Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	01
Question date	02/08/2019	Answer date	06/08/2019
Submission section question relates to	2		
Topic	a		
Question	Please expand on your use of the term 'socially acceptable'.		
Notes on question	The term was used in Section 2.1 Aims and Objectives as follows: "RaaS will develop and demonstrate the technical, organisational and commercial arrangements necessary to create the business model that allows resilience services to be delivered by third party providers to DNOs in a socially acceptable way. In addition, the Project will help generate learning to inform the development of future security of supply standards in GB."		
Answer	A robust, reliable and affordable electricity network is needed to meet current and significant future changes to the electricity system. Providing and maintaining an acceptable level of network resilience can be expensive in remote locations, especially in comparison with more densely populated urban areas. The need to meet future carbon targets will lead to the increased electrification of both the transport and heat sectors, and continued growth in distributed renewable generation. This will lead to a radical change in established electricity demand patterns; low carbon network technologies (LCTs), such as electric vehicles (EVs), heat pumps, and solar PV generation will increase significantly, along with growing volumes of electricity storage. Customers are increasingly aware of the environmental impact of the electricity they use, and in many cases are also increasingly engaged with electricity networks through the adoption of distributed generation such as solar panels, and in future potentially through mechanisms such as peer-to-peer trading or payment for demand reduction services. Traditional solutions, which in some areas rely on carbon-intensive standby diesel generators, are increasingly unacceptable to customers and society –		

	especially when local, non-polluting renewable generation resources are available. RaaS proposes a solution which facilitates the ability of connected assets to participate in multiple markets and access a variety of revenue streams. This ability to allow potential RaaS service providers to “stack revenues” has the potential to lower overall costs for customers. The RaaS Project will re-examine the balance of availability, affordability, and environmental impact to determine if technical solutions combined with a new commercial framework for service provision can provide a solution which is more socially acceptable, by reducing reliance on diesel and using local resources to deliver resilience whilst optimising the use of existing assets to help reduce overall costs for customers.
Attachments	

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Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	02
Question date	02/08/2019	Answer date	06/08/2019
Submission section question relates to	2		
Topic	c		
Question	Please expand on the unique challenges and learning that will come from a trial in the UK		
Notes on question			
Answer	As described in page 4 of our FSP, the challenge of integrating newer, more environmentally-friendly technology options to provide network resilience in GB (such as local energy storage, renewable generation, network management systems) has not been technically proven at scale, compared to traditional options (e.g. diesel generators, network reinforcement). Small-scale deployments to date have been bespoke technical solutions and are too expensive for widespread adoption. More detailed technical challenges and learnings unique to the RaaS trials are mentioned in appendix 4. e.g. seamless transitions in case of unplanned outages, rather than planned / controlled outages which have been the focus of other projects like Simris. There is no proven commercial model for DNOs to access resilience services from providers with a main income source elsewhere (i.e. not dedicated specifically to provide resilience, as is the case for standby diesel generators). Also, there is no clear set of requirements to which service providers can respond, or visibility of the resilience needs case in which third parties could invest. Hence the RaaS project focus is not limited to the technical trial challenges, but also to provide answers and learnings to the above mentioned commercial / regulatory challenges in GB.		
Attachments			

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Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN04	Question Number	4
Question date	27 August 2019	Answer date	27 August 2019
Submission section			
Topic			
Question	Please provide a benefits case in which diesel generators are still on system beyond 2020.		
Notes on question			
Answer	The cost benefit model included within the bid, which leads to an NPV of benefit of £146m for the method, already includes diesel generation for resilience beyond 2020 in the base case. This allows for the use of diesel generators to provide improved resilience across the test sites until 2028 as part of the "DNO-owned DER" counterfactual. Beyond 2028, these diesel generators are replaced by licensee owned batteries in the base case. This is based on the expectation that there will be legislation or government targets to phase out the use of diesel, in line with low carbon policies that have already been announced on diesel vehicles. Diesel is one of the lowest cost options for providing resilience, therefore, allowing this to be used in the counterfactual for longer will lower the cost of the counterfactual and therefore reduce the benefit. However, further limiting the use of diesel will increase the cost of the counterfactual, and therefore increase the benefit. We have explored this in some detail through sensitivities in the CBA model. If diesel is allowed in the counterfactual until 2032 then the benefit reduces to £128m. On the other hand, if we assume diesel is not allowed for resilience from RIIO-ED2 onwards (which aligns more closely with SSEN's sustainability ambitions and environmental objectives), then the benefit would increase to £184m.		
Attachments			

