

# Electricity Network Innovation Competition Full Submission

## Supplementary Answer Form

### Project: New Suite of Transmission Structures

Tick if this answer has been provided verbally:

Project code	SSENO3	Question Number	Q1
Question date	20 August 2015	Answer date	25 August 2015
Submission section question relates to	1.6 Project Suppliers		
Topic	Supplier selection.		
Question	<p>There is no reference in the proposal which identifies the use of the best industry innovators to achieve an optimum design. Please demonstrate the selection procedure and design innovators selected as part of this selection process.</p>		
Notes on question			
Answer	<p>In terms of the NeSTS design, SHE Transmission's first priority is to ensure that the new OHL supports are structurally, mechanically and electrically safe and fit for purpose. In addition, due regard must also be paid to construction, operational and maintenance requirements. It is also vital to ensure that the new designs are suitable for the difficult climatic and terrain conditions associated with zones in which the richest renewable resources can be found. Learning from other projects has shown that the prioritisation of visual design and stakeholder approval over these considerations may not lead to an optimal solution. For these reasons, SHE Transmission opted to select a project supplier with demonstrable experience and expertise in GB OHL projects.</p> <p>There are a number of manufacturers offering single innovative components for OHLs. However, in order to ensure that all of the points above were addressed, and to achieve optimal interface between the electrical, structural and mechanical interfaces, we felt it necessary to select a supplier that could offer full system solutions.</p> <p>We have a significant portfolio of OHL projects in various stages - to support</p>		

	<p>the delivery of this programme, SHE Transmission has entered into commercial relationships with a variety of designers, contractors and specialist consultants through a Framework Agreement. These partners were selected through an procurement exercise carried out previously by our business and considers value for money and various other competencies. This allows SHE Transmission to achieve economies of scale and ensure continuity of work programmes whilst also allowing suppliers to understand requirements in the long term. Suppliers chosen as Framework Contractors have demonstrated value for money, innovative practice and technical expertise.</p> <p>A review showed that Energyline would be the best fit, based on their expertise and experience in the development and design of OHL projects. Since being appointed as Framework Contractor, Energyline have been involved in many of SHE Transmission's OHL projects including Gills Bay and Doune Ray to Mybster OHL projects. Energyline also has experience of working with the other TOs and have worked overseas.</p> <p>The company has been integral in the delivery of the NIA project NIA_SHET_0010 New Suite of Transmission Structures, which carried out the initial assessment of a wide range of support arrangements, a key output from this process being the SAM – Support Assessment Matrix. This allowed a wide range of support types and structures to be systematically assessed. During the course of the NIA project a range of component suppliers, contractors and suppliers were contacted to ensure that as wide a range of options was considered as possible.</p> <p>The key output driver for the project is to develop a suite of structures which are appropriate for use on the GB transmission network and can be implemented at the earliest opportunity.</p>
Attachments	

Project code	SSENO3	Question Number	Q2
Question date	20 August 2015	Answer date	25 August 2015
Submission section question relates to	Appendix 15		
Topic	Energyline Ltd.		
Question	<p>Please provide further information on Energyline Limited. Please provide examples of innovative projects to demonstrate they are best placed to deliver an independent, unbiased, effective solution.</p>		
Notes on question			
Answer	<p>As per Appendix 15, Energyline Ltd works with all GB TOs on the development of large capital projects at all transmission voltages. The organisation provides a broad range of skills and experience relating to the entire lifecycle of OHL projects, from design to operations, asset engineering services including environmental management.</p> <p>Prior to the advent of the T-Pylon and the NIA 'New Suite of Transmission Structures' projects, the majority of innovation activity relating to UK overhead transmission line design has been centred on conductor system technology. Energyline are at the forefront of providing technical lead in the evaluation and application of these innovative solutions e.g. high temperature low sag (HTLS) and optical phase conductor (OPPC).</p> <p>In addition, and working with National Grid, Energyline also played a significant role in the development of the processes and techniques for tower steelwork condition surveys (TCS), now an industry standard. This standardisation brought consistency and improvements to quality of inspections, bringing major improvements to candidate selection and cost control of projects. Alongside these services they developed their own bespoke data collection and reporting system and software which is considered to be 'best in class'.</p> <p>Pre RIIO, Energyline also supported National Grid with the development of their Cable Asset Life model, an innovative approach to predicting cable system asset life. It is understood to have brought benefits to both asset life prediction and related improvements in capital planning and costing.</p> <p>A number of their senior staff were former employees of National Grid and specifically involved with and responsible for bringing new technology and</p>		

	<p>engineering processes to the 'policy table'. In particular they were key contributors to the development of the what was the last (pre T-Pylon) overhead design developments and related whole life requirements.</p> <p>Energyline have been an integral part of the delivery of the outcomes from the ongoing NIA project and in particular the development of the SAM. However, the development of the NIA project, the approach to selection, definition of requirements and assessment criteria has been done in close conjunction with SHE Transmission specialist staff.</p> <p>Note that the final selection of the outputs and the decision to implement the solution will be the responsibility of SHE Transmission. This will be determined by the appropriate technical experts from SHE Transmission based on the outputs from the NIA project and the early stages of the NeSTS project.</p>
Attachments	

Project code	SSENO3	Question Number	Q3
Question date	20 August 2015	Answer date	25 August 2015
Submission section question relates to	Section 2.1.3		
Topic	Stage Gates		
Question	Has there been any consideration of placing an additional stage gate at stage 1.1 to review the business case and the effects of existing government policy and attitude upon demand for project outputs?		
Notes on question			
Answer	<p>The NeSTS project is being developed in two discrete phases to clearly demarcate the development and demonstration phases of the project. The first 'development' phase will see the concept further developed, initial prototypes and testing undertaken and importantly we will consult with a range of stakeholders. These works will further develop the potential costs and benefits from the project and also identify any additional risks. These outputs will provide a more robust and better informed set of inputs to the Stage Gate planned at the end of Phase 1. The Stage Gate will also consider the need for future OHL infrastructure including any changes from the assessment carried out in our initial submission.</p> <p>The Stage Gate at the end of Phase 1 allows time for the NeSTS concept to be developed to a point where there is sufficient confidence to deploy the solution on a planned project.</p> <p>The UK Government announced a series of policy changes in July 2015 which may introduce a further degree of uncertainty on the development of new renewable generation project which are the key driver for much of the OHL infrastructure. These policy announcements are obviously very recent and as yet the impact on the development of future renewable generation projects is not clear.</p> <p>If the impact of these policy changes becomes apparent at an earlier stage and new information becomes available which demonstrates a significant change in the assumptions used in the development of the full submission then the business case for the project will be reviewed. As can be seen from the programme in Appendix 5 – there is a "Refine Design" activity planned for the end of each of the stages within Phase 1, this will include a high level review of the business case to ensure that the project will still deliver the</p>		

	<p>benefits anticipated.</p> <p>We appreciate the point of reviewing projects on an incremental basis to ensure best value for customers and to ensure that the business case continues to be sound. We do, and will, review projects regularly as part of our normal governance procedures.</p>
Attachments	

Project code	SSEN03	Question Number	4
Question date	02/09/2015	Answer date	09/09/2015
Submission section question relates to	2		
Topic	Project description		
Question	<p>What is the proposed height of the NeSTS? How does the height of the proposed NeSTS compare against T-Pylon and traditional steel lattice towers? It will be helpful to see a technical comparison between T-Pylon and NeSTS designs.</p>		
Notes on question			
Answer	<p>What is the proposed height of the NeSTS?</p> <p>Noting that the 'standard' span adopted for NeSTS forms 510 and 540 is 200m, the heights of the standard height NeSTS are 29.5m and 25.5m respectively. The 510 series of supports uses a vertical separation of the conductors, meanwhile, the 540 series has horizontal separation of two of the phases and is therefore shorter. A typical L8C RD suspension tower is also included for comparison. The drawings for both options are included in the Appendices for Q4-14 document.</p> <p>As with lattice steel OHL supports, extensions and reductions would be included in the series, to create a range of support heights. See also Question No. 6 for further discussion on standard span.</p> <p>How does the height of the proposed NeSTS compare against T-Pylon and traditional steel lattice towers?</p> <p>The height of the standard height T-Pylon is understood to be 34.5m (published data on line). However, it should be noted that the operating voltages of the T-Pylon and the NeSTS are not the same, and therefore direct comparison would not be appropriate. Also, the standard span dimension for the T-Pylon is not the same as that assumed for the NeSTS, so again direct comparison of heights would not be appropriate. But, after adjustments have been made for voltage and standard span, the height of the 540 Series supports would be similar to that of the T-Pylon, and the height of the 510 Series support would be similar to traditional lattice steel towers.</p> <p>It will be helpful to see a technical comparison between T-Pylon and NeSTS</p>		

	<p>designs.</p> <p>Studies to inform a full technical comparison between an 'adjusted' T-Pylon and the NeSTS supports could be undertaken within the NIC project. Within the NIA programme a limited study was undertaken to derive an outline of an 'adjusted' T-Pylon i.e. 275kV at 200m and 300m standard span. This was used for comparison purposes in the assessment process, however the support did not perform as well as the final options, generally due to the following disadvantages;</p> <ul style="list-style-type: none"> <li>• Complexity of conductor system in respect of construction and maintenance</li> <li>• Complexity of conductor system resulting in correspondingly complex angle supports</li> </ul> <p>However, the outcome of NIA does share the conclusion that pole supports offer some significant benefits in terms of environmental and construction &amp; maintenance main design aspects.</p>
Attachments	Energyline drawing no [REDACTED] – currently confidential

