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.
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 10 pages in total.
Ofgem will publish all the information contained within the Screening Submission.

Funding Licensee

TC Ormonde OFTO Ltd

Network Licence Project Partners

Funding Licensee area

Offshore

Project title

Development, Testing and Manufacture of a Universal, Subsea, 132 kV Cable Joint

Project Summary

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

This project will seek to fully develop, type test and then manufacture a new cable jointing system which will allow dissimilar sections of 132 kV subsea cable to be jointed together. Having the ability to conduct a subsea cable repair with spare cable which is different to the cable being repaired will bring advantages to OFTO licensees. The advantages relate to the mitigation of risks which could significantly prolong the time needed to conduct a cable repair: jointer availability, availability of spare cable and a ready supply of joints. At this point in time we are in discussion with three potential project partners; all three have partially complete designs for a universal joint which require some further development and then testing. Detailed proposals are still being worked on by the three potential partners; once all three proposals have been received they will be judged against each other on the basis of value for money and technical merit. It is envisaged that the project would have started by Q2 2014, with the project complete by the end of 2014 (subject to availability of testing facilities and the results of the testing).

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	£1.15m	**NIC funding requested**	£1.035m
Cross Sector Projects only: requested funding from Gas NIC, NIA or second tier LCN Fund?	*If yes, please specify*		

Problem

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

Existing repair joints held by OFTO projects necessitate that a cable repair has to be conducted using spare cable of the same specification as the cable being repaired. Each OFTO project holds repair joints (manufacturers' joints) which are unique to the cable on that project. This arrangement creates the following issues:

-- There may not be sufficient spare cable available to enable a repair to be carried out. While all OFTO projects have spare offshore cable, in some cases this may be insufficient for scenarios where a longer than normal section of cable needs to be replaced in a repair (e.g. due to a large amount of cable damage, imprecise fault location, or large areas of water ingress into the cable). Should new cable have to be manufactured for the repair, serious cost and delay will be incurred due to lead time and minimum order length. (lead times of 12-18 months are expected, with a minimum order of 2 or 3 km)

-- Some OFTOs hold as few as two repair joints specific to the cable on their project. This is sufficient for a normal repair, but not if difficulties arise during the repair and an extra joint is required. Procurement of additional joints can have a serious impact on a repair; joints can cost over £100k and can have a sizeable lead time.

-- The repair joints currently held by many OFTOs are manufacturer's joints which require the manufacturer's jointers to be used to install the joints. This causes a risk of delay to a repair should the manufacturer's jointers not be available (as has been the case on some previous subsea cable repairs).

The above issues have the effect of statistically increasing the amount of (offshore) wind farm generation lost due to unavailability caused by export cable faults. Lost wind farm generation results in extra cost to the consumer as well as increased CO2 emissions. The cost and CO2 impacts are examined later in this submission.

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.

A cable jointing system which allows the jointing of dissimilar cables, supplementing the existing cable manufacturer supplied jointing system & spares, will alleviate the problems highlighted above. The main facets required for such a universal joint are:

-- A method of bonding conductors of differing sizes.

-- An insulation/dielectric system which can be applied over a joint between conductors of different diameters, whilst suitably interfacing with the existing cable insulation.

-- A method of jointing the fibre optic cores which are within each cable.

-- Mechanical containment system to provide protection and keep the joint rigid, being able to accommodate the differing diameters of the outer servings of the cables. One of

Method(s) continued

the key roles of the mechanical system is to ensure that the tension from the armour wires either side of the joint won't place any force on the conductor joints. A joint can be subjected to considerable tensile forces during placement on the seabed.

-- Bend restriction, to ensure that the cable and the joint is not damaged during placement on the sea bed (and potentially recovery from the seabed in the future).

Having developed the above components and integrated them into a complete joint, at least one prototype joint must be made (using two samples of cable which have the largest feasible variation in size) and tested to verify joint performance. There is currently a lack of industry standard defining type testing requirements for a rigid subsea repair joint. Therefore, a key part of the project is a consultation with industry and insurers to agree a testing specification which will provide confidence in the performance and longevity of the universal joint. Production joints will then be manufactured under the project and stored by the funding licensee, ready for demonstration should a subsea cable fault occur on the licensees cables.