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Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	05
Question date	27/08/2019	Answer date	29/08/2019
Submission section question relates to			
Topic			
Question	Please clarify the IP arrangements following the project's close.		
Notes on question			
Answer	As stated in the Full Submission it is our intention that the Project will be delivered in accordance with the default IPR arrangements described in the NIC Governance document. The overriding objective of the project is to provide solutions to technical and non-technical aspects of RaaS – that is to say, the project will create a well-defined and detailed business model approach all GB DNOs can use consistently, which in turn will provide confidence to the potential RaaS providers and investors, resulting in a faster BAU adoption of the solution. A critical element of this will be a robust supply chain to enable a competive market place. Therefore, all of the project outputs are planned to be open and transparent in order to foster this market. If the detailed requirements specification, front end design work and stakeholder engagement activities planned for the first phase of the project identify any IPR related issues, this will form part of the assessment process for the Stage Gate.		
Attachments			

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	7
Question date	27 August 2019	Answer date	27 August 2019
Submission section question relates to			
Topic			
Question	Please provide an estimation of the carbon benefits of reduced curtailment across the 114 identified potential GB sites. Failing this, please provide an estimation across SSE's sites.		
Notes on question			
Answer	We have interpreted this question as relating specifically to the curtailment of renewable generation embedded in the 114 identified potential GB sites. Currently, when there is a fault on the types of primaries that are being targeted for RaaS, all customers will be disconnected from the wider electricity system including any embedded renewable generation. If "do nothing" was the counterfactual for the business case, then the implementation of the RaaS method would reduce the extent of this curtailment compared to the counterfactual. However, in the business case, all the counterfactuals we are considering involve an improvement in resilience through other approaches, consistent with our business plan commitments. Thus curtailment will be reduced in both the method case and the base case. We therefore don't believe that this will be material to the benefits case as presented in the proposal. For reference, based on analysis of SHEPD fault data across these sites, we have calculated a long-run average interruption duration for these sites of 2.4 hours per year across all these sites. However, this does vary significantly across primaries, with some experiencing average interruptions of up to six hours. The duration of individual outages can be much longer –		

	the average duration (across all these primaries) of the longest outage is almost 20 hours. In order to estimate the curtailment associated with these outages, it would be necessary to understand the existing and future projected embedded generation within the primary network level and lower voltage levels at all 114 sites. This can be a challenge as there is presently limited visibility of the extent of LV connected generation. A very high-level estimate of curtailment across GB associated with interruptions at the rural fringes of the network can be made by considering: (i) the renewable generation figures within the 2018 FES Consumer Evolution scenario (ii) an estimate of how much of this generation is installed on the HV and LV network, rather than the EHV network (25% based on SSEN's LTDS) (iii) the average duration of interruptions per year at these less resilient primaries of 2.4 hours per year (0.03% of the year) (iv) the number of primaries where RaaS could potentially be deployed in the business case (114 out of approximately 8,000, or 3%) Combining these figures suggests a reduction in renewable curtailment of approximately 60 MWh per year, rising to 130 MWh in line with the projections in the FES scenario. This is a relatively modest figure, but is based on some very simple assumptions and overlooks, for example, that rural sites may potentially have more solar or wind generation due to their rural settings. It also does not consider the possible correlations that might exist between network outages and weather – e.g. there might be a greater probability of outages, or of longer outages, during periods where it is windy and where wind generation would be higher. However, as explained above, these figures would not be included in the counterfactual within our business case and have no impact on the level of estimated benefit.
Attachments	

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Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	8
Question date	29/08/2019	Answer date	03/09/2019
Submission section question relates to			
Topic	Business Case		
Question	Please provide more detail on how the 114 potential sites were identified including details of the criteria applied and the assumptions made for alternative investments and self-derogation.		
Notes on question	Diesel Generation costs from Leigh Fisher https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/566803/Leigh_Fisher_Non-renewable_Generation_Cost.pdf Battery Energy Storage costs from McKinsey https://www.mckinsey.com/business-functions/sustainability/our-insights/the-new-economics-of-energy-storage		
Answer	The 114 candidate sites identified in the full submission for RaaS were established by analysing the latest Long Term Development Statements for all fourteen distribution licence areas. Viable sites for the business case are those which have a combination of: 1. Relatively low demand, so that the RaaS service (which increases in cost with increasing demand) is not prohibitively expensive; 2. A long circuit connection to the wider network (at least 5 km); 3. A rural setting, as confirmed by checking the location of the primary on mapping software (since urban networks are expected to be more likely to have HV network interconnection); 4. No redundancy in their connection to the wider network. The criteria are quite conservative for identifying applicable RaaS sites – for example, they currently exclude rural sites which are susceptible to future poor resilience due to having a long double circuit on a single pole or tower.		