Project code	SSEN03	Question Number	Q5
Question date	3 September 2015	Answer date	7 September 2015
Submission section question relates to	2. Project Description		
Topic	Project Description		
Question	Please provide further technical specifications, heights at different voltages, weights, monopole depth for different ground conditions, footprint, number of towers per km.		
Notes on question			
Answer	<p>The NIA project for the NeSTS design has focussed on the development of structures for 275kV OHL. The designs developed are outlined in more detail in the drawings attached below.</p> <p>These designs have been developed and assessed using the Support Assessment Matrix contained in Appendix 14 of the Full Submission Document. The selected designs were assessed using a terrain model which considered a range of ground conditions which may be encountered across GB.</p> <p>Further technical specifications such as height for voltage ranges and monopole depths will be explored in the NIC project as a full suite of OHL supports is designed. This will be further developed in the "parallel" design exercise on a planned project. This will include design on structures, foundations, access arrangements to provide a robust design for the project. This will be used to inform the Stage Gate planned at the end of Phase 1.</p> <p>Note that number of towers per km is heavily dependent on the application route. For example, a route with greatly varying altitudes and ground conditions may need more supports than a straight, flat route.</p>		
Attachments	<b>**Please note that all of these drawings are currently confidential**</b>		



Project code	SSEN03	Question Number	6
Question date	02/09/2015	Answer date	07/09/2015
Submission section question relates to	2		
Topic	Project description		
Question	Given the shorter height what is the number of towers per km compared with traditional towers?		
Notes on question			
Answer	<p>The standard span for the Series 510 and Series 540 NeSTS forms has not been fixed; the standard span of 200m adopted was chosen to allow the benefits of reduced standard spans to be investigated. For both of these forms, further studies and development would include assessment and optimisation of standard spans. The results of these studies may conclude that standard spans close to 200m offer optimum overall benefits, based on the Design Aspects considered, but they may equally find that standard spans closer to 300m do, or some intermediate value. Please also note that optimising the span criteria, and therefore providing an efficient suite of designs, may justify a broader range of spans.</p> <p>The number of supports per km is simply the reciprocal of the standard span; a standard span of 200m results in 5 supports per km, a standard span of 300m results in 3-4 supports per km.</p> <p>The number of supports per km, is determined by the specified clearance to ground for the operating voltage, the standard span, the proposed conductor and its maximum operating temperature. After adjustments have been made, including adjustments to the standard span, there would be the same number of NeSTS supports per km of OHL as both traditional lattice steel towers and the T-Pylon.</p> <p>The height of each support is driven by the need to maintain electrical clearances and the contours of the receiving landscape. This is further impacted by the micro-siting of supports to facilitate construction access, availability of crane pads, and of working and lay-down areas. There may be additional requirements by land owners which must be considered.</p>		

	<p>Therefore, across a typical overhead line project the span lengths between supports can vary significantly and are often much less than the theoretical maximum.</p> <p>The NeSTS support structures have been designed to be capable of being raised by the extending the main structure, much like a conventional steel lattice tower, which can have a number of leg extensions added.</p>
Attachments	

Project code	SSEN03	Question Number	Q7
Question date	3 September 2015	Answer date	7 September 2015
Submission section question relates to	2. Project Description		
Topic	Project Description		
Question	What types of towers have been designed – suspension, tension (and angles), dead-end, transposition towers? Please provide the technical specifications for those as well as a comparison of those specs with appropriate traditional towers e.g. L12.		
Notes on question			
Answer	<p>The scope of the ongoing NIA project is to create designs for suspension supports. However, initial designs have been developed for other supports within the suite including suspension, light angle, heavy angle and terminal supports. Full development of all types of supports is not within the scope of the NIA project – this will be completed within the NIC project.</p> <p>The NIC NeSTS project will develop the full range of support structures, to provide a comprehensive suite of supports for the transmission network – this includes all types of supports i.e. suspension, light and heavy angle, and terminal supports. Supports with height extensions will also be developed to maximise potential for deployment at various voltage levels. Again, the design of these form part of Phase 1 of the project.</p> <p>Please find attached drawings of the initial designs for the 510 and 540 series of supports from the NIA project OHL support technical specifications of NIA project outputs and an L8RD for comparison.</p>		
Attachments	<p>Energy line Drawing no – [REDACTED] - confidential</p> <p>Energy line Drawing no – [REDACTED] – confidential</p>		

Project code	SSEN03	Question Number	8
Question date	02/09/2015	Answer date	08/09/2015
Submission section question relates to	2		
Topic	Project description		
Question	<p>What are the limitations of the monopole for different ground conditions? In particular, is there is a cut off point where depth of monopole installation makes it more expensive than the traditional towers?</p>		
Notes on question			
Answer	<p>What are the limitations of the monopole for different ground conditions?</p> <p>Ground conditions are variable for all OHL supports. Traditional lattice steel towers are supported by a range of foundation types, to suit ground conditions, including but not limited to spread foundations, piled foundations, rock anchored foundations and rafts. The range of foundation solutions that are suitable for support of monopole OHL supports includes all of the above forms except for spread foundations.</p> <p>Foundations for all support designs must resist a variety of forces including compression, shear and uplift forces. These forces vary due to the effects of climatic conditions and mainly result from overturning moments and/or conductor tensions, in the case of angle and terminal supports.</p> <p>The underlying ground conditions will be the key determinant in defining the foundation requirements. If poor ground conditions or volumes of rock are present, conventional foundation solutions may not be suitable. In these circumstances, piles, rafts and rock anchors may be better suited.</p> <p>Foundations can account for up to twenty percent of the design, supply and installation costs of a new transmission line. Therefore, their design must be carefully considered.</p> <p>In particular, is there is a cut off point where depth of monopole installation makes it more expensive than the traditional towers?</p> <p>Detailed comparative foundation cost studies for monopole vs towers, and for variable ground conditions and variable depth, have not been carried out to date, so it is not possible to give a detailed response to this query. However, the studies carried out in respect of considering alternative foundation types such as caissons and rafts in normal/good ground have the</p>		

	<p>potential for overall cost savings when compared with traditional foundations to lattice steel towers.</p> <p>In the appropriate conditions, the move to a simpler monopole design may allow a wider range of foundation options, such as caissons, to be considered. This has the potential to reduce the volume of excavation (and so reduce cost of the tower foundation). This will be ultimately be determined by the specific ground and geotechnical requirements of the selected route. Therefore, the choice of foundations will be determined by the most appropriate solution for the particular conditions.</p> <p>It is recognised that NeSTS will not be appropriate in all scenarios; if the use of a monopole solution results in a more expensive and complex foundation arrangement then it will be discounted. The first stage of the NeSTS project will develop the support and foundation design to identify the most appropriate solution.</p> <p>The business case presented in the full submission is based on a cautious assumption that up to fifteen percent of future projects are expected to be suitable for NeSTS. The new designs are not expected to completely replace steel lattice supports or the T-Pylon – rather, it will provide greater choice for TOs. This will help with future network planning, and will help TOs to present greater options to stakeholders, hopefully reducing delays caused in planning applications.</p>
Attachments	

Project code	SSENO3	Question Number	Q9
Question date	03 September 2015	Answer date	07 September 2015
Submission section question relates to	Evaluation Criterion c.		
Topic	Rollout		
Question	(i) Are stringing and installation/maintenance different? (ii) If so, how will this be disseminated to other licensees?		
Notes on question			
Answer	<p>(i) The initial designs have been based around the use of a single Araucaria conductor per phase. We do not anticipate that conductor stringing will be significantly different – our new designs will meet safety and other standards. The detailed design and prototyping planned for Phase 1 will further develop any modifications which may be required during the construction phase.</p> <p>However, the NIC project will continue to investigate a range of innovations and should a novel practice be incorporated into stringing then work will be carried out to inform policy. In particular the design will consider the use of HTLS conductors.</p> <p>(ii) The dissemination plan will include the development of an e-learning module and a series of project reports and events. Any new learning that can influence policy for installation and maintenance will be shared with licensees via the Energy Networks Association.</p>		
Attachments			

Project code	SSENO3	Question Number	Q10
Question date	3 September 2015	Answer date	7 September 2015
Submission section question relates to	Appendix 3		
Topic	Rollout		
Question	Is the innovation only applicable where you can use HTLS?		
Notes on question			
Answer	<p>The work carried out on the NIA project has largely focussed on the design of the supports and associated construction and maintenance activities. These designs were based on the use of a single 700mm<sup>2</sup> Araucaria conductor per phase. Therefore, the designs developed are suitable for "traditional" type conductor arrangements and the Araucaria conductor type used represents a "worst case scenario". An equivalent HTLS conductor will be lighter than the single Araucaria conductor and therefore, will be within the structural and mechanical capabilities of the support.</p> <p>However, all of the selected designs should be suitable for the application of HTLS conductors, this should potentially allow increased electrical capacity. This is an area of the design which will be further developed in Phase 1 of the project.</p>		
Attachments			

Project code	SSENO3	Question Number	Q11
Question date	3 September 2015	Answer date	7 September 2015
Submission section question relates to	3(a)		
Topic	Costs		
Question	Please provide a cost breakdown showing how the funding is going to be used for each component of the project e.g. design, construction of prototype, etc.		
Notes on question			
Answer	Please see attached sheet – this is based on the information contained in the Whole Project Costs Tab in the Full Submission Spreadsheet.		
Attachments	See attached table		

