

SIF Beta Project Registration

Date of Submission

Aug 2023

Project Reference Number

10068217

Project Registration

Project Title

Velocity design with hydrogen - Beta

Project Reference Number

10068217

Project Licensee(s)

SGN

Project Start

Aug 2023

Project Duration

30 Months

Nominated Project Contact(s)

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Project Budget

£6,554,978.00

Funding Mechanism

SIF Beta - Round 1

SIF Funding

£5,912,134.00

Strategy Theme

Net zero and the energy system transition

Challenge Area

Data and digitisation

Lead Sector

Gas Distribution

Other Related Sectors

Lead Funding Licensee

SGN - Southern England (inc South London)

Funding Licensees

Collaborating Networks

Cadent

Technology Areas

Green Gas

Summary

This project is undertaking 'full-scale' testing with the aim of validating models for erosion, vibration, noise, and particle transportation in hydrogen flow conditions that would likely exist in a converted natural gas network for the purpose of contributing to the heat

transformation necessary to meet the 2030 and 2050 emissions targets. The project meets the Heat challenge aims to "produce insights and findings which facilitate decision making for low carbon heating by the energy networks, industry and government".

Project partners include all the gas distribution network operators (SGN, Cadent, NGN and WWU), National Gas Transmission, Institution of Gas Engineers and Managers (IGEM), and DNV. Collaboratively working with these project partners, we aim to understand how hydrogen network constraints can be minimised at the lowest economic cost.

The energy network innovation for hydrogen networks has evolved in recent years from desktop studies to multiple large-scale tests, and several live trials, for example HyDeploy, and proposed future trials such as H100 and the Hydrogen Village trials.

The Discovery phase of the project established that there was insufficient data that could be relied on to define suitable design standards for Hydrogen and Hydrogen-Natural gas mixtures in UK gas pipes.

The Alpha phase of this project was predominantly desktop based and included the following activities:

- erosion modelling
- particle transport modelling
- vibration and noise modelling
- laboratory scale tests to investigate possible synergistic hydrogen embrittlement and erosion]
- a conceptual design of full-scale test facility
- a draft test plan for undertaking tests to assess/ validate the hydrogen velocity models
- cost/ benefit modelling to assess the remediation costs associated with hydrogen velocity limitations

The perception of the challenge involved with higher hydrogen velocities has remained largely constant, however it has become apparent that there is an increasing need to communicate with other ongoing projects to ensure efficiencies and compatibility of proposed solutions, and that it will be important to ensure that a standards body such as IGEM is involved throughout the project to ensure industry buy-in.

The key users for this demonstration project are the gas distribution and transmission network operators who need to understand how to apply safe hydrogen design velocity limit to their networks, to ensure the integrity of the pressure system is maintained whilst supplying the required energy output, at the lowest economic cost

Project partners:

SGN, WWU, Cadent, NGN, National Grid Gas

The gas distribution and transmission networks are responsible for the design, operation, maintenance of the existing natural gas networks, with expertise and competence in managing below ground and above ground pipelines and installations.

Institution of Gas Engineers and Managers (IGEM)

A professional institute, and the authors of the majority of gas transmission and distribution standards used to design, operate, and maintain the UK's gas networks. IGEM's technical committees are responsible for technical and editorial updates of the standards, which are then adopted by the gas network operators for use in business as usual.

DNV

DNV is a global leader in technical assurance and risk advisory for oil and gas. The DNV team in the UK has subject matter experts in materials and fitness for service, and in the design, construction and operation of full-scale test facilities which utilise the Spadeadam test site. DNV has experts that have provided technical assurance for the gas distribution and transmission network operators for decades.

The aim is to use the outputs from the full-scale tests to validate models that can be used to set new hydrogen velocity limits that are supported by both theoretical and empirical data. Validation is required as the networks could be operated in a regime where velocities are much higher than those in any previous validation testing and historical operating experience.

The new velocity limits will allow the gas distribution and transmission networks, and any of their design sub-contractors, to design future hydrogen networks to maintain the systems integrity at the lowest economic cost.

Project Description

The project will establish safe design gas velocity limits for the UK industry to use in re-purposing gas networks in the UK to safely deliver 100% hydrogen.

Hydrogen carries approximately one-third of the energy per unit than delivered by natural gas. Therefore, an increase in mass flow can be expected to deliver the same heat energy to consumers using hydrogen.