	Yet, the RaaS project team felt it was appropriate to build a business case on relatively conservative assumptions so not to overstate the benefits. In the long run, RaaS has the potential, once proven, to reduce the cost of condition-based asset replacement by providing an alternate means of providing resilience compared to replacing assets with redundancy, maintaining compliance with security of supply standards. Additionally, the RaaS solution could have applications at lower voltage levels and aspects of this are being explored through a Northern Powergrid NIA project. While RaaS does not explore LV options directly, it could ultimately provide the route to market for future solutions. These further applications have not been included in the business case at this stage. The cost of alternative investments (e.g. reinforcement to provide resilience by changing non-firm capacity to firm capacity) is based on information contained within SSEN's Connection Charging Statements, which we have used to build up a per km cost for overhead lines and cables. The cost of diesel generation is taken from a report on the cost of non-renewable generation prepared for the UK Government in 2016 by Leigh Fisher and Jacobs[1]. Projections for battery costs have been made based on cost estimates available in the public domain, e.g. from McKinsey[2]. We have not made any assumptions about derogations while preparing the business case. P2 derogation is dependent on the group demand and some of the sites that we have identified would not require a derogation but would still benefit from RaaS, consistent with our business plan commitments.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	9
Question date	29/08/2019	Answer date	03/09/2019
Submission section question relates to			
Topic	Work Package 5		
Question	Can you please explain what activities will be carried out under WP5 Business Model. Will this include the development of a market platform and, if not, how is it envisaged that the market will be operated. Will the Business Case be for the DNO decision or for Eon (and/or other providers)? What will be done under the Revenue Stacking Methodology activity and how will this improve the DNO's ability to make a business decision?		
Notes on question			
Answer	As discussed in the FSP, WP3 Detailed Design and WP4 Operational Optimisation outputs are brought together and expanded to form the Business Model for potential RaaS suppliers. WP5 includes the following high-level tasks: • Construct investment business case for RaaS supplier • Draft Heads of Terms for RaaS method • Revenue Stacking Methodology. To clarify, the investment business case discussed in this work package is for the RaaS providers – E.ON for the trial; thus, it does not include the development of a "market platform" Such platforms are being investigated through a number of other projects such as TRANSITION, FUSION etc and such learning will be incorporated where applicable. The Heads of Terms developed through WP5 will define the service expectations and participant interfaces for the trial. The Revenue Stacking Methodology examines additional potential revenue streams for RaaS suppliers and other participants. Therefore, it does not directly impact on the DNO's ability to		

	make a business decision, although it may influence the price of the RaaS service. Further detail on the WP5 tasks is given below. To understand the tasks under WP5 it is important to understand the links with the other WPs, especially WP4 and WP6. One of the main aspects of the proposed model is the usage of the RaaS assets in other flexibility markets while they are not being used for RaaS. This implies a need for optimising availability of the asset for the different markets and scheduling. This optimisation must be done based on price signals as well as hard boundary conditions for participation in different markets and minimum requirements for the RaaS service. Since the BAU roll-out is envisioned 5–7 years in the future, it is important to consider different possible future scenarios, which must be defined in a first step. This optimisation of the usage of the RaaS assets under different scenarios will be done under WP4. WP5 then builds on these findings from different aspects. First, the investor business case will be analysed. From WP4 we should know the potential revenue streams for the different defined scenarios. Based on experience from earlier projects, interaction with supply chain, and by consulting with new equipment suppliers, a range of possible CAPEX and OPEX options for the RaaS assets will be obtained. Lastly, for the investor business case we need to look at the potential risks for a RaaS Provider in different scenarios and the subsequent impact on the return (IRR). To get a broad market view, investor consultations shall be undertaken in parallel under WP6 and fed back into the development of the BAU Investor Business Case. With this information we can construct an investor business case for each of the defined scenarios and derive the necessary RaaS fee to achieve the required return rates for the investors. These RaaS fees and the associated availability for RaaS as modelled in WP4 will also be shared with different DNOs in parallel under WP6. The feedback from both investors and DNOs, as well as our modelling will give a comprehensive view and will then be used to update the DNO business case ahead of the Stage Gate. In parallel, WP5 undertakes the development of the RaaS contract between SSEN and E.ON for the demonstration site. This includes drafting a contract based on a Heads of Terms outlining the description of the service, how to measure the service and success and responsibilities, as well as interfaces between the parties. These Heads of Terms will then be taken up under WP6 to be generalized for BAU readiness and discussed with various market participants.
Attachments	

Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Resilience as a Service (RaaS)

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	10
Question date	29/08/2019	Answer date	03/09/2019
Submission section question relates to			
Topic	Work package 6: Supply Chain Engagement		
Question	As a significant portion of the innovation in this project is locked into **WP6 Supply Chain Engagement**, why is this activity not started earlier? Any significant deviations from the analysis presented in the proposal that may lead to the project being altered or halted will therefore be identified sooner to limit abortive spending.		
Notes on question	We have changed the question to state WP6, not WP5 as originally written, as this reflects the question originally framed at the first bilateral session, and our understanding of the question. WP5 has been described in detail in Q9.		
Answer	We accept the challenge from the expert panel that bringing this work package forward will allow the commercial case to be tested with stakeholders ahead of the Stage Gate. In our resubmission we will bring some of the WP6 activities forward to enable this, which should not materially affect the budget or programme. We note that engagement has already started, driven by awareness in the GB DNO community thanks to the ENA open call for innovation, and Costain has already received contact from four potential RaaS suppliers outside the project on the back of publicity surrounding the ISP. Stakeholders will still be given access to comment on the full design and commercial documents developed for the trial, and to shape these for BAU delivery once early outputs from the physical trials are available. However, we will now also include significant engagement and consultation *during* the design of these documents, particularly the commercial arrangements, ahead of the Stage Gate. These activities will include an iterative process to validate the findings of the project with the GB DNOs and the RaaS investor market. In addition, the		

	project will front-load the setting of the Project 13 Value structure and market design, considering the plethora of bilateral agreements that the DNO, the RaaS/flexibility provider and participating generators will have in addition to the RaaS commercial agreements. This continuing investor and supply-chain development activity will allow the project to develop a list of interested stakeholders (DNOs, potential RaaS providers and their supply chains, other relevant stakeholders) pre-Stage Gate. This will allow the engagement, feedback and readiness of the RaaS supply chain to be considered as evidence to support the Stage Gate decision.
Attachments	

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Supplementary Answer Form

Project: Resilience as a Service (RaaS)

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	12
Question date	03/09/2019	Answer date	05/09/2019
Submission section question relates to			
Topic			
Question	At the first bi-lateral meeting you indicated that Project 13 principles will be used to develop the market required for RaaS. Can you please provide more information on how this will be done.		
Notes on question	Our response to this question includes descriptions of all the headline activities of WP6 because there are essential antecedents that provide context and inputs for the deployment of P13 principles.		
Answer	Project 13 (P13) is the Institution for Civil Engineering's new methodology model for delivering infrastructure projects. It has been developed with participation from Costain, Mace and Arup. Early users have included the @ONE Alliance (Anglian Water), A14 C2H (Highways England) and HS2 Ltd. National Grid plan to use P13 in five new critical infrastructure capital delivery projects. In the context of the RaaS Project, the team sees P13 principles being applied to establishing the future market for RaaS provision. The following is a more detailed breakdown of six WP6 activities to prepare the supply chain for widespread deployment of RaaS, maximising value for GB customers out to 2050. **Activity 1: Deep dive investigation into the full potential of RaaS across GB** Understand in detail the number of projects in total and per year, and their approximate size so that potential RaaS suppliers gain confidence that the RaaS market justifies investment. **Activity 2: Create Model-Based Systems Engineering (MBSE) system model of the RaaS system**		

Whilst WP5 will develop the commercial arrangements for the demonstration, WP6 will stress-test them against a variety of risk scenarios. The output of this modelling will provide understanding and therefore confidence in the risks of RaaS provision, allowing the RaaS enterprise design and market to better assign and apportion risks.

Activity 3: Supply Chain Investigation and Mapping

This activity will identify the potential market participants including RaaS suppliers, local generators and hardware providers. Activity 1 is a precursor, because until the RaaS opportunity can be dimensioned, it is difficult to create and maintain supply chain engagement. It will highlight the combinations of players for RaaS delivery, map complexity in the supply chain (e.g. supplier lock-in issues such as proprietary control systems), and give DNOs a better understanding of the combinations of organisations from which RaaS could be procured – enabling delivery from multiple organisations rather than single-source solutions.