NeSTS Work Package	Task Breakdown	Expenditure
Work Package 1 Project Management	Task 1.1 Programme Manager	[REDACTED]
	Task 1.2 IT	[REDACTED]
	Task 1.3 Stakeholder Engagement Management	[REDACTED]
	Task 1.4 NeSTS Reporting	[REDACTED]
Work Package 2 Prototype and Initial Testing	Task 2.1 Concept Refinement	[REDACTED]
	Task 2.2 Prototypes and Testing	[REDACTED]
Work Package 3 Parallel Design Process	Task 3.1 Identify Trial Routes	[REDACTED]
	Task 3.2 Evaluation against Conventional Options	[REDACTED]
Work Package 4 Full-Scale Testing	Task 4.1 Finalise Testing Requirements	[REDACTED]
	Task 4.2 Test Development and Procurement of Test Facility	[REDACTED]
	Task 4.3 Full-Scale Component and Element Testing	[REDACTED]
	Task 4.4 Evaluate Outputs and Refine Design	[REDACTED]
Work Package 5 Planning Construction and Monitoring Processes	Task 5.1 Planning and Evaluation of Design	[REDACTED]
	Task 5.2 Engagement with Supply Chain	[REDACTED]
	Task 5.3 SHE Transmission Technical Assurance	[REDACTED]
	Task 5.4 Construction of Project using New Design Approach	[REDACTED]
	Task 5.5 Develop New Tools and Practices	[REDACTED]
	Task 5.6 Develop New Tools and Practices	[REDACTED]
	Task 5.7 Monitoring and Evaluation	[REDACTED]
Work Process 6 Knowledge Dissemination	Task 6.1 Project IT	[REDACTED]
	Task 6.2 Project Events	[REDACTED]
	Task 6.3 Project Evaluation and Assessment	[REDACTED]
	Task 6.4 Project Reports	[REDACTED]
	Task 6.5 Communications Management	[REDACTED]
	Task 6.6 Dissemination and Learning	[REDACTED]
	Task 6.7 eLearning module	[REDACTED]
Total		£7,863,356.00

Project code	SSENO3	Question Number	Q12
Question date	03 September 2015	Answer date	07 September 2015
Submission section question relates to	2. Project Description		
Topic	Stage Gates		
Question	Please explain what you will be reviewing at the end of Stage 1.		
Notes on question			
Answer	<p>The project is divided into two phases as follows, with sub stages within both phases and a discrete stage gate between Phases 1 and 2:</p> <p><b>Phase 1: Development</b></p> <p>Stage 1.1 Concept proving</p> <p>Stage 1.2 Prototypes and initial testing</p> <p>Stage 1.3 Parallel design</p> <p>Stage 1.4 Full-scale testing</p> <p><b>STAGE GATE</b></p> <p><b>Phase 2: Demonstration</b></p> <p>Stage 2.1 Planning and evaluation of new design</p> <p>Stage 2.2 Implementation and construction</p> <p>Stage 2.3 Monitoring and Evaluation</p> <p>Stage 2.4 Knowledge dissemination</p>		

	<p>The formal stage gate at the end of the first, development phase will review the overall business case for the project. This is to ensure that progression to demonstration still offers a positive net business case. The following topics will be reviewed.</p> <ul style="list-style-type: none"> <li>• <b>Impact of government policy developments:</b> a series of policy changes announced in July 2015 may introduce a level of uncertainty to the volume of renewable generation seeking connection to the electricity network. There may be additional changes in energy policy between now and NeSTS deployment stage. The volume of renewable generation seeking connection to the network is a key factor in the development of new infrastructure. A review is therefore necessary to ensure that there are sufficient numbers of new renewable projects to warrant significant OHL infrastructure investment.</li> <li>• <b>Testing outcomes:</b> the conclusion of the development phase will include outcomes of testing. Testing prototypes and components will indicate areas of risk and may identify additional benefits with the NeSTS approach – the project team will evaluate these to ensure that the level of risk is acceptable and that the new designs do offer the anticipated benefits in construction and operation.</li> <li>• <b>Business case:</b> a key objective for NeSTS is the delivery of savings for customers and environmental benefits. The first phase of the project identifies costs, benefits and risks associated with a NeSTS approach. Analysis of the business case will take place at the Stage Gate – at that point, we will have sufficient information to ensure decision making is robust.</li> </ul>
Attachments	

Project code	SSENO3	Question Number	Q13
Question date	03 September 2015	Answer date	07 September 2015
Submission section question relates to	Multiple		
Topic	Stage Gates		
Question	What are the plans for the remaining £5m if the review of the business case at stage gate does not support the next phase of the project going ahead?		
Notes on question			
Answer	<p>All activities within the NeSTS project, including potentially halting the project, will be managed in accordance with the <a href="#">NIC Governance Document V2.1</a>, which states:</p> <p>"A Funding Licensee may seek permission from Ofgem to halt a Project, for example because it has become clear that the Method is not viable or there are other reasons why it is not efficient or it is not possible to continue with the Project. The Funding Licensee may suspend the Project from the time it puts in this request, pending a decision from Ofgem on the request to halt. Ofgem may also call a Funding Licensee to stop a Project.</p> <p>As part of the process to evaluate whether a Project should be halted, either at the request of Ofgem or the Funding Licensee, the Funding Licensee will need to provide Ofgem with sufficient information to evaluate whether halting the Project will be appropriate in the circumstances, including whether it would be in the best interest of customers and identifying any costs it will incur and the actions required in halting the Project.</p> <p>If Ofgem is satisfied that it is appropriate in the circumstances, including whether it would be in the best interests of customers to halt the Project, then it will confirm in writing that it shall require that the Project be halted. Ofgem will also identify any funds that have been received by the Funding Licensee which have not yet been spent; less funds already committed and less any costs that Ofgem has agreed can be incurred to halt the Project. These funds will be deemed to be Halted Project Revenues and will be returned through a subsequent Funding Direction.</p> <p>A Project that is halted must still comply with the other requirements of this Governance Document, including the requirement to provide a Close Down</p>		

	<p>Report."</p> <p>In the unlikely case that the Stage Gate concludes that a move towards demonstration of NESTS does not demonstrate a positive net business case, SHE Transmission will first seek approval to halt the project from the Programme Director and the company's Innovation Steering Board. At this point, the project will be suspended and a request to halt the project will be given to Ofgem.</p> <p>Ofgem will receive evidence detailing the reasons for our request to halt the project and will receive a full cost breakdown of any further costs that will be incurred in order to halt the project. SHE Transmission will work with Ofgem to determine the volume of unspent funds that should be returned through an agreed Funding Direction.</p> <p>Final reports including a final close down report and any appropriate knowledge dissemination will be carried out as agreed with Ofgem.</p>
Attachments	

Project code	SSENO3	Question Number	Q14
Question date	3 September 2015	Answer date	7 September 2015
Submission section question relates to	2(a)		
Topic	Benefits		
Question	<p>The benefits are quantified extensively by the amount of renewable generation that could be connected. If capital cost savings are the main benefits then is the innovation applicable to any connection that requires OHL (not just renewables)?</p>		
Notes on question			
Answer	<p>The NeSTS solution is suitable for <b>all</b> types of new OHL construction including generation connections. The benefits arise from savings associated with simplified construction and reduced foundations. From our initial analysis we believe that the NeSTS solution has the potential to reduce costs by up to ten per cent per kilometre of new OHL build.</p> <p>These benefits will only be realised if there is a future requirement to build new OHL infrastructure. In order to illustrate the savings which could be achieved from NeSTS we have used the four scenarios used in the National Grid Future Energy Scenarios document to estimate the future OHL build requirements. Each of these gives a different requirement for new OHL build in future and hence will impact on the potential benefits from NeSTS.</p> <p>Even, the least optimistic of these scenarios show a significant demand for future OHLs. However, it is recognised that recent UK Government policy announcements may have an impact on these requirements. This will be considered in the Stage Gate at the end of Phase 1.</p>		
Attachments			

Project code	SSEN03	Question Number	15
Question date	8 September 2015	Answer date	11 September 2015
Submission section question relates to			
Topic	Costs		
Question	Have you factored in the additional cost should you need to use high temperature low sag lines?		
Notes on question			
Answer	<p>The initial NeSTS project designs are based around the use of a single 700mm<sup>2</sup> Aracauria conductor. This was used as it represents the "worst case" in terms of the mechanical loading for the new suite of supports. The design has been developed such that the use of HTLS conductors can be included if appropriate. This will be further developed during the initial phases of the project.</p> <p>The choice of conductor will be determined by the rating of the circuit and the characteristics of the line. If HTLS conductors are the most appropriate choice then it can be applied to both conventional and the new designs. From our engagement work with the other TOs it is clear that HTLS conductors have the potential to offer benefits and ensuring that the NeSTS designs are capable of exploiting these benefits.</p> <p>Therefore, we have not asked for any additional funds for the inclusion of HTLS conductor as the appropriate conductor will be selected for the project. However, the costs do include development of designs and construction techniques...</p>		
Attachments			

Project code	SSEN03	Question Number	16
Question date	8 September 2015	Answer date	11 September 2015
Submission section question relates to	Evaluation Criterion (g): Methodology		
Topic	Methodology		
Question	Please explain what progress the NIA project has made. How would this build on that learning, i.e. what is the starting point for this project?		
Notes on question			
Answer	<p>The NIA project's objective was to design a suite of 275kV OHL structures that is cheaper, smaller and quicker to build than conventional OHL supports. This was to be done using several innovations which had not been trialled together previously. The new designs were also to focus on safety and improving environmental impact.</p> <p>(i) Progress made by the NIA project.</p> <p>Progress of this project is as follows (a copy of the latest progress report is also available in Appendix 10 of the submission document):</p> <ul style="list-style-type: none"> <li>• A review of technology available in GB and overseas was carried out.</li> <li>• A number of structure options were designed based on best available technology, and these were shortlisted to eight designs.</li> <li>• The Support Assessment Matrix (SAM) was developed to benchmark the new designs against an L8 RD support type. An extract of the (SAM) was published in Appendix 14 of the submission document. This provides a qualitative assessment of the shortlisted designs.</li> <li>• Scale models have been constructed, including two conventional steel lattice supports (L7 and L8 RDs) for comparison.</li> <li>• Trial build of component parts for horizontal and vee support arrangements is underway at the moment – suppliers have been contacted and will soon be selected, as this aspect of the NIA project is planned for October.</li> <li>• An event was held in August to share learning with other transmission operators and to understand their feedback, with an additional meeting planned for September.</li> <li>• Work is also ongoing to provide a comprehensive close-down report</li> </ul>		

and share project learning.