Design gas velocity limits are used by network designers to ensure there is no integrity risk to pipe components caused by erosion, noise, or vibration from excessive gas velocity in the pipes.

While current design codes use gas velocity limits proven to be safe in designing networks carrying natural gas by long standing practice, no suitably valid and representative data has been gathered to establish safe limits while carrying hydrogen in UK gas distribution networks.

If hydraulic modelling of gas networks shows gas velocities in the networks that exceed the safe velocity limits, additional pipe must be

installed (network reinforcement).

This project will deliver a test campaign, on a full-scale test rig, to produce data that will be accepted by the industry and the professional body representing gas engineers in the UK as valid to amend the design codes to ensure the safe transport of hydrogen in UK gas distribution infrastructure.

Analysis completed in previous phases of the project show significant network reinforcement costs can be avoided during the energy transition if the gas design velocities can be safely increased from current limits.

Add Preceding Projects

10037659 - Velocity Design with Hydrogen – Alpha

Nominated Contact Email Address(es)

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Project Description And Benefits

Applicants Location

SGN

St Lawrence House, Station Approach, Horley, England, RH6 9HJ

DNV

Location of project work:

DNV Spadeadam, Brampton, CA8 7BB

DNV Loughborough, LE11 3GR

Location of demonstration (test rig and testing campaign):

DNV Spadeadam, Brampton, CA8 7BB

Project Short Description

Hydrogen gas does not have the same energy content as natural gas, so, to deliver the same energy requirement, the volume of hydrogen flowing to consumers would have to increase a little over 3 times for a 100% hydrogen network, compared to natural gas. As existing networks are re-purposed to carry hydrogen-natural gas mixtures and ultimately 100% hydrogen, either an increase to the pressure, an increase in gas velocity, or an increase in the effective diameter (reinforcing) of the pipelines would be required. Increasing the pressure is not feasible for many parts of the networks and replacing/ reinforcing pipelines is costly. Therefore, increasing the velocity is the most feasible low-cost option.

Network designers are required to limit the velocity of gas in the networks at design (peak demand) conditions to prevent erosion from entrained debris or damage from noise and vibration.

This project will undertake testing at the DNV Spadeadam test facility which aims to validate hydrogen velocity models for erosion, vibration, noise, and particle transportation, to enable safe design velocity limits for gas networks with the purpose of providing low-carbon heat for domestic and non-domestic.

Innovation Justification

Gas engineers are required to design pipe networks to ensure that, at peak energy delivery, the velocity of the gas does not exceed limits. These limits are to protect pipe components from the effects of erosion from entrained debris, or noise and vibration.

As Hydrogen delivers approximately one-third of the energy per unit compared to natural gas, the re-purposing of existing assets to deliver the same energy demand will require an increased flow of gas.

If the design velocity limit is too low, substantial unnecessary reinforcement costs will be incurred as existing infrastructure is transitioned to carry hydrogen. If the design velocity limits are too high, asset integrity risk will be increased.

The current design velocity limits (natural gas) are long standing safe industry practice. However, there has been no suitably representative research done on the velocities at which Hydrogen will start to entrain debris and to a level that causes excessive erosion or causes other hazards due to excessive noise or vibration.

The Discovery and Alpha phases of this project showed:

- Insufficient valid data on the behaviour of 100% hydrogen and hydrogen-natural gas blends to reliably establish safe velocity limits for these gases in UK gas infrastructure
- The requirements of a full-scale test campaign to be conducted along with a cost-benefit model to establish safe design velocity limits in representative conditions.

An industry and stakeholder engagement plan, in the Beta Phase scope, ensures that the project results are accepted as valid and credible by the industry and used to develop design codes and standards.

The gas engineering professional body, IGEM, will:

- Lead industry workshops to allow experienced professionals to challenge the design of the test rig and the planned test campaigns
- Commission a standards committee to develop suitable design standards for the industry.

The post-project results will be:

- IRL 7 - The integration of technologies has been verified and validated with sufficient detail to be actionable: The results of the project can be relied upon to build safe design standards.
- CRL 8 -- Market Introduction: The design standards are available for the industry to incorporate into their business-as-usual

practices. The final CRL level 9 - Full Launch, may take some period after completion as network operators implement the practices into their design of networks to be "hydrogensafe".

The test campaign will be run on a test rig constructed at DNV's Spadeadam test facility in Cumbria, making maximum use of the facilities and equipment already available.