Activity 4: Make an Enterprise Design for RaaS using Project 13 principles

Activity 4 is dependent on Activity 2, because the enterprise cannot come together effectively without a clear understanding of the risks involved.

The P13 Enterprise Design activity depends on Activity 3 (and therefore on Activity 1), because the supply chain map defines the permutations and combinations of organisations that can potentially combine to deliver RaaS to the DNO, and places boundaries around potential enterprise designs.

With the antecedent activities complete, the P13 approach is to define a 'value thread': a set of RaaS system **outcomes** that drive positive behaviour in all involved organisations within the RaaS supply chain. This will be key in creating a RaaS enterprise rather than the transactional structure which infant markets will default to.

This activity will set the value thread and validate this via consultation with the DNOs and supply chain communities. This will be the fundamental concept all transactions and agreements will be based on from the bottom to top of the value chain. For instance, the drivers of major transport infrastructure projects are not all about building the road or railway, but also about growing the local economy. Hence, for each investment decision the project team takes, the contracts are aligned with KPIs which measure the economic growth the investment stimulates.

The value thread will be used to develop the core KPIs for market design and incentivisation for delivery at scale, building on WP5 activities.

The impact of P13 on Activity 4 is the optimised set of organisational relationships that will deliver the sought-after outcomes in a more collaborative way.

Activity 5: Write a Commercial Strategy for the mass-deployment of RaaS by all GB DNOs

In order to realise value from the RaaS project's investment, this activity will focus on creating a template for all future iterations of RaaS provision.

	Taking the P13 value thread agreed upon in Activity 4, the project team will write a commercial strategy and procurement template for DNOs to guide the future iterations of RaaS. In this, the collaborative nature will be embedded, the value exchange will be set, and subsequent contracts will incentivise based on the agreed definition of value. A way in which this has effectively been used in the water sector is the @ONE Alliance - Anglian Water. By taking the P13 approach in their Capital Delivery works, Anglian Water became one of the highest performing water utilities with significant improvements in cost, carbon and time. The energy industry is starting to adopt the philosophy with National Grid selecting five capital projects to adopt the philosophy, but these projects are not yet in the execution phase.
Attachments	

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Project: Resilience as a Service

Tick if this answer has been provided verbally: ☐

Project code	SSEEN07	Question Number	13
Question date	03/09/2019	Answer date	05/09/2019
Submission section question relates to			
Topic	Carbon Benefits		
Question	Please provide a "worst-case" carbon benefits assessment for the method assuming: a) Diesel remains part of the counter-factual until 2040 b) The RaaS provider deploys a new diesel generator which provides no other function beyond RaaS. and comment on the likelihood of b) in the light of your response to SQ3 and information in Appendix 8.		
Notes on question	This analysis has been undertaken by TNEI on behalf of the RaaS project. Diesel Generation costs from Leigh Fisher https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/566803/Leigh_Fisher_Non-renewable_Generation_Cost.pdf		
Answer	a) If Diesel remains part of the counterfactual until 2040, the cost benefit analysis results in £108m of financial benefit to 2050, and 12kT of carbon benefit achieved through application to 109 sites (the number of applicable sites has reduced slightly due to the availability of diesel to 2040). b) If the RaaS provider deploys a new diesel generator which provides no other function beyond RaaS, the CO_2 emissions associated with having diesel in the method would be 11.9kT equivalent by 2050. That is based on the assumption that for RaaS, the diesel would run for two hours per year at the primary peak demand. However, this scenario is believed to be relatively unlikely. Through WP6 we will investigate the requirements for growing a competitive market that drives innovation and cost reduction. As a licensee we seek to facilitate new markets in a neutral manner, thus do not envisage imposing any rules preventing the participation of Diesel generators. EU and UK Government		

	carbon emissions targets alongside any future policies introduced by BEIS and DEFRA are expected to make the sole use of Diesel generation exclusively for the RaaS solution uneconomic in an open market. There may be some scenarios where local customers already have standby generation in place, making their use to deliver a service economic until their end of life. Yet if a small diesel set was to support the RaaS system, we expect it would only deliver part of the solution as it would be working in tandem with local renewables and energy storage systems. To demonstrate the impact of the small diesel generators supporting a broader RaaS solution, if the diesel provides 10% of the demand for two hours then the CO_2 emissions associated with having diesel in the method would reduce to a 1.19kT equivalent by 2050.
Attachments	