(ii) How would (the NIC project) build on that learning, i.e. what is the starting point for (the NIC) project?

The starting point of the NIC project contains several tasks:

- Review the NIA outputs and establish whether further innovation can be applied in the new designs;
- Further develop the SAM so that it provides a tool for best analysis for other TOs. This would include further work on visual and environmental impact.
- Refine the designs in line with the outputs from the SAM; and
- Prepare the prototype and testing requirements specification.
- Once satisfied that the designs are electrically, mechanically and structurally suitable for progression, the programme of stakeholder engagement commences.

Note that the NIA shortlisted eight designs as suitable for progression. The refinement of designs at the outset of the NIC project will reduce the number of these.

Attachments

Project code	SSEN03	Question Number	17
Question date	8 September 2015	Answer date	11 September 2015
Submission section question relates to	Evaluation Criterion g		
Topic	Methodology		
Question	How much consumer testing have you done under the NIA project? Is the selected prototype(s) the most acceptable to the public?		
Notes on question			
Answer	<p>The NIA project did not include consumer testing in its scope. The NIA project focussed on a desktop study and scale model construction of potential structures. However, the brief for the NIA project was to create smaller supports with improved environmental impact in comparison to conventional supports, as these are key concerns for stakeholders.</p> <p>The first priority for the NIA project was to ensure that designs were electrically, structurally and mechanically sound. This helps to minimise the potential to create new designs which are aesthetically pleasing to consumers, but which cause difficulties in construction, operation or maintenance.</p> <p>The NIC project team has reviewed feedback from National Grid Electricity Transmission's T-Pylon and the SHE Transmission's Modular Approach to Substation Construction projects. Key points were as follows.</p> <ul style="list-style-type: none"> <li>a. A meeting with National Grid representatives indicated that initially driving the T-Pylon project from an aesthetics, rather than engineering, point of view had created several challenges in moving the T-Pylon from concept design to engineering reality.</li> <li>b. A YouGov Survey of 2,444 adults held in April 2015 showed that 59% of people preferred an alternative design over a traditional steel lattice structure, while only 36% preferred the conventional design (this could indicate that design options and opinion may depend on project-specific issues such as local environment and opinion on renewables etc.).</li> </ul>		

- c. SHE Transmission commissioned a report on a stakeholder engagement programme that formed part of the Modular Approach to Substation Construction project. Data and analysis for this was written by Social Market Research Ltd, the company that supported the project's stakeholder consultation activities.

Local authorities and planners felt that the two most important aspects of visual impact of infrastructure were:

- The potential effect of the visual appearance on tourism and leisure; and
- Colour of materials and equipment.

66% of environmental and community representatives interviewed for the project felt that infrastructure's visual impact would depend greatly on the context of the project. A representative from the Forestry Commission Scotland commented that, for infrastructure projects (in this example, this was a new substation):

"(We... need to engage with local communities particularly in the North of Scotland...very sensitive...critical...there are few things which are as emotive as transmission infrastructure and substations!"

This being the case, having a new design to complement traditional OHL supports and the T-Pylon could help to ensure TOs are more able to meet stakeholder requirements in terms of visual/environmental impact.

The NIC project includes a programme of stakeholder engagement, which commences at Stage 1.2. This allows us to provide stakeholders an opportunity to influence the visual layout whilst ensuring the prototypes shown to them meet the needs of the network.

Learning has informed the approach we plan to take in relation to stakeholder consultation for the NeSTS project. In addition to working with statutory authorities representing community and environmental concerns, the project will also conduct a series of focus groups with members of the public, some of whom may have been affected by previous infrastructure projects.

Visual and environmental impacts constitute two of the Main Design Aspects in the SAM, to help us ensure that these topics are given thorough consideration for the NeSTS designs.

Attachments

Project code	SSENO3	Question Number	18
Question date		Answer date	
Submission section question relates to	Evaluation Criterion (c).		
Topic	Rollout		
Question	Can you justify the assumption of 15% rollout?		
Notes on question			
Answer	<p>The key benefit from NeSTS comes from the use of a simpler, monopole structure which offers the opportunity to introduce more straightforward and less intrusive foundations. The simpler structure also facilitates benefits from reduced construction time due to a decrease in the number of OHL support elements which need to be assembled, and the potential to do more construction off site. The NeSTS team will develop these possibilities further during the early stages of the project.</p> <p>TNEI worked with SHE Transmission to forecast typical volumes of new OHL projects post RIIO:T1. As advised in the Carbon Plan, it is very difficult to understand what the future holds in terms of energy policy and the uptake of low carbon technologies. TNEI examined TOs' business plans and made estimations based on these and National Grid's Future Energy Scenarios. This has allowed us a basis upon which to make assumptions.</p> <p>To assign a potential roll-out figure of 15%, the project team consulted with SHE Transmission colleagues involved in the design, development, construction, commissioning and operation of OHL infrastructure. This included input from a variety of disciplines including mechanical, structural and electrical experts plus environmental and planning specialists. This information was further supplemented by input from Energyline. Further views were gathered from the other TOs during dissemination activities carried out during as part of the ongoing NIA project.</p> <p>The potential for further roll will continue to be assessed during Phase 1 of the project and will be a key component of the planned Stage Gate. Note that our case for up to 15% is fairly cautious – we are not attempting to</p>		

	replace traditional structures or enter the NeSTS designs into competition with the T-Pylon. Our basis comes from the fact that each OHL support type suits different circuit types/ratings/environments and that the new designs offer an additional option TOs can consider for new OHL projects. However, the NeSTS designs offer all-terrain suitability, while other solutions may not.
Attachments	

Project code	SSENO3	Question Number	19
Question date	8 Sept 15	Answer date	11 Sept 15
Submission section question relates to	Evaluation Criteria a		
Topic	a Risks		
Question	Which line will the project be trialled on? Is this suitable of this line at risk given the change to government policy on wind subsidies?		
Notes on question			
Answer	<p>There are a number of projects for which NeSTS would be suitable – these projects have been shortlisted so that in the event of NIC funds being awarded, the NeSTS project can quickly be assigned to one of these. These projects have been selected due to the route conditions and expected challenges, including planning applications. These projects are in development stage, where it is still possible for the NeSTS design to be adopted i.e. prior to committing to a traditional design and submitting a planning application.</p> <p>Once the project has been selected, the NeSTS designs will be used as the basis for consenting and final design for the project. All of the projects identified have had initial scoping completed to identify the rating and electrical characteristics, with outline locations and OHL routes identified.</p> <p>For example, one of the projects identified incorporates a wide range of terrains including high altitude, loch-side, wooded and a river valley. The route will also provide a range of conditions which will test the capability of the new suite of structures. This is an environmentally sensitive area and we expect that there will be issues with planning and consent applications. This is also an area which already has a number of windfarms and the NeSTS designs may be better suited to the area than conventional OHL designs.</p> <p>The UK Government's recent policy changes may affect the number of new renewable projects seeking connection – it is too soon for TOs to understand the full implications of this and of course, there may be further policy announcements ahead. As identified in our response to Question 3, if additional information becomes available which indicates a significant change in the requirement for future OHL infrastructure we will carry out a high level review of the project's business case to ensure that the</p>		

	<p>anticipated benefits can be realised.</p> <p>In the meantime, SHE Transmission will continue to provide the infrastructure necessary to connect new renewables to the network and provide the energy people need.</p>
Attachments	

Project code	SSENO3	Question Number	20
Question date	8 Sept 15	Answer date	11 Sept 15
Submission section question relates to			
Topic	Funding		
Question	What other incentive mechanisms could this project be benefitting from?		
Notes on question			
Answer	<p>The NIC is the only appropriate funding source for the project. While it is recognised that there are funding mechanisms in place to reduce the visual impact of OHLs, most notably the Visual Amenity Allowance, NeSTS falls outside of the scope for this funding for two reasons.</p> <ul style="list-style-type: none"> <li>§ The Visual Amenity Allowance only applies to existing infrastructure within National Parks and designated Areas of Outstanding Natural Beauty. NeSTS applies to new build OHLs, therefore the use of the Visual Amenity Allowance is not permitted to fund this initial deployment.</li> <li>§ The Visual Amenity Allowance cannot be used for the development and demonstration of unproven technologies. NeSTS introduces a series of innovations within the suite of designs – first time deployment naturally carries an element of risk.</li> </ul> <p>The Environmental Discretionary Reward (EDR) was also considered. The EDR encourages TOs to meet climate change mitigation objectives, namely enabling the decarbonisation of electricity and minimising the harm of their operational and business activities on the environment. However, this incentive will reward TOs for work already carried out, rather than provide funds to carry out new projects. Whilst NeSTS may contribute to our submission for the EDR in future, there is no direct funding as a consequence of the project.</p> <p>If NeSTS were to be funded under 'business as usual' revenue, SHE Transmission could not allocate funding for the incremental costs of knowledge capture and dissemination. Without a learning capture and share plan, TOs would be less likely to integrate NeSTS into their networks. Similarly, the lack of familiarisation with NeSTS amongst the supply chain and amongst statutory authorities could result in delays and uncertainty</p>		

during procurement and planning stages of a project. Ultimately, no single project could accommodate the additional cost of the development activities required to ensure the successful delivery of the NeSTS approach.

