022.

The risk register has been reviewed and there are no foreseen risks, other than those already identified, in this reporting period.

Key activities in the next reporting period are:

Contract Award to the successful R&D partner. The expected R&D partner partnership is expected to include an insulator manufacturer and OHL contractor.

In order to ensure an efficient RICA design solution, a wider project team working group will be formed to manage the wider technical issues of a functional specification to include R&D partner members and NG Design Assurance, Asset Operations, Safety and Health and Quality Assurance with specialist additional Operational OHL experience. In addition, relevant inputs from TAB members will be required to maximise opportunity or roll-out RICA across other GB Networks.

Building on the work conducted for detailed requirement definition (D.S1.1) and with the R&D partners input a more detailed Draft functional specification (D.S2a.1) in September 2022will be delivered.

This revised functional specification will also be the subject of monthly workshops with stakeholders to incorporate feedback into specifications and disseminated through the TAB and other relevant media, e.g. industrial conferences.

Building on the work conducted for detailed requirement definition (D.S1.1) and with the R&D partners input an overall end to end OHL route RICA design is to be defined ,D.S2a.2 – First generation product design portfolio to be delivered in December 2022.

These first-generation RICA designs will help to address not only the ICA elements but the overall engineering aspects such as tower load, earthwire shielding angle etc, as well as installation, maintenance and repair techniques.

These designs and procedures will be fully costed, to enable a more accurate investment case.

A series of workshops with stakeholders to review impact of different design choices on investments and applications will be organised.

The results will be disseminated through TAB.

The overall project plan is shown in Appendix 1

Progress against budget

Cost Category	Total Project Budget (£k)	Year Spend to Date (£k)
Labour	1,411,099	251,764
Equipment	906,871	64,717
Contractors	4,458,214	125,882
IT	-	-
IPR	201,949	-
Travel and Expenses	46,899	-
Payments to users	-	-
Contingency	1,819,884	-
Decommissioning	288,494	-
Other	-	-
TOTAL	9,133,410	442,363

Project bank account

Project bank account statement is provided separately to Ofgem

Project deliverables

Upon Contract Award a significant amount of effort is expected to be directed at both the revisions to the technical specification (D.S2a1 September 2022) and also the development of the first generation product design (D.S2a.2 December 2022), by both the successful R&D partner and their subcontractors (as applicable) and the NG Project team.

The R&D partner is required to produce a project plan, addressing the aims, risks, and other associated issues with clear deliverables identified.

In order to prove and develop both the design and functional specification, a testing regime for proposed components will also be developed.

To ensure an efficient RICA design solution, a wider project team working group will be formed to manage the wider technical issues of a functional specification to include R&D partner members and NG Design Assurance, Asset Operations, Safety and Health and Quality Assurance with specialist additional Operational OHL experience. In addition, to input from TAB members as required.

With a R&D partner selected, the condition of proposed OHL routes can further be developed to ensure the addition of RICA will not impact on their integrity.

An early resolution to the earthwire shielding angle needs to be found, as engineering solutions may have independent Asset Design and Development implications.

These first-generation RICA designs must be complemented with installation and maintenance procedures and cost elements are understood.

Learning outcomes

The deliverable DS1.1 identified the gaps in NGET, National and International Standards when considering RICA technologies. Given the timescale available for the project, it is not feasible to expect technical standards (particularly those that are international / national) to be changed to accommodate insulating cross-arms.

While there are no National and International Standards for RICA available, internal National Grid Technical Specifications could be updated to manage, the risks of adopting new technology. It is certain that there will be significant knowledge generated during the RICA project that will support the development of the National and International Standards.

One of the learning points identified is that of the earthwire placement and modifications to maintain the shielding angle. This was highlighted in both DS1.1 and the VIP application feasibility study. Correct placement of the earthwire is very important for the reliability and availability of the route minimising temporary trips caused by lightning strikes and possible longer outage periods.

Despite challenges associated with RICA implementation on the network and required engineering solutions TAB discussions, the engagement during ENIC conference and with internal NGET stakeholders reinforced the need and demand for uprating techniques such as RICA on the GB Network.

Figure 5 illustrates key technology gaps to be addressed within the project.