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.

The funding estimate is based on estimates provided by potential contractors based on preliminary discussions with test labs, including some contingency on account of the amount of uncertainty in the testing scope. The cost of manufacturing three production joints is included in the project cost, providing a store of joints ready for implementation should a subsea cable fault occur, enabling demonstration of the project.

One of the largest factors in the cost of the project is the testing required on the developed joint. The estimated funding figure will therefore remain uncertain until a full testing specification can be agreed with insurers and industry. Contingency is also required should a sample joint fail the type testing, requiring design modifications and re-testing to be carried out.

Project delivery at a competitive price will be ensured through a combination of competitive tendering and professional supervision of contractors. Bid costs are estimated to be £50k.

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.

A universal joint would accelerate the development of low carbon energy (offshore wind) and directly reduce CO2 emissions by expediting repairs of faults which reduce offshore wind output. The universal joint would therefore reduce the cost of offshore wind energy and so reduce costs to customers.

GB offshore wind projects already in service or underway total approximately 1000 km of 132-155 kV 3-core cable (the type of cable targeted by the universal joint). Over the next 10 years additional wind farm connections at these voltages are expected to add a further 1,700 km (source: CCI report for The Crown Estate, July 2012).

Given the probability of cable failure suggested by Cigre statistics, the probability of a fault occurring on one of these cables is likely to rise from approximately 0.5 faults/yr to 1.5 faults/yr over the next 10 years.

For these faults it has been assumed that:
-- There is a 5% probability that sufficient spare cable or spare joints will not be available. (Projects tend to be well stocked initially. However, projects' stocks of spares will deplete over time, increasing the probability that they are insufficient)

-- The repair delays caused by insufficient spares are estimated to range from 2 months (for joints) to 18 months (for cable), with a mean of 6 months

-- There is a 20% probability that specialist jointers are unavailable when required. Two projects in Britain have already experienced situations where the cable manufacturer was unable to provide jointers when required.

-- Repair delays caused by jointer unavailability were estimated to be 2 months.
Thus with one fault every two years, average amount of avoidable delay each year is:
0.5 fault / yr * ((5% * 6mth) + (20% * 2 mth)) = 0.35 months of delay p.a.

Over the next 10 years this would rise to 1 month of delay p.a.

There is a direct CO2 reduction; increased output from offshore wind will displace fossil-fired generation. It can be assumed that having a 132-155 kV cable out of service will reduce wind energy output by 20 GWhr/mth (Source: Vattenfall Shareholder report for Jan-Mar 2012, 132 kV fault at Thanet led to loss of 60 GWhr over a quarter).

Using a Carbon Conversion factor of 0.43 t/MWhr (Source: Ofgem impact assessment of GSR007) the project could stop the emission of up to 8600 tonnes of CO2 per annum.

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.

Delayed cable repairs will reduce wind farm output, increasing the cost per MWhr of wind energy. Ultimately this cost will be passed to consumers through increased support prices needed to incentivise the construction of offshore wind. It has been assumed that:

-- A 132-155 kV offshore transmission cable being out of service will result in reducing wind energy output by 20 GWhr/mth (Source: Vattenfall Shareholder report Jan-Mar 2012, reference to outage at Thanet)

-- Wind power costs £140/MWhr now, falling to £100/MWhr in 10 years time (Source: The Crown Estate, Offshore Wind Cost Reductions Pathways Study, 2012).

Thus the benefit of avoiding cable repair delays is:

(currently) 0.35 months pa * 20GWhr/mth * £140/MWhr = £0.9m pa

(in 10 years) 1 month pa * 20 GWhr/mth * £100/MWhr = £2m pa

The one-off expenditure of circa £1m on the project yields a benefit of between £0.9m and £2m per annum, yielding a payback period of 6 – 12 months.

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).

The knowledge created by the project will largely be contained within the design of the universal subsea joint, which will be validated by type testing to give confidence that the joint is ready for implementation. Access to the the knowledge generated by the project would be made available to all GB network licensees.