Therefore, we believe that NIC is the most appropriate mechanism for funding the project.

Attachments

Project code	SSEN03	Question Number	21
Question date	8 September 2015	Answer date	11 September 2015
Submission section question relates to	Evaluation Criterion (e).		
Topic	Partners		
Question	Please clarify Energyline's role in the project?		
Notes on question			
Answer	<p>Energyline (EL) Ltd is an engineering consultancy specialising in the design and construction of transmission voltage OHL projects.</p> <p>EL have extensive experience in the design and development of OHL projects and have provided key input to a number of SHE Transmission's ongoing OHL projects.</p> <p>EL has worked on the NIA NeSTS project to develop initial designs and feasibility, and will continue to provide design and technical support throughout the lifecycle of the NIC project.</p> <p>EL will continue to work on the application design and will also assume responsibility for design assurance and technical approval. EL is a project supplier – their role in NIC NeSTS is to provide technical support on all design and implementation issues. They will also support SHE Transmission with stakeholder engagement and knowledge dissemination activities. EL's work tasks will include the following:</p> <ul style="list-style-type: none"> <li>• Support SHE Transmission in reviewing the NIA outputs at the onset of the NIC project then reviewing and refining the outputs and designs respectively throughout the NIC project lifecycle;</li> <li>• Lead in the development of the full NeSTS designs and prepare prototype and testing requirements;</li> <li>• Lead in building the scale prototypes;</li> <li>• Support SHE Transmission in stakeholder engagement activities;</li> <li>• Assist SHE Transmission in confirming requirements for ancillary equipment and facilities;</li> <li>• Support SHE Transmission and the appointed contractor for the route</li> </ul>		

	<p>design and application</p> <ul style="list-style-type: none"><li>• Manage the full-scale testing process</li><li>• Prepare output reports and assist SHE Transmission with refinement of designs.</li><li>• Supporting monitoring and evaluation processes.</li><li>• Providing knowledge from their technical bank as appropriate in topics such as environmental planning, OHL design and civil engineering.</li></ul>
Attachments	

Project code	SSEN03	Question Number	22
Question date	8 September 2015	Answer date	11 September 2015
Submission section question relates to	Project Description		
Topic	Benefits		
Question	<p>The validation task to be conducted by [REDACTED] adds reassurance that the benefits will be appropriately calculated and apportioned, but is not defined in detail. Do TNEI and SSE have a plan for validation?</p>		
Notes on question			
Answer	<p>[REDACTED] and SHE Transmission will create a full plan should funding be awarded. Initially, the validation content has been agreed as follows:</p> <ol style="list-style-type: none"> <li>1. Verify cost savings by component i.e. new conductor and insulator arrangements, foundations and access works. This will validate any anticipated savings. Importantly, the validation will aim to incorporate whole life costs and savings to allow TOs to understand the financial benefits of using the new designs.</li> <li>2. Understand and quantify benefits in terms of visual and environmental impact, including time and cost savings, associated with the planning application. This is an important addition to work that will be carried out by SMR – SMR will conduct a full programme of stakeholder engagement to provide qualitative analysis relating to stakeholders' perception of the new support designs.</li> <li>3. It is expected that NeSTS will reduce carbon emissions compared to traditional OHL projects. TNEI will assess carbon emissions saved as a result of new foundation techniques and the smaller footprint.</li> </ol> <p>[REDACTED] s report will be made available so that other TOs have a full, independent understanding of the benefits of deploying the new supports and will work alongside the knowledge dissemination programme created for the project.</p>		

Attachments	

Project code	SSENO3	Question Number	23
Question date	17 September 2015	Answer date	22 September 2015
Submission section question relates to	P51		
Topic	Costs		
Question	Could you link the spend prior to the stage gate to specific activities? Please clarify the timing of the expenditure shown on p51 in light of this.		
Notes on question			
Answer	<p>Please find see attached sheets which identify the Funding Request up to the Planned Stage Gate at the end of Phase 1, and also the corresponding information from the Whole Project Costs Tab in the Full Submission Spreadsheet.</p> <p>As can be seen the expenditure up to the Stage Gate is approximately £1.6 million. At the Stage Gate, the project will be fully reassessed to ensure that it delivers the anticipated benefits, thus safeguarding the remaining £5 million.</p>		
Attachments			

## Outstanding Funding required (prior to Stage Gate)

	2015/20 16	2016/17	2017/18	2018/1 9	2020/2 1	2021/2 2	Total
Labour							
Equipment							
Contractors							
IT							
IPR Costs							
Travel & Expenses							
Payments to users and Contingency							
Decommissioning							
Other							
<b>Total</b>	-	-	-	-	-	-	-
	£214,06 5	1,152,375	£260,81 8				£1,627,2 59
							NIC Funding Request
							£ 1,624,6 89

### Attachment 1 to Q23 – NIC Funding Request Tab on Full Submission Spreadsheet to Stage Gate

Note that these costs are as per Appendix 2 of the main submission document with the exception of year 2017/2018

NeSTS Work Package	Task Breakdown	Expenditure
	Task 1.1 Programme Manager	[REDACTED]
	Task 1.2 IT	[REDACTED]
	Task 1.3 Stakeholder Engagement Management	[REDACTED]
Work Package 1 Project Management	Task 1.4 NeSTS Reporting	[REDACTED]
	Task 2.1 Concept Refinement	[REDACTED]
Work Package 2 Prototype and Initial Testing	Task 2.2 Prototypes and Testing inc Stakeholder Engagement	[REDACTED]
	Task 3.1 Identify Trial Routes	[REDACTED]
Work Package 3 Parallel Design Process	Task 3.2 Evaluation against Conventional Options	[REDACTED]
	Task 4.1 Finalise Testing Requirements	[REDACTED]
	Task 4.2 Test Development and Procurement of Test Facility	[REDACTED]
Work Package 4 Full-Scale Testing **Note that Tasks 4.3 and 4.4 are post-stage gate and therefore there are no costs listed for these items**	Task 4.3 Full-Scale Component and Element Testing	[REDACTED]
	Task 4.4 Evaluate Outputs and Refine Design	[REDACTED]
	Task 6.1 Project IT	[REDACTED]
	Task 6.2 Project Events	[REDACTED]
	Task 6.3 Project Evaluation and Assessment	[REDACTED]
	Task 6.4 Project Reports	[REDACTED]
	Task 6.5 Communications Management	[REDACTED]
	Task 6.6 Dissemination and Learning	[REDACTED]
Work Process 6 Knowledge Dissemination	Task 6.7 eLearning module	[REDACTED]
Total (note that this figure includes inflation/interest as per the Full Submission Spreadsheet)		£1,808,066.00

Attachment 2 for Q23- NeSTS project expenditure to Stage Gate based on Whole Project Tab from Full Submission Spreadsheet.

Project code	SSEN03	Question Number	24
Question date	17/09/2015	Answer date	21/09/2015
Submission section question relates to			
Topic	Specialist input		
Question	What specialists input have you had in the NIA e.g. structural engineers, architects, civil engineers? What reports have they produced?		
Notes on question			
Answer	<p>(i) What specialist input have you had in the NIA?</p> <p>The Energyline team working on and named in the NIA project includes the following specialists:</p> <ul style="list-style-type: none"> <li>• Mr Malcolm Lowe – Principal Structural/Civil Engineer</li> <li>• Dr David Tripp – Principal Electrical Engineer</li> <li>• Matthew Heath (EL Australia) – Senior OHL Design Engineer (Conductor Systems and Monopole Design)</li> <li>• Mr Steve Turner – Senior Construction Engineer</li> <li>• Mr David Cox – Senior Operations and Maintenance Engineer</li> <li>• Mr Mick McIoughlin – Senior Environmental Specialist</li> </ul> <p>The EL team also comprises other staff within each of the main disciplines e.g. Planning and Environmental, Structural/Civil Design, Electrical Design, Conductor System Design.</p> <p>Furthermore SHE Transmission has also provided review and input at key stages, from a number of key individuals, including:</p> <ul style="list-style-type: none"> <li>• Alexander Campbell – Lead Project Manager North</li> <li>• John Baker – Engineering Policy Manager</li> <li>• Malcolm Waddell – Engineering Design Manager</li> <li>• Peter Lodge – Business Planning Manager</li> <li>• Iain Grey – Operations Manager</li> <li>• Tawanda Chitifa – R+D Project Manager</li> </ul>		