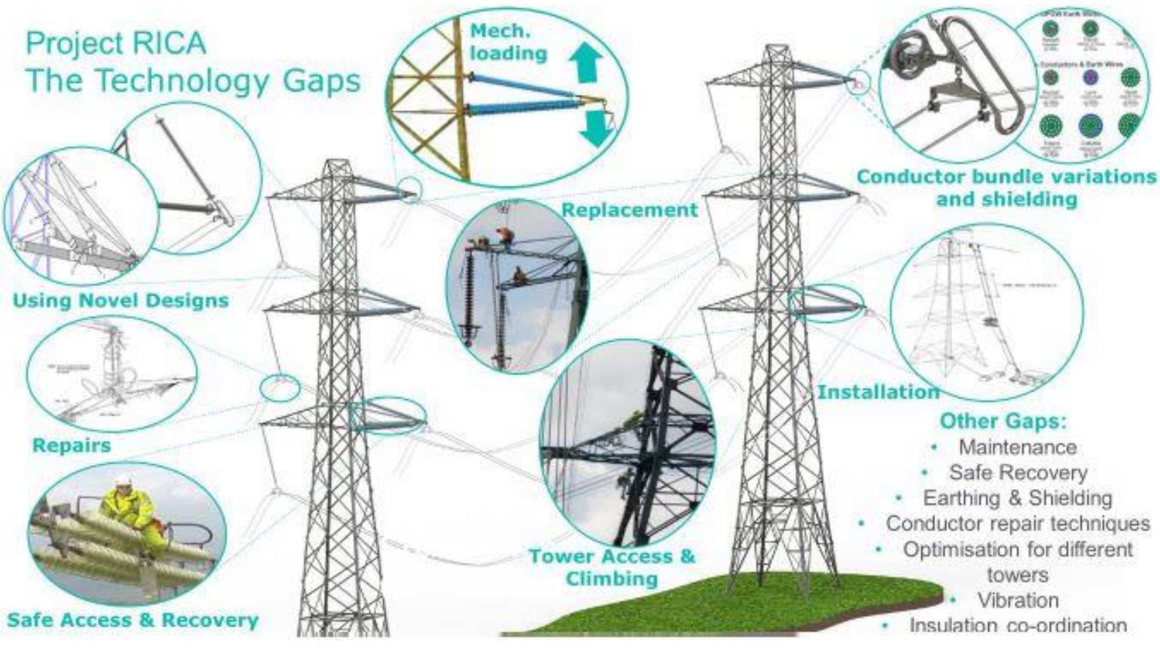


Figure 5 Summary of Technology Gaps

IPR

Beyond the standard ownership of reports and project documentation no relevant IPR has been generated or registered during this reporting period.

Risk register

The current FSP, risk register has been reviewed and found to be adequate for the project thus far and going into the next reporting period (Appendix 2). As part of the CA Process the successful R&D partner, will produce a risk register for its activities to deliver RICA technology.

Once a R&D partner has been selected, the project risk register will again be updated after review of the R&D partner's processes and delivery plan with potential impact on the overall project.