A full-scale test rig is:

- Needed to test actual pipe components and materials used in UK gas infrastructure under the same operational conditions.
- Limited in the upper size of pipes tested to optimise the costs against data validity. Larger sizes of gas transmission pipe are less prone to erosion and vibration due to their size and are designed to be cleaned. This also saves substantial costs in the building of the test rig.
- Required as re-creating operational conditions at lab-scale is technically challenging and costly.

As the results of this project will be of benefit to the whole industry and ultimately consumers during the energy transition, SIF funding is the best way to deliver this work. Network operators cannot fund this innovation research in their business-as-usual activities as

- It is required to build the safety case for the impending hydrogen transition
- They must ensure valid designs before they can introduce hydrogen into their networks.

The project goes beyond incremental innovation by delivering data to drive improved design standards used by the whole industry. SIF also provides an open platform for sharing knowledge and project outputs, allowing for benefits to be shared to the wider industry. Some counterfactual solutions have been considered and the outcomes detailed below.

Suitably representative testing done elsewhere or in other industries:

- None found

Apply existing design velocity limits:

- There will be substantial reinforcement costs that consumers will have to pay for to transition to low carbon heating.

Cleaning the networks:

- This is feasible (and common practice) for large diameter gas transmission lines that are designed to have cleaning equipment ("Pigs") passed down their length.
- However, the smaller diameter pipes in lower pressure distribution networks and service connections cannot be practically and economically cleaned for several reasons.
- Much of the debris present in these networks is legacy from town gas distribution and the lower pressures increase the possibility of ingress of debris. Further, the pipe diameters and design of the fittings make it impossible to run pigs through the pipes.
- To flush the pipes in multiple branched lower pressure networks, sections must be physically isolated that can be flushed using a suitable medium (that must then be captured and safely disposed). Each section must then be re-integrated, without any flushing media being retained, and without affecting security of supply to consumers. This cost is prohibitive.

Impacts and benefits

The project will deliver cost reductions in operating the networks and wider energy system.

Alpha phase network modelling looked at the network reinforcement requirements, using current design velocity limits, needed to convert a single low pressure distribution network (Dundee used as a sample site) to 100% hydrogen.

The Dundee LP network has 575 km of pipe and was chosen as it was considered to be representative of a medium sized distribution network in the UK.

The modelling showed that if the Dundee network was to deliver the same energy with 100% hydrogen while maintaining the required pressures (to ensure the safe operation of downstream appliances) throughout the network, the addition of 17.7 km of pipe at an indicated cost of £5.7 million would be required.

If gas design velocities are limited in this model to the current design standards (40 m/s and 20 m/s), the additional reinforcement cost would be increased to £5.9 million.

The total UK gas distribution network is made up of approximately 277,000 km of pipe (of which about 93% is LP networks) and 23.6 million service connection pipes (connecting Consumer's meters to the gas distribution pipe).

Work completed in the Hydrogen Ready Services project, part of the NIA funded H21 suite of projects, showed that that approximately 15 million services would have a future supply issue on 100% hydrogen, based on a 5 mbar pressure drop criteria, 20 million if the velocity restriction (currently 15 m/s) cannot be increased at times of peak demand.

Also built into the CBA is assumptions around the likely change in number of consumers receiving heat energy from hydrogen after the energy transition using latest future energy scenarios produced by the Energy Systems Operator.

The Cost Benefit Analysis submitted with this proposal (in the Project Management Book) analyses the reinforcement costs that can be avoided if the design gas velocities can be safely increased, using conservative assumptions around the likely hydrogen energy

consumption after the energy transition.

The CBA shows that the Whole Life NPV delivered to Consumers by the delivery of this project will be £1.55 billion, defined in the Adopted Option 1 in the CBA.

A more conservative Rejected Option 2 in the CBA is based on the project showing that a marginal increase in design velocities is safe, resulting in a reduction in reinforcement costs avoided, and delivers a Whole Life NPV of £383million.

NPVs over shorter periods for Adopted Option 1 in the CBA:

1 year: £0.08 million

3 year: £0.35 million

5 year: £19.37 million

10 year: £107.2 million

Should the project results indicate a marginal increase in design velocities is safe, the shorter term NPVs from the Rejected Option 2 in the CBA would be:

1 year: £0.08 million

3 year: £0.35 million

5 year: £4.23 million

10 year: £25.73 million

The Beta phase Total Project Cost is £6,554,978.00 of which £5,912,134.00 of SIF funding is proposed.

