Electricity Network Innovation Competition Screening Submission Pro-forma

Notes on completion

Before completing this form, please refer to the Electricity Network Innovation Competition (NIC) Governance Document, which details all of the information that you are required to provide. Please use the default font (Verdana size 10) in your submission, the text entry areas are predetermined and should not be changed. The full-completed submission should not exceed 11 pages in total.

Ofgem will publish all the information contained within the Screening Submission.

Funding Licensee

Scottish Hydro Electric Transmission plc

Network Licence Project Partners

None

Funding Licensee area

Scottish Hydro Electric Transmission plc (SHE Transmission) area

Project title

Modular Approach to Substation Construction - (MASC)

Project Summary

The Licensee must provide an approximate Project start and end date.

Transmission Licensees are expecting to build an increasing number of substations over the coming years, mainly to facilitate the connection of renewables. A reduction in design and construction, installation and associated timescales and costs including environmental impact of these substations will directly benefit Transmission Customers.

Equipment suppliers are increasingly offering innovative modular substation components which have been proven in other sectors. We propose to develop and trial an holistic approach which integrates substation components with other innovations in civil works and cabling to create a Modular Approach to Substation Construction. This can maximise benefits to deliver substations which, potentially:

- Are visually and acoustically less intrusive than traditional build models.
- Are more flexible in their ability to allow a timely increase/decrease in capacity in response to network changes.
- Use standard components to achieve economies of scale and reduce costs.
- Are quicker to deploy – potentially accelerating renewable connections.

This project aims to use the learning from an ongoing NIA project (ref NIA_SHET_0013) to develop a modular design, and then complete the installation of a substation. Funding is requested through NIC to meet the additional costs for the development, implementation and testing of modular substation construction on the GB network for the first time. The project is expected to run from January 2015 to June 2019.

Estimated Project funding

The Licensee must provide an approximate figure of the total cost of the project and the NIC funding it is applying for.

Total cost of Project	£51.5m	**NIC funding requested**	£8.75m
Cross Sector Projects only: requested funding from Gas NIC, NIA or second tier LCN Fund?	*If yes, please specify* The Project will not request funding from the Gas NIC or LCNF		

Problem

The Licensee must provide a narrative which explains the Problem(s) which the Project is seeking to address.

The Carbon Plan advises of the requirement for carbon emissions to be reduced by at least 35% of base levels set in 2000 by 2022. This will, in part, be achieved by the low carbon electrification of heating, transport and industrial processes, which is likely to steadily increase electricity demand by between 30% and 60% by 2050. Another factor in achieving this target is the increasing volume of renewable energy generation. Both of these factors mean that extensive work is needed to prepare the electricity network so that it can cope with these changes; investment in substation infrastructure is necessary to provide the additional capacity and enhanced levels of inter connectability required.

Much of the cost of the investment in new and enhanced substation infrastructure will be borne directly by customers. All of the Transmission Operators have similar significant programmes of substation investment which give rise to a number of specific challenges including:

- **Costs and supply chain**: Substations are traditionally designed on a near bespoke basis. This does not offer opportunities for economies of scale in terms of equipment and supplier costs.
- **Substation consents**: Substations are known as being visually detractive to the local landscape and can be inefficient in terms of land use. This results in negative visual amenity impacts, onerous consent processes and high land costs.
- **Flexibility**: Traditional substations are very 'permanent' in nature; there is little scope for easy and low-cost options for expanding or reducing capacity.
- **Design Standards**: Traditional design criteria tend to the peak demand requirements of the connections. In many cases the intermittent nature of the new renewable generators has the potential to lead to poor asset utilisation.
- **Asset Life**: Existing standards and designs are based on a long asset life (typically around 40 years plus). However, wind farms and other renewable energy assets are anticipated to have a much shorter lifespan of typically 25 years. This can result in uncertainties over the long term utilisation of this equipment and the potential for "stranded assets".

A move toward a modular and more "standardised" but flexible design philosophy will present Transmission Owners (TOs) with a range of new opportunities. It is expected that the NIA project (NIA_SHET_0013) will develop designs for a modular approach. This NIC project will develop and demonstrate the designs by implementing them on a planned substation build project. The project will also include additional monitoring and measurement of the new equipment during the operational phase to ensure that the new designs are behaving as anticipated. This will give confidence to introduce these designs on a wider basis.

Method(s)

The Licensee must describe the Method(s) which are being demonstrated or developed. It must also outline how the Method(s) could solve the Problem. The type of Method should be identified where possible eg technical, commercial etc.