	<p>The final stage of studies and reporting includes input and peer review from.</p> <ul style="list-style-type: none"> <li>• Landscape and Visual - Mr Bill Blackledge (<a href="http://www.2bconsultancy.co.uk/about.htm">http://www.2bconsultancy.co.uk/about.htm</a>)</li> <li>• Foundation and Ground Engineering - Dr Michael De Freitas (<a href="http://www.imperial.ac.uk/people/m.defreitas">http://www.imperial.ac.uk/people/m.defreitas</a>)</li> </ul> <p>(ii) What reports have (these specialists) produced?</p> <p>Reporting has been in accordance with the NIA Project Execution Plan and Governance Document. A number of progress reports have been produced by the project team at various stages of the project to capture the learning to date.</p> <p>These are as follows:</p> <ul style="list-style-type: none"> <li>• Stage 1 - 90SS545_REP_001_Stage 1 Report (Energyline, Oct 14)</li> <li>• Stage 2 – Initial Design Brief and Support Examples (Energyline, Dec 14)</li> <li>• Stage 3 – 90SS545_REP_002 Stage 3 Progress Report (Energyline, April 15)</li> <li>• Project Progress Report 2014 (SHE Transmission, July 2014)</li> <li>• Project Progress Report 2015 (SHE Transmission, July 2015)</li> </ul> <p>An example report is attached – this is the Phase 3 Interim Report produced by Energyline in April 2015, which describes progress to that point. Since then the project has further progressed and has identified the structures which are most likely to provide the greatest benefits for TOs and customers. Please note that this is an interim report which has been provided for information and should be treated as confidential. The SHE Transmission project progress reports are in the public domain and can be viewed on the ENA Smarter Networks Portal, found here:</p> <p><a href="http://www.smarternetworks.org/Project.aspx?ProjectID=1302#downloads">http://www.smarternetworks.org/Project.aspx?ProjectID=1302#downloads</a></p> <p>Final reporting (Stage 4) is underway for completion by the end of October 2015.</p>
Attachments	NIA Stage 3 Interim Report for Q24 - confidential

Project code	SSEN03	Question Number	25
Question date	17/09/2015	Answer date	21/09/2015
Submission section question relates to			
Topic	Financial benefits		
Question	What's the supporting evidence for the reduction in foundation costs with NeSTS?		
Notes on question			
Answer	See Attachment 1		
Attachments	Attachment 1 – Foundation Costs – Supporting Evidence		

## Attachment 1 – Foundation Costs – Supporting Evidence

Also appended to Q35

Further to the discussions and responses provided at the first Expert Panel, the anticipated cost savings relating to the foundation design has been based on:

- **50% direct construction** related costs, including site/drainage reinstatement and corresponding crop losses.
- **50% scheme related costs** that are generally as a result of routing and micro-siting of consents e.g. agreements with third parties such as landowners.

A 50/50 ratio for division of costs is appropriate – in areas where land use and value is at a premium, scheme costs can be significant.

A review of construction cost proportions indicates that material/labour costs will account for around 30%, and plant machinery at 70%, taking into account the wide range of possible factors and applications.

Given the range of support types, ground conditions and overall land/third party issues (values) it is not possible to derive a definitive rule for comparison. However, the table below illustrates the basis to the proposed savings by comparing the 510 series concept design support with an 'equivalent' L8RD lattice steel tower.

**Table 1: Comparison between 510 and L8 RD OHL supports**

Cost Aspect	L8 RD	NeSTS (510 Series)	Comment/ Basis
Reinforced Concrete Volume	18m <sup>3</sup>	30m <sup>3</sup>	
Excavation volume	95m <sup>3</sup>	30m <sup>3</sup>	
Spoil	18m <sup>3</sup>	30m <sup>3</sup>	
Installation Time (Effort)	2 weeks	1 week	Note that lattice steel could take up to three weeks to erect on a site with side slope.
Construction Impact/Working Area	1225m <sup>2</sup> (35m x 35m)	200m <sup>2</sup>	Environmental surveys and mitigation, land damage, reinstatement of site, drainage repairs and crop loss.
Land sterilisation (footprint at ground level)	49m <sup>2</sup> (7m x7m )	1.8m <sup>2</sup>	Wayleave/ servitude/ easement costs for consent and future use.
Land needed for design	289m <sup>2</sup> (17m x17m )	87m <sup>2</sup>	Initial micro-siting, impact on third party apparatus and operations and future impacts.

Route costs can vary significantly but the use of the new designs is expected to provide further cost efficiencies. Savings are anticipated from:

- **Direct construction** larger land-take differentials (in favour of monopolies) for taller supports, environmental surveys and mitigation, wider competition in foundation installation supplier base, opportunities for refinement/optimisation of designs.
- **Scheme costs** – the reduced need to divert third party apparatus away from the area of influence required for foundation design and/or restricting third party operations.

Based on the information in Table 1 above, a potential cost saving of up to 35% has been derived from:

Direct costs/ scheme costs [A]	50:50
Material costs/ Other construction costs [B]	30:70
Relative value of Cost Aspect [C]	NeSTS value/ L8 RD value
Notes:	
1. 'Other costs include: formwork, plant & equipment, site overhead costs etc. 2. The 'Relative value' values are based primarily on volume of concrete for 'Direct costs (materials)', and on footprint areas and construction times for 'Direct costs (other)' and 'Scheme costs'.	

Direct costs (materials)	[A]x[B]x[C]	0.5 x 0.3 x 2.6 =	0.39
Direct costs (other)	[A]x[B]x[C]	0.5 x 0.7 x 0.5 =	0.18
Scheme costs	[A]x [C]	0.5 x 0.2 =	0.10
Relative cost NeSTS/L8RD			0.67

It is reasonable to assume that when all other factors (route and project specific) are taken into consideration, the potential savings relating to the foundation design aspect could be further increased as the design is developed – it is anticipated that this will be equivalent of up to 50%. Whilst it is acknowledged that the scheme-related cost savings could be accounted for under different headings, the benefits all equate to the foundation design.

The expectation is that once optimisation studies and design refinement has been completed early in Phase 1 then the overall cost assessment can be modelled accurately using the parallel design and project specific information.

Project code	SSENO3	Question Number	26
Question date	17 September 2015	Answer date	22 September 2015
Submission section question relates to			
Topic			
Question	How do you plan to implement contractual arrangements for construction of the pylons?		
Notes on question			
Answer	<p>SHE Transmission uses a framework agreement with approved suppliers selected due to their experience, expertise and value for money.</p> <p>Contractors considered for this project already have considerable experience of delivering OHL projects on the SHE Transmission territory.</p> <p>Once the design of the suite of supports is finalised and an appropriate route is identified [REDACTED] [REDACTED]. This exercise will be conducted alongside an equivalent exercise based on a conventional design.</p> <p>This approach to the selection of a contractor will continue to be assessed as the design of the project progresses and the specific project deliverables become clearer. This will be informed by the ongoing NeSTS design and the specific requirements of the selected route.</p>		
Attachments			

Project code	SSENO3	Question Number	27								
Question date	17 September 2015	Answer date	22 September 2015								
Submission section question relates to											
Topic	Stakeholder Engagement										
Question	Please provide a breakdown of how you plan to spend the stakeholder engagement budget?										
Notes on question											
Answer	The stakeholder engagement budget for the project is £266,947, and covers costs for the following items. The expenditure items are categorised in the Table 1 below, and are listed in the Event and Engagement Plan (Table 2).										
<p><b>Table 2: Expenditure categories</b></p> <table border="1"> <tr> <td>1. Development and delivery of independent stakeholder engagement, analysis and reporting.</td> <td>[REDACTED]</td> </tr> <tr> <td>2. Event management including room hire, catering and travel for staff and contractors.</td> <td>[REDACTED]</td> </tr> <tr> <td>3. Creation of literature and media. This may include consultation papers, surveys, information documents and publicity (such as press, information videos and social media).</td> <td>[REDACTED]</td> </tr> <tr> <td>4. Labour costs for SHE Transmission, Energyline and Social Market Research (note that most of SMR labour costs are listed under Item 1, and some labour is calculated into Item 5).</td> <td>[REDACTED]</td> </tr> </table>				1. Development and delivery of independent stakeholder engagement, analysis and reporting.	[REDACTED]	2. Event management including room hire, catering and travel for staff and contractors.	[REDACTED]	3. Creation of literature and media. This may include consultation papers, surveys, information documents and publicity (such as press, information videos and social media).	[REDACTED]	4. Labour costs for SHE Transmission, Energyline and Social Market Research (note that most of SMR labour costs are listed under Item 1, and some labour is calculated into Item 5).	[REDACTED]
1. Development and delivery of independent stakeholder engagement, analysis and reporting.	[REDACTED]										
2. Event management including room hire, catering and travel for staff and contractors.	[REDACTED]										
3. Creation of literature and media. This may include consultation papers, surveys, information documents and publicity (such as press, information videos and social media).	[REDACTED]										
4. Labour costs for SHE Transmission, Energyline and Social Market Research (note that most of SMR labour costs are listed under Item 1, and some labour is calculated into Item 5).	[REDACTED]										

5. Additional ad-hoc meetings, phone calls, teleconferences on request.

Total [REDACTED]