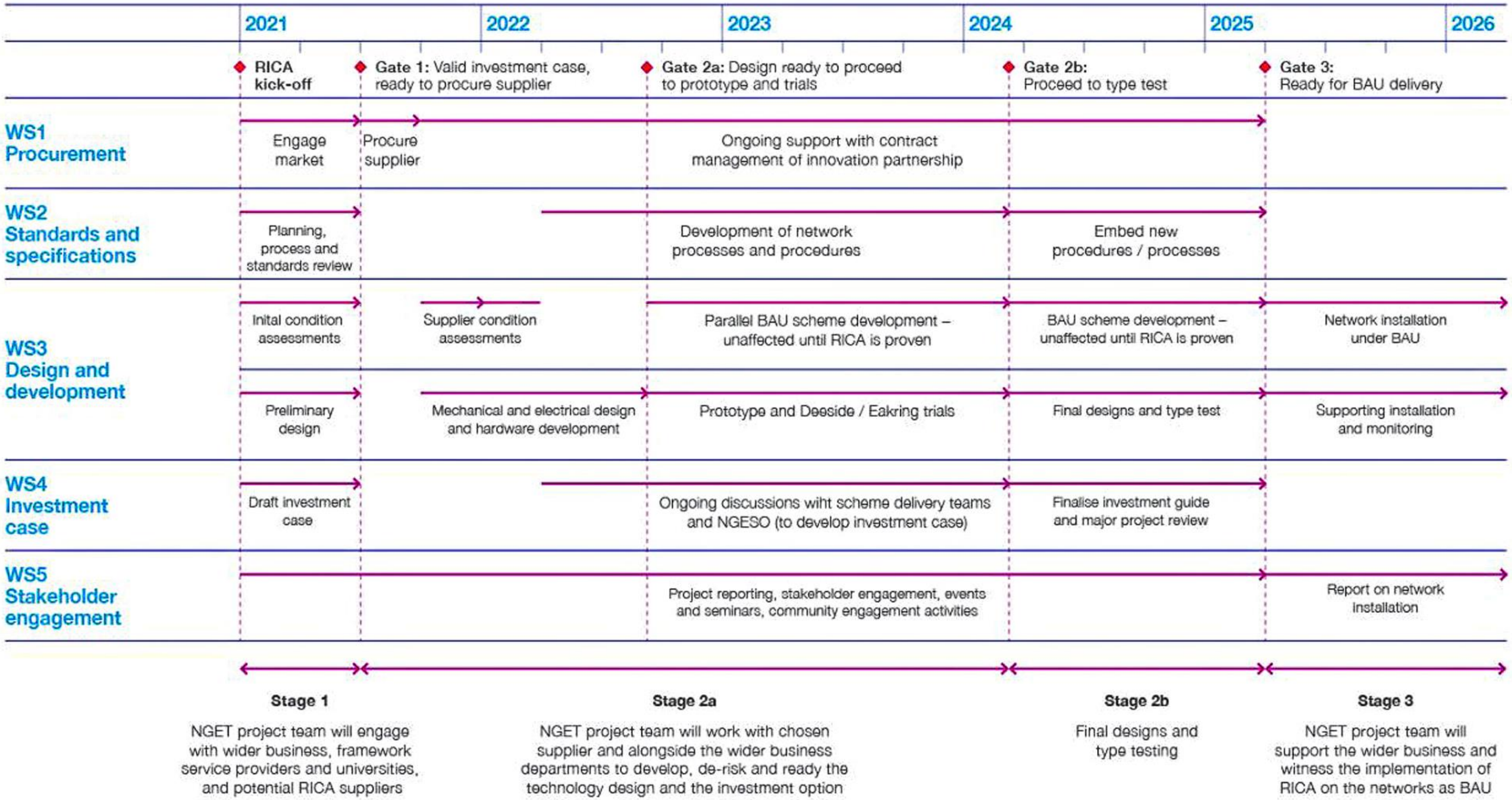
Accuracy assurance statement

The report has been written by the NIC RICA Project Manager, James Deas, reviewed and approved by the Deeside Centre for Innovation Manager Alexander Yanushkevich, PhD. Every effort has been made to ensure all information contained within this report is accurate at the time of publication. Project deliverables can be found at https://www.ofgem.gov.uk/publications/electricity-nic-submission-rica-national-grid-electricity-transmission. Financial data presented in this report is gathered from NGET SAP financial system.

As the senior manager responsible for RICA, I confirm the processes in place and steps taken to prepare this PPR are sufficiently robust and the information provided is accurate and complete.

Alexander Yanushkevich	8.12.2021
Deeside Centre for Innovation Manager Alexander Yanushkevich, PhD.	Date

Appendix 1 - RICA overall project plan



Appendix 2 – RICA risk register

An extract from the project register is found below, sorted by descending order of (mitigated) risk score. Legend: Low (L), Medium (M), High (H), Likelihood (Li), Consequence (C), Number (#).

#	Risk summary	Li	C	Score	Mitigation Actions	Category
1	Currency fluctuation or tariff impacts on delivery or costs of key components, leading to project cost increases and delays.	M	M	8	Allowing sensible conservatism for currency fluctuations. Review market activity at project stage gate.	Delivery
2	COVID-19 - second wave or persistence affects personnel health, procurement events, or trials, leading to project cost increases and delays.	M	M	8	Develop delivery plan to account for COVID-19 risk. Engage with suppliers early to understand impacts of COVID-19 on their operations.	Delivery
3	RICA does not secure public support due to lack of engagement with communities, leading to project delays, cost increases, or barriers to post-project implementation.	M	M	8	Community and stakeholder engagement plan designed for early and regular community group engagement and consultation.	Stakeholders
4	Project does not secure stakeholder buy-in due to lack of engagement with other utilities, government agencies or industry bodies, leading to project cost increases and delays.	M	M	8	Early engagement with letters of support. Clear plan with RACI, active dissemination of project materials. Ongoing engagement with stakeholders.	Stakeholders
5	Insulators are damaged while accessing due to unfamiliarity of personnel with novel technology, leading to outages.	M	M	8	Develop and testing of access and egress procedures. Knowledge dissemination to maintenance teams.	Technical
6	Due to any number of factors including emergence of other technologies or changing network needs, the investment case for RICA is not made. RICA funding is spent with no value delivered to consumers.	L	H	6	RICA NIC project enables multiple use cases (new capacity, visual impact, clearance). The project collaborates with stakeholders including the SO and NGET departments throughout the project steering committee to identify emerging network needs.	Outputs
7	Dynamic risks due to altered fixity of conductor compared to conventional cross arms leads to reduced asset life or safety risk to public.	L	H	6	PLSCAD modelling and testing to establish dynamic behaviour. Pivoted cross arms compared to fixed cross arms for instabilities.	Technical