SHE Transmission intends to develop and demonstrate a "modular" design approach to a planned substation construction project, which provides value for money and flexibility of use compared to traditional substation models. The modular design approach will reduce the time it takes to deliver and commission a new substation, and will minimise the impact on the environment compared to standard designs. The use of a more modular approach will also potentially allow a more flexible approach to operation and maintenance whilst maintaining safety and reliability standards. This approach also introduces a "next generation" approach to substation design which can be used to enable serial, rather than bespoke, production of substations.

This project will be an early deployment of the learning from an ongoing NIA project which explores solutions, integrating modular substation components with new civil and cabling innovations to create generic type design solutions that can be applied in a range of potential operational scenarios and environments. It will also lead to a more aligned relationship between the asset life and duty cycle of a substation and the assets it serves. Additionally, enhanced modular design will improve visual and aural amenity.

Method(s) continued

The project will be delivered in phases; initially, these are identified as follows, however a confirmed, comprehensive summary will be detailed in the full submission document.

- Develop detailed design solutions, building on NIA outputs;
- Identify specific sites and projects which are most appropriate for the early deployment of the new design techniques;
- Include additional engagement with key stakeholders including planning authorities and other statutory authorities, to incorporate their input into the final substation design;
- Construction of project using new "modular" approach, this will include all aspects of the project including civil works, foundations, fencing and access roads etc;
- Development of new operational practices to suit new designs including training where appropriate;
- Development of new technology specific tools and equipment;
- This will include an enhanced level of monitoring of the new installation to ensure long term suitability over a range of scenarios;
- Monitoring and Evaluation of new designs; and
- Learning and dissemination activities.

The project will be structured such that it delivers learning from the early stages (i.e. during the detailed design phases). However, the overall project duration allows for an extended period of monitoring and evaluation once the equipment is in service to ensure that it is performing as expected.

Funding commentary

The Licensee must provide a commentary on the accuracy of its funding estimate. If the Project has phases, the Licensee must identify the approximate cost of each phase. OFTOs should indicate potential bid costs expenses.

There would be three distinct phases of the project:

- Stage 1: Site Specific Detailed Design up to 18 months - approx. 20% of costs
- Stage 2: Procure and Build – up to 24 months approx 60% of costs
- Stage 3: Monitor and Evaluate - 24 months - approx. 20% of costs

Further details of budget and phasing to be provided in full submission.
The project will build on initial learning and generic solutions done via an existing NIA project. The outputs from this project will have identified a "generic" design for the Modular Substation Solution. The NIC project will start before the end of the NIA project to allow the early deployment of the solution. This will help deliver leering from the NIC project at an early stage.

The bulk of the construction costs for the new substation are already accounted for in the SHE Transmission Business Plan. The NIC funding request would cover the additional costs incurred in planning, implementing and testing this new design for the first time; this takes into account the additional cost of manufacturing low volume items, additional cost and time for deploying novel technology, extensive stakeholder engagement, additional monitoring and evaluation of plant performance and learning and dissemination

It is estimated that bid preparation costs will be in the region of £165k.

Specific Requirements (please tick which of the specific requirements this project fulfils)

A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software)	
A specific novel arrangement or application of existing electricity transmission equipment (including control and communications systems software)	✓
A specific novel operational practice directly related to the operation of the electricity transmission system	✓
A specific novel commercial arrangement	

Accelerates the development of a low carbon energy sector & has the potential to deliver net financial benefits to existing and/or future customers

The Licensee must demonstrate that the Solution has the potential to accelerate the development of the low carbon energy sector in GB and/or deliver wider environmental benefits to GB customers. The Licensee must demonstrate the potential to deliver net financial benefits to existing and/or future customers.

As stated in the Electricity NIC Governance Document, the Network Licensee must provide the following to demonstrate compliance with this criterion:

i. How the proposed Project will make a contribution to the Carbon Plan. In particular the Network Licensee should outline:
- *What aspects of the Carbon Plan the Solution facilitates*
- *The contribution of the rollout of the Method across GB can have in facilitating these aspects of the Carbon Plan*
- *How the rollout of the proposed Method across GB will deliver the Solution more quickly than the current most efficient method in GB; and/or*

ii. How the proposed Project could deliver environmental benefits to customers; and

iii. The expected financial benefits the Project could deliver to customers.