In the Beta Phase, additional analysis will expand to include the effects of design velocity on medium and intermediate pressure networks, Pressure Reducing Stations (PRS), other Above Ground Installations (AGI).

The analysis will use the test data delivered by the project to evaluate the optimum cost-benefit to balance reduced reinforcement costs without increasing integrity risk to UK networks during the energy transition.

Project Plans And Milestones

Project Plans, Milestones & Risks

The Beta phase has six work packages:

Work Package 1: Test facility (DNV Spadeadam). SIF Funding: £3,896,082.00

Work package lead: DNV

Work package support: SGN, Cadent, WWU, NGN, National Grid Gas, IGEM

DNV will undertake the detailed design, safety studies, construction, operation, and maintenance of a test rig at Spadeadam to undertake the following tests in representative hydrogen velocities:

- erosion
- particle transportations
- vibration
- noise

The test rig will utilise existing infrastructure and equipment at Spadeadam, such as high-pressure storage vessels.

Work Package 2: Testing (Erosion and particle transportation): SIF Funding: £816,373.00

Work package lead: DNV

Work package support: SGN, Cadent, WWU, NGN, National Grid Gas, IGEM

DNV SMEs will compile a detailed test schedule for erosion and particle transportation tests and ensure the test rig allows all required outputs to be delivered. Comparison of the test results with industry models will enable suitable allowable velocity limits to be determined.

Work Package 3: Testing (Noise and Vibration): SIF Funding: £354,273.00

Work package lead: DNV

Work package support: SGN, Cadent, WWU, NGN, National Grid Gas, IGEM

DNV SMEs will compile a detailed test schedule for noise and vibration tests and ensure the test rig allows all required outputs to be delivered. Comparison of the test results with industry models will enable suitable allowable velocity limits to be determined.

Work Package 4: Cost-benefit analysis: SIF Funding: £276,724.00

Work package lead: DNV

Work package support: SGN, Cadent, WWU, NGN, National Grid Gas, IGEM

DNV will build on the Alpha phase outputs to analyse the effects of hydrogen velocities on a wider range of asset types and operating pressures to gain a more accurate understanding of the remediation costs required to upgrade UK network infrastructure. We have assumed that five additional network models (three low-pressure and two medium pressure/intermediate pressure) will be sufficient for this work pack.

Work Package 5: Stakeholder engagement and project management: SIF Funding: £315,741.00

Work package lead: DNV

Work package support: SGN, Cadent, WWU, NGN, National Grid Gas, IGEM

DNV will work with the project partners to obtain industry buy-in to the project outcomes to allow velocity limits to be applied in their business at the end of the project (assuming the decision is made to enable hydrogen transmission and distribution for heat). The following tasks will be included:

- Monthly meetings with all project partners
- Communicate with other related SIF projects and hydrogen research
- Three workshops with IGEM technical panel experts
- Collation and review of debris experience related to high velocities, i.e. high gas use customers
- Monitoring officer reviews, external communications/presentations
- Project management

Work Package 6: Project Partners input Beta Phase: SIF Funding: £252,941.00

This is a combined work package to cover the input of the project partners, including the Lead Partner SGN over the duration of the Beta Phase of the project.

Success criteria

The project aims to "produce insights and findings which facilitate decision making for low carbon heating" by providing evidence to support validation of industry models for erosion, particle transport, vibration, and noise. The models should be accepted by the industry to enable the safe design of hydrogen networks at the lowest economic cost.

Successful outputs are the evidence base and acceptance of models to be used to determine safe design parameters for hydrogen networks.

Main Risks

A risk with any project focussed on hydrogen for heat is that policy decisions on hydrogen will depend on many factors including supply chain feasibility and system resilience. Also, the Gas Safety Management Regulations (GSMR) do not currently permit the transport and supply of 100% hydrogen for heat.

Early modelling in the Alpha phase has shown that higher hydrogen velocities may be permitted, however there is the possibility that the full-scale test results do not support a significant allowable increase in the velocity limits.

Risks will be identified and managed in the risk register by the project lead and monitoring officer.

The nature of this project, being a test schedule that can only be undertaken once the test facility has been constructed, means that most of the investment in the project infrastructure must be made prior to the testing commencing.

