



**COMHAIRLE NAN EILEAN SIAR**

**SCOPE OF REQUIREMENTS**

**For:**

**SUPPLY OF  
HYDROGEN FUELLING STATION FOR H2SEED PROJECT**

**TO**

**COMHAIRLE NAN EILEAN SIAR  
TECHNICAL SERVICES DEPARTMENT  
H2SEED PROJECT**

**Reference: TSC/PR/01:036**

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# SCOPE OF REQUIREMENTS

## 1. Background

- 1.1. The H2seed Project is the second phase of the Hebridean Hydrogen Project. The Project covers the whole value chain of hydrogen technologies: hydrogen production from renewably generated electricity, hydrogen storage, hydrogen fuelling station and hydrogen use in both stationary and transport applications.
- 1.2. A fuelling station is required to store and dispense hydrogen generated by an electrolyser with an output of 5Nm<sup>3</sup>/h at a pressure of 30bar. The electrical supply to the electrolyser will be generated from renewable resources and therefore hydrogen generation will be intermittent. It is anticipated that hydrogen will be produced for between six and eight hours per day.
- 1.3. As well as developing hydrogen infrastructure, an important element of the H2seed Project involves raising awareness. The Comhairle is committed to:
  - a) Enhancing local workforce skills through training in the use of, and maintenance of, hydrogen technologies;
  - b) Providing training for local emergency services; and,
  - c) Engaging with the public to promote the potential of a hydrogen economy in the Outer Hebrides.

## 2. General System Specifications

- 2.1. The refuelling station will comprise the following subsystems:
  - a) Hydrogen low pressure buffer storage system (up to 30bar working pressure);
  - b) Hydrogen compressor;
  - c) Hydrogen high pressure storage system; and,
  - d) Hydrogen fuel dispenser.
- 2.2. The refuelling station must:
  - a) Be based on proven technology;
  - b) Be suitable for installation outdoors in an environment with a high saline air content such as found in a coastal location;
  - c) Include a hydrogen leak detection system;
  - d) Include an automated Nitrogen purging capability;
  - e) Provide a record of refuelling events, or charge/discharge cycles;
  - f) Have an easy to use Human Machine Interface; and,
  - g) Include reference, operation and maintenance manuals for each sub-system and the system as a whole as described in Condition 41 of Section 2

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2.3. All equipment must be able to operate with hydrogen with the following characteristics:

- a) Hydrogen purity >99.995%;
- b) Hydrogen dew point < -50°C (worst case); and,
- c) Contamination limits of O<sub>2</sub> in H<sub>2</sub> <10 ppmvol and N<sub>2</sub> in H<sub>2</sub> <10 ppmvol.

2.4. The control system should be a PLC based system remotely monitored using TCP/IP protocol. An optional OPC server integrated in the system to allow operation with SCADA programs will be viewed favourably.

2.5. Power supply may be either:

- a) single phase 230VAC@50Hz, **or**
- b) three phase 400VAC@50Hz.

2.6. The supplier must provide evidence of a QRA (Quality Risk Assessment) or a HAZOP (Hazard and Operability) evaluation.

### 3. Subsystem Specifications

3.1. Hydrogen Low Pressure Buffer Storage System

- a) Design pressure: 30bar.
- b) Capacity: The buffer storage must be capable of storing the hydrogen produced in a twenty-four hour period under normal operation and assuming the following:
  - The electrolyser operates for eight hours in the twenty-four hour period;
  - No transfer to the high pressure storage system occurs in the twenty-four hour period; and,
  - A transfer from the low pressure buffer storage to the high pressure storage occurred immediately prior to the start of the twenty-four hour period.
- c) A modular solution is preferred to permit:
  - On-site safety testing with minimal interruption to operation; and,
  - The potential for expansion.