(i) By 2020, the Government expects that 15% of the UK's energy needs will be met from renewable sources, with around 30% of electricity generation coming from renewable sources, as indicated in the UK's Carbon Plan. The plan also estimates that electricity demand could increase by between 30% and 60% by 2050 (see Part 2.144 of the Plan) because of the increased electricification of processes and proliferation of renewable energy. To achieve these targets and meet the anticipated rise in demand, extensive upgrade work is required across the UK's energy networks, including an increase in the number of substations connecting our networks.

In order to meet the anticipated demand for renewable connections and to deliver the associated system reinforcement, SHE Transmission is required to install and commission in excess of 2000MW of new substation capacity by 2025, this is likely to cost in excess of £1bn. The other TOs will have similar requirement to install substations on their network.

The work carried out to date to create modular components for substations, together with new developments in civil and other associated works related to substation build, affords us an excellent opportunity to create a new approach to substation design. The modular substation approach will be faster to deploy, more cost-effective and have less impact on the environment than traditional models while better able to cope with expansion and contraction; this will accelerate the connection of large volumes of renewable energy, which will meet the increased demand for electricity. This comes from the project's enablement of serial, rather than bespoke, production of the substation.

(ii) Standard design substations are generally perceived to have a negative visual impact and can be inefficient in terms of their physical footprint; this can lead to issues with visual amenity, onerous consent procedures and high land costs. The modular approach will reduce the visual and environmental impact of substations. There is also potential to reduced civil works for both the substation itself and for the associated access roads, thereby improving the impact of substations on the environment. In addition to this, the new design will mean faster connection of renewable energy and this will deliver environmental benefits to customers.

(iii) The learning and knowledge provided by this project will allow TOs to reduce the cost of this multi-billion pound investment (resulting in a reduced costs for customers) whilst enabling a faster to deploy and more flexible solution. Savings will be derived from a number of areas including:

- Economies of scale from serial production;
- Reduced civil requirements;
- Reduced construction and commissioning time on site (from increased off site testing and commissioning)
- Greater flexibility to increase/decrease substation rating in the future to meet changing demands.

Initial studies and early engagement with equipment suppliers and stakeholders have indicated that savings of up to 10% may be achievable if this new approach is implemented.

Delivers value for money for electricity customers

The Licensee must demonstrate that the Method(s) being trialled can derive benefits and resulting learning that can be attributed to or are applicable to the electricity transmission system.

As stated in the Electricity NIC Governance Document, the Network Licensee must provide the following to demonstrate compliance with this criterion:

i. What is the potential Direct Impact of the Project on a Network Licensee's electricity network or on the operations of the GB System Operator;
ii. Justification that the scale/ cost of the Project is appropriate in relation to the learning that is expected to be captured;
iii. The processes that will be employed to ensure that the Project is delivered at a competitive cost;
iv. The expected proportion of the benefits which will accrue to the electricity Transmission System as opposed to other parts of the energy supply chain; and
v. How Project Participants have been identified and selected including details of the process that has been followed and the rationale for selecting Project participants and ideas for the Project.

(i) SHE Transmission's Innovation Strategy (January 2012) identifies several high-level innovation objectives which will be positively impacted by the MASC project. They are:

1. Accelerate network development and connections including the integration of increasing amounts of renewable generation.
2. Minimise the cost of providing network capacity.
3. Maximise the use of existing assets to deliver capacity and speed connection.
4. Maintain and improve safety and environmental performance.
5. Maintain and improve network performance.

The concept for this project arose as a result of ongoing work to achieve these objectives, and will have a direct impact against them.

(ii) The learning from the work carried out by the MASC project will provide significant knowledge and learning for all TOs. Initial studies and early engagement with the equipment suppliers suggests that integration to "business as usual" (BaU) practices; using the learning captured from the project could provide savings of up to 10% when compared to a more traditional build substation. These projects typically have very high capital costs, with the vast majority of these costs borne by transmission customers. The learning from the work carried out by the project should contribute directly to reducing both the costs and the risks associated with these projects. This will be beneficial to both current and future customers

In order to fully understand and evaluate the potential of this technology we propose to develop and implement a modular based solution for a planned substation project. To ensure that this new approach is thoroughly tested and validated we believe that this should be done on a project which is of appropriate scale (i.e. MVA rating/voltage) to be sufficiently representative of the range of projects undertaken by TOs. Only by carrying out a project which involves the full scale design and deployment of this new technology will we achieve the level of confidence to adopt this solution on a wide spread basis.