Table 3: Event and engagement plan

Events	Item Number (see definition above)	Cost	Notes
Licensee workshops x 3 (up to 45 people in each)	1	[REDACTED]	Based on SMR quote
	2	[REDACTED]	Room hire, equipment, catering etc based on three workshops each with up to 45 delegates including project staff.
	3	[REDACTED]	Information packs and documents
	4	[REDACTED]	Labour costs
	<b>Subtotal</b>	[REDACTED]	
Face to face interviews x 60 max	1	[REDACTED]	Based on SMR quote
	2	[REDACTED]	Based on SMR travelling solo to interviewees
	3	[REDACTED]	Information packs and documents
	4	[REDACTED]	Labour costs
	<b>Subtotal</b>	[REDACTED]	
Focus groups x 8 (up to 10 people in each)	1	[REDACTED]	Based on SMR quote
	2	[REDACTED]	Based on room hire, catering and travel for up to 80 people max, and staff travel and subsistence.
	3	[REDACTED]	Information packs and documents
	4	[REDACTED]	Labour costs
	<b>Subtotal</b>	[REDACTED]	
Project set up	1	[REDACTED]	Based on SMR quote
	2	[REDACTED]	SMR travel costs.
	3	[REDACTED]	n/a
	4	[REDACTED]	Labour costs
	<b>Subtotal</b>	[REDACTED]	

		1	[REDACTED]	Regular attendance at BaU statutory authority meetings and additional meetings on request
<b>Regular statutory authority and other party meetings (10+ occasions)</b>	2	[REDACTED]	50% cost split between Future Networks team and Environmental Planning team.	
	3	[REDACTED]	Information packs and documents	
	4	[REDACTED]	Labour costs	
	5	[REDACTED]	Additional meetings with interested parties, calls, teleconferences etc.	
	<b>Subtotal</b>	[REDACTED]		
<b>Report</b>	1	[REDACTED]	Based on SMR quote	
	4	[REDACTED]	Labour costs	
	<b>Subtotal</b>	[REDACTED]		
		[REDACTED]		
Attachments				

It should be noted that these engagement activities will be carried out over the full duration of the project. This will allow opinion and input to be gathered during the development , construction and operational phases of the project.

Project code	SSENO3	Question Number	28
Question date	17 September 2015	Answer date	22 September 2015
Submission section question relates to			
Topic			
Question	Will there be any foreground IP held by Energyline or SSE for any aspect of this project? If so, how will this be dealt with?		
Notes on question			
Answer	There will be no foreground IP held by Energyline or SHE Transmission for this project. The initial work has been funded by NIA in accordance with the IPR arrangements set out in the Governance document. If successful the NeSTS project will be delivered in accordance with the default IPR provisions in the NIC Governance arrangements.		
Attachments			

Project code	SSEN03	Question Number	29
Question date	29/9/2015	Answer date	02/10/2015
Submission section question relates to	Evaluation Criteria (a)		
Topic	Rollout		
Question	<p>The Project Summary suggests that the NeSTS are to be used in areas where deployment of T-Pylons is inappropriate. Does this limit the NeSTS' potential for GB-wide deployment, and hence, limit the applicability of learning to other licensees? Or will it be possible to install the NeSTS across GB, on a wide variety of terrains?</p>		
Notes on question			
Answer	<p>NeSTS is applicable to a wide range of terrain conditions and has the potential to provide for GB deployment and will provide learning to other licensees.</p> <p>There are a wide range of factors which influence the most appropriate support structure for new OHL. For any given project this requires consideration of a wide range of potentially conflicting factors. These include electrical requirements, structural issues, construction issues and environmental considerations.</p> <p>TOs currently have a limited number of options ranging from relatively simple 132kV wooden pole trident lines upto the new 400kV T – pylon. The NeSTS project looks to use the best available technology to provide a new suite of support structures which will fill a “gap” in the current range of solutions.</p> <p>The NeSTS solution has been assessed across a range of terrain conditions to ensure it delivers the anticipated benefits. The modelling work carried out in the initial NIA project used a ground profile which had three components to represent different terrains across GB. These represented south west of England, highland Scotland and a coastal location (Caithness). This gives confidence that the new structures will be applicable across the whole of GB for a given range of electrical, routing and environmental considerations.</p> <p>The letters of support contained in the Full Submission document confirm that the other TOs see the potential benefits from the project.</p>		
Attachments			

Project code	SSEN03	Question Number	30																				
Question date	29/09/2015	Answer date	02/10/2015																				
Submission section question relates to	Evaluation Criteria (b)																						
Topic	Costs																						
Question	Could you provide an estimation of the NeSTS' maintenance and operational costs? How does this compare to the corresponding costs for the traditional designs?																						
Notes on question																							
Answer	<p><u>Corrosion Protection</u></p> <p>Corrosion protection (Painting) of existing lattice steel towers has a significant impact on the lifetime maintenance costs of an overhead line. The comparison of costs for painting the NeSTS supports can be estimated in terms of the surface area and the reduction in effort anticipated.</p> <p>The relative effort cannot easily be quantified at this stage, however, a reduction factor of 0.5 is considered to be a reasonable, conservative estimate. The unobstructed, single-plane, curved surfaces of the monopoles would avoid the difficulties of lattice steel which has angular elements with many arises, corners, and internal angles.</p> <p>The estimated cost reduction factor for painting would be as presented in the table below.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>L8RD M4.9</th> <th>510 Series</th> <th>540 Series</th> </tr> </thead> <tbody> <tr> <td>Surface Area per kilometre (<math>m^2/km</math>)</td> <td>1.09 (A)</td> <td>0.43 (B)</td> <td>0.79 (B)</td> </tr> <tr> <td>Surface Area Reduction Factor (<math>C = B/A</math>)</td> <td>1</td> <td>0.39</td> <td>0.72</td> </tr> <tr> <td>Effort Reduction Factor (<math>X</math>)</td> <td>1</td> <td>0.5</td> <td>0.5</td> </tr> <tr> <td>Cost Reduction Factor = <math>C \times X</math></td> <td>1</td> <td>0.20</td> <td>0.36</td> </tr> </tbody> </table> <p>In the longer term we will explore the potential for the development of automated painting systems to maintain the structures. The project will</p>			Value	L8RD M4.9	510 Series	540 Series	Surface Area per kilometre ( $m^2/km$ )	1.09 (A)	0.43 (B)	0.79 (B)	Surface Area Reduction Factor ( $C = B/A$ )	1	0.39	0.72	Effort Reduction Factor ( $X$ )	1	0.5	0.5	Cost Reduction Factor = $C \times X$	1	0.20	0.36
Value	L8RD M4.9	510 Series	540 Series																				
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Effort Reduction Factor ( $X$ )	1	0.5	0.5																				
Cost Reduction Factor = $C \times X$	1	0.20	0.36																				

	<p>also consider the use of alternate coatings which could further extend and reduce the need for maintenance.</p> <p><u>Material Selection</u></p> <p>Maintenance costs are also influenced by the materials used for construction. Steel is used exclusively in the manufacture of lattice steel towers, and therefore, the need for painting cannot reasonably be avoided during the service life. The material of choice for the NeSTS is also steel, however, the use of Fibre Reinforced Plastic (FRP) for the principal pole elements has not been ruled out. Maintenance costs associated with FRP poles would be significantly lower than for steel, and therefore there is a potential saving to be realised on maintenance costs associated with material selection.</p> <p><u>Outage Costs</u></p> <p>As detailed at the first bilateral meeting of 16/09/2015; the NeSTS utilise a double earth wire arrangement as opposed to the singular earth wire of typical lattice steel towers. This arrangement provides greater operational flexibility with regard to negating the need for double circuit outages as a result of earth wire works. Hence, system operation and constraint costs would be reduced.</p> <p>Furthermore, the NIC programme comprises activities that will identify and assess further opportunities for simplifying maintenance procedures e.g. repair or replacement of support elements or conductor system components.</p> <p>The Stage Gate planned at the end of the first Phase will include an assessment of the lifetime O+M costs.</p>
Attachments	

Project code	SSEN03	Question Number	31
Question date	29/09/2015	Answer date	01/10/2015
Submission section question relates to	Evaluation criteria (c)		
Topic	Project Description		
Question	<p>The Project Summary states that the NeSTS will have a shorter height compared to traditional tower designs, whereas the answer to Q4 states that the 510 series is of a similar height to the traditional tower design. Could you clarify the height differences between the NeSTS and traditional towers, for comparable voltages?</p>		
Notes on question			
Answer	<p>With reference to the Supplementary Answer Form provided for Question No. 6; the optimised Standard Span for the NeSTS has not been determined to date, however, it is expected to be less than 300m. The height of an OHL support is directly related to the Standard Span in that both the height to bottom attachment point and inter-phased spacing reduce as the Standard Span reduces.</p> <p>The tri-form conductor configuration adopted for the 540 Series support would further reduce the height of the support compared to a vertical conductor configuration.</p> <p>On the assumption that the Standard Spans for the NeSTS will be 200m, the heights of the 510 Series and the 540 Series supports would be 29.5m and 25.6m, which compare to the 35.56 height of the L8RD D M4.9 support (which has a standard span of 300m). The height reduction factors for the 510 Series and the 540 Series supports compared to the L8RD M4.9 would then be <math>29.5/35.56=0.83</math> and <math>25.6/35.56=0.72</math> respectively.</p> <p>However, if the Standard Span of the NeSTS were increased to 300m the heights of the 510 and 540 Series supports would be approximately 36.5m and 30.0m respectively. The height reduction factors for the 510 and 540 Series supports compared to the L8RD M4.9 would then be <math>36.5/35.56=1.03</math> and <math>30.0/35.56=0.84</math> respectively.</p> <p>The 300m span NeSTS structures are not fully developed and that optimisation of the Standard Span and therefore Standard Height will form part of the NIC programme.</p> <p>The height of each support is driven by the need to maintain electrical</p>		