Any critical test results or findings will be shared with the project partners and escalated as a risk mitigation if it is deemed that they do not enable the project success criteria to be met.

Stage Gates

In the engagement strategy, to aid in taking project outcomes into "business-as-usual", workshops have been scheduled at key points of the project where partners and stakeholders can challenge the designs, test campaigns and outputs.

Should any of these challenges result in a substantial change to the scope of the project, the project partners will approach UKRI to agree the necessary changes, including halting the project if it is apparent that little of value will be delivered by proceeding further.

Regulatory Barriers

The impact of this project on regulatory barriers:

- This project, and all projects that are gathering evidence for the potential to transport hydrogen for heat, are being undertaken with the knowledge that they are contributing to the research and development and testing programme that will enable strategic decisions by 2026 on the role of hydrogen for heat as stated in the Government's 'UK Hydrogen Strategy'. A decision to progress with hydrogen would enable the creation of a hydrogen gas safety management regulations, as the current gas safety management regulations does not permit the transport and supply of 100% hydrogen.
- Relevant design codes and practices that are published by IGEN have been developed for natural gas. Some of these documents such as IGEN/TD/1, IGEN/TD/3, IGEN/TD/4, IGEN/TD/13 specify restricting velocity limits for natural gas that would likely be exceeded when transporting hydrogen and providing the same energy output. These will be appropriately revised to account for the project outcomes. IGEN is a partner in the project to ensure the project outcomes are a valid basis for the revisions.
- "Licence to operate" regulations that UK Gas Distribution network operators demonstrate compliance with include health & safety (regulated by the Health & Safety Executive), supply and customer protection standards (Regulated by Ofgem). Network operators who are partners in the project will take the amended IGEN standards into their work processes to demonstrate continued compliance.

Business As Usual

The route to "business-as-usual" for this project's outcomes is through the project stakeholder engagement strategy.

The engagement strategy has two key components:

1. All UK gas distribution network operators are partners in the Beta Phase of the project and will ensure that the project scope and outcomes are valid and reliable for their business. The networks have indicated that there is a desire to adopt safe validated hydrogen velocity limits that have the potential to allow hydrogen network conversion at the lowest economical cost.
2. IGEN, the professional body responsible for issuing design standards and codes of practice for use by gas engineers were partners in the Alpha phase and will continue to be project partners in the Beta phase.

IGEM has a specific role within work package 5 'Stakeholder Engagement' where regular communication in addition to 3 workshops are planned to ensure that IGEN technical panel members are involved with discussions prior to testing, and will peer review the test outcomes and conclusions, thus maximising the potential for successful findings to be incorporated into IGEN hydrogen supplement standards.

During the Beta phase, IGEN will convene several industry workshops at key stages of the project where industry professionals will be invited to provide input to maximise the outputs from the test campaign and ensure alignment with the IGEN hydrogen supplement standards.

Once the test results are validated, Members from the relevant IGEN standard technical panels to review and accept the results for use in the hydrogen supplements to IGEN standards IGEN/TD/1, IGEN/TD/3, IGEN/TD/4, and IGEN/TD/13.

Commercials

Consumer interaction and engagement

The project engagement strategy includes network operators and IGEM, the professional body. No direct interaction with consumers is planned in the Beta phase of the project, however the gas networks have committed to gathering any debris related evidence related to known high gas velocities and the potential issues and solutions for customers with high consumption, such as power stations.

There are significant research projects that are providing the evidence base on the impact of hydrogen supply for domestic and non-domestic consumers, such as the hydrogen village project, where a live trial is planned at the location of Whitby or Redcar.

The scope of this SIF project terminates at the consumer's ECV, (next to the meter) so the effect of hydrogen velocity on downstream installations and appliances in consumer's premises is excluded. Note that the effect of hydrogen in consumer's premises are being evaluated in other projects, including the village trial projects.

Once the project outcomes have been suitably incorporated into "business-as-usual", we can anticipate that the project will be part of the proof that the industry will use to demonstrate the safety case for operating gas distribution assets in the UK containing hydrogen-natural gas mixtures and 100% hydrogen through the heat energy transition.

The project testing is being undertaken outside of the gas networks at the DNV test facility in Spadeadam, to avoid any potential interruption to customers during the tests.

Supply shortages and interruptions

This project will be delivered on test equipment, isolated from operational gas supply assets, installed and operated at DNV's Spadeadam test facility.