(iii) The project will be delivered in accordance with SHE Transmission's procurement obligations and Large Capital Projects process, to ensure that the MASC project delivers best value. Where appropriate this will include competitive procurement exercises to ensure best value for customers.

(iv) These projects typically have very high capital costs, with much of the costs being borne by transmission customers. Therefore, transmission customers will benefit directly from any savings derived from the project. If this approach is found to be successful then it may be of benefit to other sectors in the supply chain including renewable developers.

(v) The project was developed in response to the objectives outlined in (i) above. The process for selecting the project and its participants involves ongoing extensive stakeholder engagement; this includes other TOs, renewable developers, supply chain and academics as well as a range of internal stakeholders. Engagement is taking several forms; workshops, meetings and presentations have already been held to gauge interest in the project. SHE Transmission will identify partners via a formal selection process wherever appropriate, so as to ensure best value for our customers.

Demonstrates the Project generates knowledge that can be shared amongst all Network Licensees

The Licensee must explain the learning which it expects the Method(s) it is trialling to deliver. The Licensee must demonstrate that it has a robust methodology in place to capture the learning from the Trial(s).

As stated in the Electricity NIC Governance Document, the Network Licensee must provide the following to demonstrate compliance with this criterion:

i. What new knowledge is intended to be generated from completing the Project;
ii. What methodology will be used to capture results from the Project and how the Project's results will be disseminated to other Network Licensees; and
iii. Whether the Network Licensee wishes to conform to the default IPR arrangements as set out in Section B: Chapter 9. If the Network Licensee wishes to deviate from the default IPR arrangements it must outline the proposed arrangements, justify why the arrangements are more suitable than the default arrangements and justify how the new arrangements will deliver value for money for customers.

The development of a modular approach to substation construction will enable the generation of new knowledge from the projects and studies undertaken within it. A full description of the plan to capture learning will be included in the full bid submission.

(i) Learning will be identified in many areas, including

1. Detailed substation design requirements and specification;
2. Protection system requirements and specification;
3. Overall footprint requirements, including civil and access requirements;
4. Options for potential expansion, contraction and redeployment of equipment;
5. Visual impact of new designs;
6. Embedded carbon and losses associated with new design;
7. Utilisation / load profiling especially when looking at renewable connections; and
8. Stakeholder considerations – Planners, Environmental Regulators etc.

(ii) SHE Transmission will use a standard framework to capture results from the project. Knowledge will be disseminated through various methods; these will likely include at least some of the following, although this is not an exhaustive list. A full description of our comprehensive methodology knowledge and dissemination programme will be included in the full bid submission.

- SHE Transmission-hosted events for other TOs and relevant other third party organisations;
- ENA Learning Portal to upload presentations and lectures;
- A project "blog" will be created, with regular updates published on www.ssepd.co.uk;
- Regular press releases will be published as appropriate;
- A e-learning course will be developed to share learning; and
- We may undertake case studies with manufacturers to show best working practice.

(iii) SHE Transmission wishes to use the default IPR arrangements.

Please tick if the project conforms to the default IPR arrangements set out in the NIC Governance Document?	✓

If the Licensee wishes to deviate from the default requirement for IPR then it must demonstrate how the learning will be disseminated to other Licensees and how value for money will be ensured. The Licensee must also outline the proposed alternative arrangements and justify why the arrangements are more suitable than the default arrangements.

It is the intention that the work undertaken using NIC funding will adhere to the NIC default IPR arrangements. However, this will be subject to confirmation depending upon the final outcome of commercial negotiations with equipment suppliers, our project partners etc. If appropriate we will provide further details in the full submission.

How is the project innovative and with an unproven business case where the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness?

Demonstrate why the Licensee has not previously used this Solution (including where the Solution involves commercial arrangements) and why NIC funding is required to undertake it. This must include why the Licensee would not run the trial as part of its normal course of business and why the Solution is not Research.

As stated in the Electricity NIC Governance Document, the Network Licensee must provide the following to demonstrate compliance with this criterion:

i. Why the Project is innovative and has not been tried before;
ii. Why the Network Licensee will not fund such a Project as part of their business as usual activities;
iii. Why the Project can only be undertaken with the support of the NIC, including reference to the specific risks (e.g. commercial, technical, operational or regulatory) associated with the Project.

