Hydrogen Demo Valley

Pre-Feasibility Study

Duty Specification for existing Industrial Boiler (retrofit option)

REV.	DATE	DESCRIPTION	PREPARED	VERIFIED	APPROVED
0	09/03/2022	FINAL ISSUE	V. DELLA VECCHIA	A. LECCESE	P.F. PEPPOLONI
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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

Inside the main context illustrated in the previous paragraph, ENEA is interested in testing the NG-H2 blend in an existing boiler of great potential (multi-MW), such as the district heating plant present in La Casaccia Research Center.

In order to achieve this goal, two distinct options are possible: a retrofit adaptation of two of the three existing BONO boilers of 7 MW each (preferred option), or the installation of a new unit outside the industrial boilers building (located in F28 building). This duty specification concerns the revamping of the existing BONO industrial boilers.

3. PACKAGE SPECIFICATIONS

Main characteristics (existing boiler)

a)	Nominal duty (each)	6975 kW
b)	Boiler type	OMP6000-G-CH4(nr. 5744, 5745, 6495)
c)	Fuel type	Natural gas
d)	Service Factor	< 1000 h/y (expected 480 h/y) (TBC by ENEA)

Main characteristics (after retrofit):

a) Nominal duty (each) — 6975 kW

b) Service Factor — < 1000 h/y (expected 480 h/y) (TBC by ENEA)

c) H2 in feeding NG-H2 stream — 5-20% vol.

d) Working conditions:
- Natural gas feed: 0-100% of nominal duty
- H2/NG feed (5%-20% H2 vol.): 0-50% of nominal duty

4. UTILITIES SPECIFICATION

Natural gas

Natural gas composition is compliant with Italian decree of May 18 2018 and subsequent amendments and additions. Refer to table below:

Component	Average (mol. %)
CH_4 – Methane	90.224
C_2H_6 – Ethane	6.065
C_3H_8 – Propane	1.050
C_4H_{10} – i-Butane	0.111
C_4H_{10} – n-Butane	0.154
C_5H_{12} – i-Pentane	0.035
C_5H_{12} – n-Pentane	0.027
Hexane +	0.018
CO_2 – Carbon Dioxide	1,021
N_2 – Nitrogen	1.263

Component	Average (mol. %)
He – Helium	0.034
H2 – Hydrogen	0.000
O2 – Oxygen	0.000
Co – Carbon Monoxide	0.000
H_2S - Hydrogen Sulfide	≤ 5 mg/Sm3
S as Mercaptans (*)	≤ 5 mg/Sm3
Total Sulfur (*)	≤ 20 mg/Sm3

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 (treated for As removal)
b) Pressure 2,5 barg (TBC)
c) Quality see table below

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:

- A main combustion system, low NOx emission type;
- A main control panel, 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).
- Burner Management System (BMS PLC).
- All the equipment constituting the package shall be placed in one container. The container shall be suitable for outdoor installation with a required degree of protection IP 55. Alternatively, the package can be installed on outdoor skids (Supplier to advise).
- Provisions for F&G detection and fire-fighting.
- The supply must however include everything necessary for a safe and correct operation of the unit.
- Compliance with PED, ATEX and Italian legislation.
- The complete Unit, associated equipment and components shall be suitable for the following IEC area classification:
  Zone 2, grade IIA, Temp T1

7. GUARANTEES

As a minimum requirement, Vendor shall guarantee the following:

- Vendor shall state and guarantee fuel efficiency at maximum continuous rate (MCR) (LHV basis), with reference to specified fired fuel and ambient temperature of 15°C.

- Vendor shall state and guarantee utility consumption, fuel gas and electrical consumption, at MCR condition.

- For natural gas only fuel, Vendor shall guarantee the following emission pollutant levels referred to 3% vol. oxygen content, dry condition:
  - NOx 100 mg/Nm3;
  - PM 5 mg/Nm3

- For H2-NG mix fuel, Vendor shall guarantee the following emission pollutant levels referred to 3% vol. oxygen content, dry condition:
  - NOx 200 mg/Nm3;
  - PM 5 mg/Nm3

- Vendor shall guarantee noise level of 85 dBA at 1m from the whole package skid edge.

8. REQUESTED INFORMATION

Supplier shall submit a technical and commercial proposal to include:

- Process Flow Diagram
- Electric power, utilities and chemicals consumptions
- Effluents and emissions
- List of signals to be sent from the PLC to monitor the operation
- Dimensions and weight
- Reference list
- Expected lifetime
- Maintenance requirements with expected Opex
- Schedule for design, construction and delivery of the unit
- Budgetary offer for purchase, lease or right to use.
- Typical performance guarantees.
- Commissioning times and costs.
- Battery limits summary.