No shortages or interruptions or interruptions of supply to consumers will be caused by the implementation of the project.

The outcomes of the project, when incorporated into relevant design standards, will ensure that consumer's security of supply is maintained when the gas distribution infrastructure is transitioned to conveying hydrogen-natural gas mixtures and 100% hydrogen.

Commercialisation

This project will produce outcomes that can be used by all UK gas transmission and distribution operators to maintain the safe and efficient supply of heating gas through the energy transition.

The test outcomes will be accepted by the project partners: SGN, Cadent, WWU, NGN, National Grid Gas, IGEM and DNV. The assessments that follow the testing aim to enable the validation of models for erosion, particle transportation, vibration, and noise, which can then be incorporated into design standards.

IGEM authors the main design standards for transmission (IGEM/TD/1), distribution (IGEM/TD/3), and service (IGEM/TD/4) pipelines, and pressure reduction installations (IGEM/TD/13). In addition to this the gas transmission and distribution networks have their own design specifications which refer to the 'parent' IGEM standards.

Having IGEM, and the gas transmission and distribution operators as project partners ensures that the project direction is consistent with the management and update of the standards and specifications, and that the acceptance of updates into the standards for use as business as usual is maximised.

The design standards issued by IGEM will be available to gas network designers and network operators, regardless of whether they are partners in the Beta phase of the project.

Intellectual Property Rights

The IPR arrangements for project will comply with the Chapter 9 SIF Governance document. The work products that could constitute Foreground IPR consist of:

- Design of the test rig.
- The results of the test campaigns.
- The cost benefit analysis.

The partner's retained Background IPR includes:

- The knowledge skills, expertise to design, build and operate the test rig.
- The expertise to design and deliver the test campaigns.
- The distribution network simulation models built by the network operators.
- The hydraulic modelling software used to analyse the distribution networks so the cost-benefit model can be built.
- The knowledge, skills and experience in the safe operation and maintenance of gas networks in the UK.

The Foreground IP developed by the project will be freely shared with industry and used by IGEM to develop new design standards for use by all network designers.

To the extent that this Foreground IP could be licenced, a royalty-free licence to use the Foreground IP will be available for use by IGEM and the industry stakeholders who use it to develop new design standards to be assured of safe and reliable gas network designs.

Costs and Value for Money

The total Beta Phase of the project will cost £6,554,990.00 of which the partners are requesting SIF Funding for £5,912,134.00.

The contribution by partners has been funded through:

- Reduced contingency (Higher risk of cost over-runs to be carried by partners) and margins.

Contributions-in kind have been estimated using UKRI guidance and HMRC depreciation rates. Payment-in-kind contribution consists of:

- Contribution of existing equipment and materials to be incorporated in the test rig
- Contribution of the indirect and overhead costs required to maintain the safe operation of full-scale test rigs and the test campaigns at DNV's Spadeadam facility as an upper tier COMAH site.
- Hydraulic simulation software license required to complete the network modelling component of the project cost benefit analysis outcome.
- DNV senior leadership time to sponsor the project
- Use of conferencing facilities, provision of site tours & demonstrations and workshops as well as publicity material

Partner's contributions to the project combine to a total of 20.59% of the SIF Funding Offer.

Suitably capable and skilled sub-contractors will be employed to construction of the test rig at Spadeadam. The components of the test rig will be sourced from approved suppliers.

Suppliers and sub-contractors will comply with DNV's Supply Chain Code of Practice.

The scope of the Beta phase of the project was defined in the Alpha phase of the project. The scope was agreed by the partners to be the minimum required to deliver the outcomes needed.

In building the project cost, the partners have ensured that:

- The design of the test rig uses the minimum equipment, materials and consumables to deliver the required test outcomes.
- The test rig design re-uses as much of the equipment, material, and supporting systems available at DNV's Spadeadam facility as possible.
- The scope of the test campaigns and requirements of the test rig have been defined in the Alpha phase of the project to produce the minimum outcomes required to be accepted as a valid basis for incorporation into new design standards.

The project costs have been assembled using rates that are competitive with the supply of similar skilled consultancy services to the UK market.

Document upload

Documents Uploaded Where Applicable

Yes

Documents:

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SIF Beta Project Registration 2024-04-18 11_43

This project has been approved by a senior member of staff

Yes