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|  Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile |  | | CONTRACT TERIN/2021/265 | UNIT WP1-LA1 |
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Ref. T.EN: 203998C-001-SP-4100-200001

Hydrogen Demo Valley Pre-Feasibility Study

Duty Specification for Conventional Electrolyser Package

20-PK-01



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1. INTRODUCTION

ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, has planned the realization of a Hydrogen Demo Valley (HdV) inside the research facility located at “La Casaccia”, in the municipality of Rome (Italy). Such infrastructure will act as an incubator of technologies and services related to the entire hydrogen value chain, and is expected to be completed in May 2024.

T.EN Italy Solutions SpA has been awarded the preparation of a pre-feasibility study aimed at defining the scope and the execution model for the subsequent design phase and construction activity.

2. PROCESS DESCRIPTION



This duty specification defines the supply of a conventional 200 kWe Electrolyser Packaged unit for the production of 40 Nm³/h of hydrogen, based on established and referenced alkaline or PEM technology. Optionally, Supplier is requested to propose also a higher capacity unit, up to 500 kWe, targeting 100 Nm³/h of hydrogen production.

The Electrolyser Package shall use potable water as feedstock and will be powered by a Photovoltaic System and the existing electricity network, using as a priority the electricity produced by Photovoltaic System and, as a second option, electricity from the network. As a consequence, the Electrolyser shall work at least between 20% and 100% of the nominal load.

The main elements that will constitute the Electrolyser Package are the Electrolyser Stack, the Water demineralization unit, the hydrogen Purification and Drying Units and some auxiliary systems, necessary to provide the required service fluids and ensure the correct and safe operation of the package.

The Electrolyser Package will also include a transformer/rectifier system, for supplying direct current to the electrolyser stack, and the control system, to manage the operation of the entire package. The production of hydrogen from the Electrolyser Package shall be 40 Nm³/h (and, optionally, up to 100 Nm³/h). The Electrolyser Package will work approximately 6000 hours / year. The produced oxygen will be vented, till when it is subject to further utilization.

3. PRODUCT SPECIFICATIONS

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Main characteristics:

- | | |
|--|---|
| a) Nominal electrical input power | 200 kWe (and, optionally, up to 500 kWe) |
| b) Nominal H ₂ production | 40 Nm ³ /h (and, optionally, up to 100 Nm ³ /h) |
| c) H ₂ delivery pressure | 24 - 30 barg |
| d) H ₂ delivery temperature | < 50°C |
| e) H ₂ purity | ≥ 99.97 (*) mol% (Supplier to advise) |
| f) Service Factor | > 6000 hrs / year |

(*) Hydrogen quality shall comply with SAE standard J2719:2020_03 "Hydrogen Fuel Quality for Fuel Cell Vehicles"

4. UTILITIES SPECIFICATION



Electric power

- | | |
|-------------------|--|
| a) Medium voltage | 8,4 kV |
| b) Low voltage | 400 V, 50 Hz, 3 Ph 230 V, 50 Hz, 1 Ph |
| c) UPS | will follow |

Potable Water

- | | |
|-------------|-----------------|
| a) Source | Tap water |
| b) Pressure | 2,5 barg (TBC) |
| c) Quality | see table below |

| | | |
|--|--------------------|------|
| pH | — | 6,80 |
| Conductivity a 20°C | μS/cm ² | 262 |
| Kubel oxidation number (as O ₂) | mg/l | <1,0 |
| Arsenic - As | μg/l | 6,4 |
| Disinfectant (residue) | mg/l | 0,08 |

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| | | |
|---|------|-------|
| Iron - Fe | µg/l | 21,2 |
| Nitrites (as NO ₂) | mg/l | < 0,1 |
| Sulfates | mg/l | 24,7 |
| Ammonium (as NH ₄ ⁺) | mg/l | < 0,1 |
| Total hardness | F° | 9,2 |
| Dry residue at 180°C | mg/l | 292,6 |

Nitrogen

will be supplied by ENEA

Instrument air

will be supplied by ENEA



5. SITE AND CLIMATIC DATA (MONTHLY AVERAGE)

- Ambient temperature (min/max) 4°C / 29°C
- Max humidity (at min/max temp.) 77% / 65%
- Wind speed (max) 16 km/h
- Rain (max) 132 mm
- Altitude above sea level 150 m

6. SCOPE OF SUPPLY

The package shall include (but not necessarily be limited to) the following main parts:

- Electrolyser Stack
- Transformer / Rectifier system
- Water Demineralization Unit
- Hydrogen Purification Unit
- Drying Units
- Chilled Water Unit

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- Cooling Water Unit
- A unit control cabinet, equipped with a PLC (SIL-3) for the local control and supervision of electrical and thermal parameters. The control system shall be equipped with local/remote switch suitable for remoted start/stop, load modulation and communicating facilities for interfacing with the SCADA in the main control room with open industry standard protocols (such as OPC, modbus, DNP3, etc).
- The supply must however include everything necessary for a safe and correct operation of the unit
- All the equipment constituting the Electrolyser package shall be placed in one or more containers.
- Each container shall be suitable for outdoor installation with a required degree of protection IP 55
- Compliance with PED, ATEX and Italian legislation.

7. REQUESTED INFORMATION

Supplier shall submit a technical and commercial proposal to include:

- Process Flow Diagram and Heat & Material Balance
- Number of stacks
- Electric power, potable water, utilities and chemicals consumptions
- Efficiency vs. load rangeability
- Power requirement in stand-by mode
- Dynamic behaviour
- Effluents and emissions
- List of signals to be sent from the PLC to monitor the operation
- Dimensions and weight
- Reference list
- Expected lifetime (BOP life span, stack life span)
- Maintenance requirements with expected Opex
- Schedule for design, construction and delivery of the unit

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- Budgetary offer for purchase, lease or right to use.
- Typical performance guarantees.
- Commissioning times and costs.
- Battery limits summary.