(i) This project has been developed to take advantage of improved technology and equipment being made available by a wide range of equipment manufacturers and suppliers. This new range of modular and containerised equipment has been implemented in many other parts of the world but has not to date been tested or fully utilised in an integrated way on the GB network. To fully exploit the benefits of this alternative technology will require development and testing of new design and operational practises to allow GB Licensees to use the equipment with confidence as BaU. The development of these new practices in addition to the uncertainty and risk of using equipment for the first time has prevented this technology from being adopted previously.

(ii) Substations are typically very bespoke in nature; they have traditionally had to be constructed with the aim of meeting peak demand with the connection of firm generation. As development and connection of renewable energy increases, the needs requirements of substations have changed. However, substations are costly and the uncertainty and risk mean a single project could not carry the additional cost and uncertainty of developing a new modular approach to substation construction as part of their business as usual activities.

How is the project innovative and with an unproven business case where the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness? (Continued)

(iii) The NIC project will be used to fund the additional costs of developing the new requirements, addressing any changes to existing operational practices required to implement the new designs. We are also proposing that the NIC project includes funds for additional measurement and monitoring equipment to allow the continued assessment of the new equipment once it is in service to give sufficient confidence to apply this approach in a BaU environment. No individual project can justify the incremental cost for these activities therefore; NIC is the most appropriate means of funding these activities.

Project Partners and external resourcing/funding

The Licensee must provide evidence of how Project Partners have been identified and selected, including details of the process that has been followed and the rationale for selecting participants and ideas for the project.

The Licensee should provide details of any Project Partners who will be actively involved in the Project and are prepared to devote time, resources and/or funding to the Project. If the Licensee has not identified any specific Project Partners, it should provide details of the type of Project Partners it wishes to attract to the Project.

We are engaging with active participants in the marketplace, with significant interest being shown in this proposal. A number of collaborative workshops have been held with potential partners to develop the project scope.

We have started working with a range of potential project partners, including possible sources of external funding such as councils and development agencies, both in the UK and in Europe. We have engaged with the supply chain and with manufacturers to ensure that they are supportive of this project. Academic partners will also be selected as appropriate.

We are keen to involve a number of partners in this project and we will continue to engage with potential partners, looking to formalise their commitment and level of support prior to bid submission. The full submission bid will include details of our engagement plans. Commercial sensitivities mean that all partners can be identified only at full bid submission stage.

Derogations or exemptions

The Licensee should outline if it considers that the Project will require any derogations, exemptions or changes to the regulatory arrangements.

At this stage we do not anticipate that the MASC project will require any derogations, exemptions or changes to the regulatory arrangements. However, as we further develop the project and begin to investigate these new solutions in detail, there is potential that we may identify areas which may require us to consider derogations or exemptions.

If necessary we will provide further details of any potential derogations or exemptions in the full submission.

Customer impact

The Licensee should outline any planned interaction with customers or customers' premises as part of the Project, and any other direct customer impact (such as amended contractual or charging arrangements, or supply interruptions).

Any customer or developer who participates in the project will be recruited on a voluntary basis with an appropriate set of commercial arrangements in place to protect both parties.

This project will deploy the new technology in a live environment on a planned substation project – potentially a network reinforcement or renewable connection project. In order to ensure that the project is delivered on time we will continue to develop the conventional solution alongside the innovative alternative. This will allow both alternatives to be fully costed and evaluated before fully committing to deployment.

We do not envisage any direct customer impacts via the project at this stage; however, as we develop the detail of the MASC project and identify the demonstration site we may need to reconsider this position.

Details of cross sector aspects

The Licensee should complete this box only if this Project forms part of a larger cross sector Project that is seeking funding from multiple competitions (Electricity NIC, Gas NIC or LCN Fund). The Licensee must explain about the Project it will be collaborating with, how it all fits together, and must also add a justification for the funding split.

Not Applicable.

Any further detail the Licensee feels may support its submission

The MASC project will allow substation design, construction and operation to make a step change in comparison to the small incremental improvements that have traditionally applied to substation design. This change has partially been initiated and encouraged by our supply chain partners, and we anticipate a healthy response from a number of potential equipment suppliers. We will be looking to enter into an appropriate set of commercial arrangements with the supply chain to minimise risk and protect customers' money.

The NIC funding request will cover the additional costs incurred in planning, implementing and testing this new design for the first time; this takes into account the additional cost of manufacturing low volume items, additional cost and time for deploying novel technology, extensive stakeholder engagement, additional monitoring and evaluation of plant performance and learning and dissemination.

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