3.2. Compressor

- a) The maximum input pressure to the compressor will be the design pressure of the low pressure buffer storage system (30bar). The minimum input pressure to the compressor may be freely chosen subject to the specification for the low pressure buffer storage system being satisfied.
- b) Flow rate from the low pressure buffer storage to the high pressure storage is within the range 2.5 to 5.0Nm<sup>3</sup>/h.
- c) Maximum output pressure is that necessary to fill a high pressure storage system capable of refuelling vehicles with 350bar storage.

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- d) The compressor must:
  - Be fully hydrogen compatible; and,
  - Present no risk of hydrogen contamination from oil or particles.

### 3.3. Hydrogen High Pressure Storage System

- a) Design pressure: That required for refuelling vehicles with 350bar storage.
- b) Capacity: a minimum of 25kg of hydrogen.
- c) Cascade management valve skid with valves, tubing and fittings to manage the filling.

### 3.4. Fuel Dispenser - The fuel dispenser must:

- a) Be a stand-alone unit with a touch screen user interface;
- b) Provide a hydrogen dispensing nozzle capable of supplying hydrogen to a hydrogen powered vehicle with a minimum onboard capacity of 2.4kg of H<sub>2</sub> at 350bar;
- c) Be able to refuel a vehicle in less than five minutes;
- d) Provide a hydrogen dispensing nozzle capable of supplying hydrogen to standard “k-type” hydrogen cylinders with a capacity of 0.8kg of H<sub>2</sub> at 200bar; and,
- e) Be capable of supporting a maximum daily usage of
  - two vehicles per day, and,
  - twelve 200bar hydrogen standard cylinders per day.

## 4. Health And Safety Standards And Design Standards

4.1. The refuelling station system must fulfil the following standards, or their UK equivalent, where necessary:

- a) EIHP2 WP2 – Gaseous H<sub>2</sub> Vehicle Refuelling Stations;
- b) EIGA IGC Doc 15/06/E – Gaseous Hydrogen Stations;
- c) CGA G-5.3 – Commodity Specification for Hydrogen;
- d) NFPA 52 – Vehicular Fuel Systems Code, 2006 Edition;
- e) ISO 14687 – Hydrogen Fuel – Product Specification;
- f) SAE J2719 – Information Report on the Development of a H<sub>2</sub> Quality Guideline for Fuel Cell Vehicles;
- g) CGA G5 – Hydrogen;
- h) Dangerous Substances and Explosive Atmosphere Regulations, 2002. L134-138 HSE;
- i) Fuel Cells. Understand the Hazards, Control the Risks, HSE;
- j) ISO15916 – Basic Considerations for the Safety of H<sub>2</sub> Systems;
- k) IEC 60079 – Electrical Apparatus in Hazardous Atmosphere;

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- l) IEC 61779 – Electrical Apparatus for the Detection and Measurement of Flammable Gases;
- m) EIHP WP5 – Safety (Recommendations);
- n) ATEX 100 – Directive 94/9/EC – Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres;
- o) ATEX 137 - Directive 99/92/EC – Minimum Requirements for Improving Safety and Health Protection of Workers Potentially at Risk from Explosive Atmospheres;
- p) EIGA IGC Doc 134/05/E – Potentially Explosive Atmosphere – EU Directive 1999/92/EC;
- q) EIGA IGC Doc 75/07/E – Determination of Safety Distances;
- r) Guide for Hydrogen Hazards Analysis on Components and Systems – NASA/TM-2003-212059;
- s) UL 2075 – Gas and Vapor Detectors and Sensors;
- t) ANSI/ISA 12.13.01 - Performance Requirements for Combustible Gas Detectors;
- u) BS7671:2001 Incorporating Amendments 1 & 2, 2004 (The IEE Wiring Regulations), IEE.

4.2. The Low Pressure Storage & High Pressure Storage subsystems must fulfil the following standards, or their UK equivalent, where necessary.