#	Risk summary	Li	C	Score	Mitigation Actions	Category
8	RICAs increase risk of galloping clashes due to increased proximity of conductors, potentially leading to conductor damage and outages.	L	H	6	Cross arm spacing designed to increase conductor spacing.	Technical
9	Failure of type testing due to novel design aspects, leading to project cost increases and delays.	L	H	6	Work with more than one insulator supplier. Engage type registration engineer early on.	Technical
10	Supplier pulls out from project or becomes insolvent, leading to cost increases and delays to project.	L	H	6	Engage supplier early. Use approved suppliers with suitable financial background checks. Ensure insurance covers consumer for cost recovery. Allow new suppliers sufficient time to be approved.	Procurement
11	New earthing processes for RICA lead to physical strain on personnel to implement.	L	M	4	Develop earthing tools and trials (e.g. at Deeside/Eakring) during NIC project. Design for constructability. Develop and testing of access and egress procedures. Knowledge dissemination to maintenance teams.	Technical
12	Due to timing misalignment, RICA cannot be implemented on short-term delivery routes e.g. through NOA or VIP. Live monitoring cannot be delivered under stage 3 and benefits are delivered later with lower present value to consumer.	M	L	4	Explore the multiple use cases enabled by RICA which allow alternative routes. The project will collaborate with other NGET departments to ensure required timeframes are met for good opportunities.	Delivery
13	Access to test facilities and laboratories not secured due to unavailability, leading to project cost increases and delays.	L	M	4	Engage early with the facilities, require suppliers to identify alternative facilities.	Delivery
14	Faults with RICA are difficult to identify visually due to their composite materials - leading to longer time to identify faults, potentially leading to increases in outages.	L	M	4	Design for reliability during the feasibility study and detailed design stages of the NIC project.	Technical
15	More electrical faults (e.g. flashover/flashunder) possible due to the higher volume of insulators in RICA design, leading to potential increase in outages.	L	M	4	Conduct FMEA and other reliability analysis. Engage closely with insulator suppliers to develop detailed functional specification addressing material properties and failure risk.	Technical
16	Compression insulators are heavy - improper handling could lead to damage due to composite material properties, leading to outages.	L	M	4	Robust handling and commissioning techniques. Visual inspection prior to commissioning.	Technical

#	Risk summary	Li	C	Score	Mitigation Actions	Category
17	Increased mechanical loading on tower due to increased wind shear on conductors with height raised by RICA, leading to higher cost of investment case.	L	M	4	Structural assessment of RICA using PLSCAD.	Technical
18	No suitable supplier selected through initial procurement event, leading to project cost increases and delays.	L	M	4	Establish robust, pragmatic procurement process. Engage market early. Request CVs of suppliers or consortia.	Procurement
19	Additional scope items required/larger effort for design and trialling activities new to novel RICA technology, leading to project cost increases and delays.	L	M	4	Investigate risk sharing between supplier and NGET. Engage with technical consultants and other networks to understand potential costs at feasibility stage.	Technical
20	NGET does not have suitable internal resources or availability to deliver the NIC project due to other internal requirements, leading to project cost increases and delays.	L	M	4	Engage with senior managers and appropriate teams at FSP stage and continuously from start of project.	Delivery
21	Additional works for installing RICAs due to novel technology, leading to increased outage time.	L	M	4	Develop detailed installation procedures including new methods where possible in the Feasibility stage of the project. Estimate any additional time requirements for these new procedures and factor this into the Scheme delivery.	Technical
22	Suppliers indicate that documentation are already available for processes to be developed on NIC project due to previous work internationally, reducing work required on project.	M	L	4	This is an opportunity for the project. Adapt programme to ensure best use of NIC funds, including returning funds if possible.	Delivery
23	Conflicts of interest between members of the technical advisory board (TAB) and the chosen supplier for the innovation partnership, leading to an unfair procurement process and/or to project cost increases and delays due to re-procurement.	L	M	4	Mitigated by conflict of interest form at RFI/procurement stages.	Procurement
24	Sharing of information between supplier NG and project supporters leads to an information leak and potential legal issues.	L	M	4	NDA with suppliers and project supporters.	Delivery

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