It is also envisaged that a long-term commercial framework would be established with the company selected to manufacture and install the universal joint; this commercial framework would enable all GB transmission licensees to purchase and install joints on the same terms, and so would ensure that the benefit of the NIC funding is available to all licensees. Discussions regarding this commercial framework have started and more detailed information will be available within the Full Submission. It is noted that a commercial framework exists for the universal subsea joint used by the telecom industry, and this may provide a suitable model for the power industry.

The other main area of knowledge creation is the specification for the type-testing of the universal joint. As previously stated, there is little precedent set for type testing rigid subsea repair joints. The test specification part of this project will therefore create a specification which can be referenced by the cable industry in the future, possibly helping to form a standard for this type of testing.

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.

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.

The project is clearly innovative as it will develop a jointing technology which currently doesn't exist, allowing new operational practices to overcome the problems caused by the present repair joint methods.

Development of a universal subsea joint without NIC funding is an unattractive proposition for an OFTO. The cost and risk of being the OFTO who invests in the development outweighs the benefits, due to a difficulty in preventing others from also benefiting from the investment. Also, wind generators (not OFTOs) stand to gain the most from a universal subsea joint, through enjoyment of increased revenues from the higher generation outputs attributable to a minimisation of cable repair times.

Another barrier to the project being developed as part of 'business as usual' is the fact that OFTOs do not have the capital available to fund such up-front development costs, this is one of the features of cost effective non-recourse project financing.

The NIC funding would therefore allow the universal subsea joint concept to overcome the current barriers to it's development, producing a product ready to be utilised by GB Network Licensees.

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.*
Project ideas were developed from one or more of the following sources: i) Concepts brought to our attention by third parties (e.g. suppliers and the wind farms that we serve). ii) Concepts developed internally based on needs identified by our asset managers. iii) Concepts in wide circulation in the offshore-cable industry, with their benefits generally acknowledged, but which have previously not been possible to implement because the benefit to any single party is insufficient. Ideas were then filtered based on: i) the strength of their cost-benefit case for the electricity consumer, this being seen as a good proxy for the probability of bid success. ii) whether they had a level of technical risk appropriate for innovative new approaches that could, with funding, could rapidly be applied to actual in-service assets. iii) the soundness of their business case. This idea (universal joint for subsea cables) had previously been in circulation in the industry, having been very successfully applied to subsea telecom cables. It was also identified by our asset managers and internally developed. At the time of making this submission, three companies have presented proposals setting out their concepts for a universal subsea joint. Each company has their own pre-existing concept/initial design for achieving a universal subsea joint. A competitive process is being run, whereby the proposal from each company will be scrutinised and assessed on the grounds of value for money and technical merit. The technical details presented in the proposals will be considered, as well as the experience and track record which each company has in relation to similar development projects. An objective decision will then be made to select the most suitable company to partner with on the project. This will ensure that value for money will be achieved by the project, as well as maximising the chances of success through selecting a company with sufficient technical knowledge, competence and experience to be able to develop a universal joint which will pass type testing.

Derogations or exemptions

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

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).

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.

Any further detail the Licensee feels may support its submission
The paragraphs below describe why NIC funding is required: Although the benefits of a universal joint to the electricity industry (and ultimately the electricity consumer) are very substantial, the majority of this benefit comes through increased renewable generation. Whilst OFTOs as a whole will also benefit, no individual or related group of OFTOs could justify the costs. In principle a group of OFTOs and generators could agree to jointly fund the manufacture and testing of universal joints. However the key background IP (the joint technology itself) is held by manufacturers who will not wish to restrict their sales by entering into an agreement to only provide the technology at a competitive price where the purchaser is one of the parties who have funded testing. This gives rise to a "free rider" problem – generators and OFTOs will not be willing to fund the testing costs if others will then get the same benefit without paying. Manufacturer are also unwilling to take the risk of the investment as they cannot be sure that the market will value it. In addition the financial structure of OFTOs (which is designed to minimise the cost of capital, and hence the cost to NETSO and ultimately the consumer) makes it difficult to fund projects outside the normal range of operation and maintenance activities for which budgetary provision has been made – even if the expenditure is expected to ultimately reduce long-term costs. The failure of this technology to emerge, despite widespread industry agreement that it would be attractive, demonstrates the barriers described above.
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