- a) Directive 97/23/EC – Pressure Equipment Directive (PED);
- b) ISO 15869 – Gaseous H<sub>2</sub> and H<sub>2</sub> Blends – Land Vehicle Fuel Tanks (Draft);
- c) EIGA IGC Doc 100/03/E – Hydrogen cylinders and transport vessels;
- d) ASME – Boiler and Pressure Vessel Code;
- e) NFPA 55 – Standard for the Storage, Use and handling of Compressed and Liquefied Gases in Portable Cylinders;
- f) CGA PS-21 – CGA Position Statement on Adjacent Storage of Compressed Hydrogen and Other Flammable Gases.

4.3. The Dispensing Nozzles must fulfil the following standards, or their UK equivalent, where necessary:

- a) ISO 17268 – Compressed H<sub>2</sub> Surface Vehicle Refuelling Connexion Devices;
- b) EIHP WP3 – Refuelling Interface (Recommendations);
- c) ISO 5772 – Rubber Hoses and Hose Assemblies for measured Fuel Dispensing;
- d) SAE J2600 – Compressed H<sub>2</sub> Vehicles Fuelling Connexion Devices;
- e) SAE J2601 – Compressed H<sub>2</sub> Vehicles Fuelling Communication Devices (in progress);

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- f) CSA HGV4.1.6 – Series for Fuel Dispensing Equipment and Components (in progress).

4.4. The Refuelling Station subsystem must fulfil the following standards, or their UK equivalent, where necessary:

- a) Directive 97/23/EC – Pressure Equipment Directive (PED);
- b) ISO 4126 – Safety Devices for Protection Against over Pressures;
- c) ISO 6718 – Bursting Disk and Bursting Disk Devices;
- d) IEC 60079 – Electrical Apparatus for Explosive Gas Atmospheres;
- e) Directive 89/336/EU – Electromagnetic Compatibility (EMC);
- f) Directive 73/23/EU – Low Voltage Directive;
- g) Directive 98/37/EC – Machinery Safety;
- h) ASME B31 – Gas Transmission;
- i) CSA HGV4.7-8 – Series for Fuel Dispensing Equipment and Components (in progress);
- j) CGA G-5.5 – Hydrogen Vent Systems;
- k) CGA G-5.6 – Hydrogen Pipeline Systems;
- l) CGA S1 – Pressure relief Devices Standard.

4.5. Pipework must fulfil the following standards, or their UK equivalent, where necessary:

- a) EIGA IGC Doc 121/04/E – Hydrogen Transportation Pipelines;
- b) CGA G-5.4 – Standard for Hydrogen Piping Systems at Consumer Locations.

### 5. Training

5.1. The offer must include an operators training course as described in Condition 40 of Section 2. Details of the training course should be provided in the offer.

### 6. Price

6.1. The offer price must include the above specified Equipment, all packaging, transport to Stornoway, Isle of Lewis, Scotland, transport insurance and training.

### 7. Service and Maintenance

7.1. A separate offer to provide a five year service and maintenance programme is requested as described in Condition 38 of Section 2. Annual costs for the five year period should be presented.

7.2. The offer should provide outline proposals for assisting the Comhairle in developing a local service and maintenance work force.

### 8. Contract Period

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- 8.1. The Closing date and time for receipt by the Comhairle of tender is Monday 3rd March 2008 at 16:00 hours (GMT).
- 8.2. The Comhairle anticipates awarding the contract on 10 March 2008 and placing a contract order on 21 March 2008.
- 8.3. The Supplier will indicate the lead-time or delivery date, taking into account the dates indicated in Clause 8.3, in their proposal.

### **9. Other Criteria**

- 9.1. The offer should provide outline proposals for
  - a) Engaging in collaborative Research and Development opportunities with the local university (Lews Castle College).
  - b) Promoting the Hebridean Hydrogen Park locally within the Outer Hebrides, nationally and internationally.
- 9.2. A delivery time of 5 months or less from contract award will be viewed favourably