	<p>clearances and the contours of the receiving landscape. This is further impacted by the micro-siting of supports to facilitate construction access, availability of crane pads, and of working and lay-down areas. There may be additional requirements by land owners which must be considered. Therefore, across a typical overhead line project the span lengths between supports can vary significantly and are often much less than the theoretical maximum.</p> <p>The NeSTS support structures have been designed to be capable of being raised by the extending the main structure, much like a conventional steel lattice tower, which can have a number of leg extensions added.</p>
Attachments	

Project code	SSEN03	Question Number	32
Question date	29/09/2015	Answer date	02/10/2015
Submission section question relates to	Evaluation Criteria ( c )		
Topic	Project Description		
Question	Will the design and analysis of both the 510 and 540 series be continued throughout the NIC process? Or will one of these be dropped at a certain stage in order to concentrate on only one design?		
Notes on question			
Answer	<p>The principal outcome of the NIA project has identified the potential benefits which could be realised from using monopole rather than lattice steel construction. There are many common features between the two designs and many of the development activities in the design phase will be common to both variants. For example material selection, access arrangements, construction methodology etc. will be based around the use of a monopole.</p> <p>Therefore, the NIC programme include both the 510 Series form and the 540 Series form as part of a unified suite of NeSTS structures, which provide the most appropriate range of supports to satisfy GB requirements.</p> <p>The parallel design phase of the NIC programme will focus on the specific requirements of the selected route. It is anticipated that at this stage the project will begin to focus on a single design.</p>		
Attachments			

Project code	SSEN03	Question Number	33
Question date	29/09/2015	Answer date	02/10/2015
Submission section question relates to	Evaluation Criteria (c)		
Topic	Project Description		
Question	Will it be possible to replace one traditional tower with a NeSTS tower (resulting in one NeSTS tower between traditional towers)? This does not seem possible for the 540 series, due to this design having two cross arms, compared to three found on the traditional designs.		
Notes on question			
Answer	<p>Although the current scope has focused on a route end to end solution, it should be possible to replace one in a series of traditional lattice steel towers with a NeSTS support. The 510 Series support, having a vertical conductor configuration, would be most suited to this scenario. The 540 Series support may also be suitable; however, further studies as part of the NIC project would be required, including: checks on the effects of minor longitudinal angles of deviation along conductors, and checks on inter-phase in-span clearances.</p> <p>The ability of the new designs to be used for sections of a route and to be able to integrate with traditional designs will be considered in the ongoing development of the new suite of supports during the initial design phase of the project.</p> <p>It is worth noting that there are existing lattice steel designs where transition from the typical vertical to a custom designed lower height variants have been incorporated within the route. These bespoke towers have been constructed to meet a particular requirement to provide a lower profile in a specific location.</p>		

Attachments	
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Project code	SSEN03	Question Number	34
Question date	29/2015	Answer date	02/10/2015
Submission section question relates to	Evaluation Criteria (g)		
Topic	Stakeholder Engagement		
Question	<p>According to the Project Summary, stakeholder consultation will begin in December 2016. From reading your answer to Q17, am I correct in saying that this will be the first consumer testing undertaken as part of this project? If this provides negative feedback, how will this affect the project?</p>		
Notes on question			
Answer	<p>The first priority for the initial NIA project was to ensure that designs were electrically, structurally and mechanically sound. This helps to minimise the potential risk of creating new designs which are aesthetically pleasing to consumers, but are impractical in terms of construction, operation or maintenance. This will ensure that we have a robust set of information to allow us to confidently engage with our stakeholders.</p> <p>However, SHE Transmission has an abundance of views from consultation sourced from a wide range of new infrastructure projects. Initial consultation for new infrastructure projects will generally aim to engage with statutory consultees, non-statutory consultees and members of the local community who may be affected by the project. Typical feedback will include official consultation responses from organisations and comments recorded at public consultation events. These provide qualitative and quantitative data on stakeholder opinion and are used to influence and inform routing and other options for new projects.</p> <p>In addition, we have information from the stakeholder engagement activities carried out in earlier NIC projects such as MASC and have also considered the results of consultations carried out on T pylon. This information has given a strong indication of the likely views and concerns of the various stakeholder groupings in relation to OHLs.</p> <p>In terms of the NeSTS project, stakeholder engagement is a vital component in forming the design of the new OHL supports. Stakeholder engagement will take place consistently throughout the project, and will be evaluated to show:</p> <ol style="list-style-type: none"> <li>1. How public perception has been, taking into account the novelty of</li> </ol>		

	<p>the new designs and their impact on visual amenity.</p> <ol style="list-style-type: none"> <li>2. How the views of organisations such as Scottish Natural Heritage, Scottish Environmental Protection Agency, and the Forestry Commission Scotland have influenced our use of foundations and construction practices.</li> <li>3. Our ability to create a deployment ready solution that provides reassurance to other network operators.</li> </ol> <p>Based on the back of the extensive engagement we have done on previous projects we strongly believe that the approach will be favoured by stakeholders however should the feedback differ from this we would assess the impact of this feedback on our deployment assumptions and factor into the gate decision in the project.</p>
Attachments	

Project code	SSEN03	Question Number	35								
Question date	01/10/2015	Answer date	06/10/2015								
Submission section question relates to	Evaluation Criteria (b)										
Topic	Costs										
Question	Could you provide a detailed breakdown of the cost comparison which you have made between the NeSTS and the traditional structures, preferably in spreadsheet format? Which traditional tower structure was used during this comparison?										
Notes on question											
Answer	<p>i) Please find attached the cost breakdown between the new NeSTS structure and a traditional lattice steel structure. The key cost elements are shown in the attached Table 1, along with the cost breakdown for a traditional lattice steel structure and the new NeSTS structure. These cost categories were estimated based on projects which used the L8 tower suite.</p> <p>ii) As indicated in the Full submission document there can be significant variations in cost components depending on project specific requirements. The projects benefits have been assessed using the information included in the TOs Charging Statements, average cost for new OHL infrastructure is shown below:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Base Case Costs per OHL voltage in £000s/km</th> </tr> <tr> <th></th> <th>275kV</th> <th>132kV</th> </tr> </thead> <tbody> <tr> <td>Average Cost</td> <td>£1,468</td> <td>£814</td> </tr> </tbody> </table> <p>ii) The key differences are in the three cost elements below</p> <ul style="list-style-type: none"> <li>• Foundations - further details included in Q25. Foundation costs potentially reduced by upto fifty per cent. This is attached for information. Attached again for information.</li> <li>• Support supply/ construction – simpler structures more readily installed – see Section 3 of Full Submission.</li> <li>• Conductor systems – additional earth wire increases conductor cost – see Section 3 of Full Submission.</li> </ul>			Base Case Costs per OHL voltage in £000s/km			275kV	132kV	Average Cost	£1,468	£814
Base Case Costs per OHL voltage in £000s/km											
	275kV	132kV									
Average Cost	£1,468	£814									

	These are highlighted in green on the attached spreadsheet. The scenario shown assumes a 275kV OHL and a ten percent saving from NeSTS.
Attachments	Table 1 – [REDACTED] SSEN03 – [REDACTED]

Project code	SSEN03	Question Number	36
Question date	01/10/2015	Answer date	06/10/2015
Submission section question relates to	Evaluation Criteria (b)		
Topic	Costs		
Question	What is the monetary value of the project risk/contingency? Is this included in the final total? If so, what percentage is attributed to it?.		
Notes on question			
Answer	<p>SHE Transmission has not included any additional project risk or contingency within the NIC Funding Request. As indicated in Section 6 of the Full Submission the default level of 5% (£332K) of the funding request to safeguard against cost over-runs has been anticipated.</p> <p>Whilst SHE Transmission remain confident in our current cost estimates the Stage Gate at the end of Phase 1 of the project will give an opportunity to consider any additional costs and risks which have not currently been identified. This will be considered in the assessment as to whether the project proceeds beyond the Stage Gate.</p>		
Attachments			

Project code	SSENO3	Question Number	37
Question date	20 October 2015	Answer date	22 October 2015
Submission section question relates to	Criteria (g)		
Topic	NIA Outputs		
Question	<p>Can you confirm whether the output of the NIA project will enable a full suite of transmission tower designs (including light/heavy angle towers; termination towers) to be taken to stage 1.1 of the NIC Project. Will these different tower designs be at the same stage of development by stage 1.1 of the NIC project?</p>		
Notes on question			
Answer	<p>The scope of the ongoing NIA project is to create designs for suspension supports. However, initial designs have been developed for other supports within the suite including suspension, light angle, heavy angle and terminal supports. Full development of all types of supports is not within the scope of the NIA project – this will be completed within the NIC project.</p> <p>The NIC NeSTS project will develop the full range of support structures, to provide a comprehensive suite of supports for the transmission network – this includes all types of supports i.e. suspension, light and heavy angle, and terminal supports. Supports with height extensions will also be developed, and the scalability to other voltage levels confirmed to maximise potential for deployment.</p> <p>This work will largely be completed during Stage 1.1 of the project and will continue to be developed and refined throughout the project. The work done will allow a range of supports to be designed to suit a wide range of potential applications. The detailed design of the supports for a particular project will depend upon the third party requirements/ constraints and the receiving environment including; weather zone, altitude, route etc.</p>		
Attachments			