Finanziato dall'Unione europea
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MINISTERO DELL'AMBIENTE
E DELLA SICUREZZA ENERGETICA

ATTACHMENT 6

Subject: Public selection procedure for the awarding of a consulting service.

NATIONAL RECOVERY AND RESILIENCE PLAN (NRRP), MISSION 2 "GREEN REVOLUTION AND ECOLOGICAL TRANSITION", COMPONENT 2 "RENEWABLE ENERGY, HYDROGEN, NETWORK AND SUSTAINABLE MOBILITY", INVESTMENT 3.5 "HYDROGEN RESEARCH AND DEVELOPMENT", IN IMPLEMENTATION OF THE DECREE OF THE MINISTER OF THE ENVIRONMENT AND ENERGY SECURITY OF DECEMBER 13, 2024, NO. 438

Research Project "**Biogas Electrically-Managed Membrane-Assisted Reforming System for Clean Hydrogen Production - BEMARS" - RSH2C_000010 - Cup: F59J25000420004"**

SUMMARY

INTRODUCTION

This document constitutes the Technical Specifications for the procurement of services for the BEMARS Project - Electrically Operated Membrane-Assisted Reforming System for the Production of Green and Clean Hydrogen from Biogas/Biosyngas/Biomethane.

NATIONAL RECOVERY AND RESILIENCE PLAN (NRRP), MISSION 2 "GREEN REVOLUTION AND ECOLOGICAL TRANSITION", COMPONENT 2 "RENEWABLE ENERGY, HYDROGEN, NETWORK AND SUSTAINABLE MOBILITY", INVESTMENT 3.5 "HYDROGEN RESEARCH AND DEVELOPMENT", IN IMPLEMENTATION OF THE DECREE OF THE MINISTER OF THE ENVIRONMENT AND ENERGY SECURITY OF DECEMBER 13, 2024, NO. 438

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In these Technical Specifications, the minimum characteristics and requirements are considered mandatory and binding, and must be met under penalty of exclusion.

SCOPE OF THE PROVISION

The services covered by this Framework Agreement are as follows:

1. Activities related to Project OR2: Kinetic Studies (Industrial Research/RI)

2. Activities related to Project OR3: Advanced CFD Simulations (Industrial Research/RI)

THEMATIC AREAS OF REFERENCE

The services are dedicated to the development of the BEMARS project, which focuses on the production of green hydrogen through the innovative membrane-assisted reforming process applied to renewable feedstocks such as biogas, biomethane, and biosyngas.

The overall objective is to achieve significant process improvement through the optimization of existing technologies (steam reforming and hydrogen separation) but applied in a new and synergistic manner, integrating:

• Fluidized bed reactors optimized for simultaneous hydrogen conversion and separation,

• Membrane systems for selective high-temperature hydrogen separation,

• Innovative heating systems based on high-efficiency electrical resistances, powered by renewable sources, replacing traditional burners.

The project therefore aims to:

• Increase the efficiency of the hydrogen production process,

• Reduce the cost of hydrogen produced compared to the current state of the art,

• Increase the modularity and reliability of compact industrial-scale (containerizable) plants.

The technologies applied in the project are aimed at producing high-purity (>99.9%) renewable hydrogen, with a radical improvement in energy efficiency and a reduction in costs compared to traditional reforming systems.

The technology is characterized by highly innovative elements, resulting from both the integration of advanced systems (reforming + membranes + electric heating) and engineering optimization.

DESCRIPTION OF THE OBJECTS OF 3 SUPPLIES

This technical specification defines the requirements for the tasks within Realization Objective (RO) 2, which involves the study of commercial catalysts for the steam reforming of biogas/biomethane/biosyngas and membranes for hydrogen separation, and Realization Objective (RO) 3, which involves the analysis of membrane configurations.

1. PERFORMANCE EVALUATION OF PALLADIUM MEMBRANES €5,000 OR2

Description: Evaluate (through validated modeling) the performance at different temperatures and pressures (both inlet stream and gas sweep) of Pd-Pd/Ag membranes (cylindrical and/or flat) for hydrogen separation, using gas mixtures obtainable from the steam reforming process of biomethane, biogas, and biosyngas. Comparison with current PSA solutions is needed to identify the best configurations (including mixed configurations: palladium and PSA membranes) for hydrogen production from methane, biogas, and syngas, based on the compositions of biomethane, biogas, and biosyngas and the system efficiency and cost targets of the BEMARS project.

Technical Requirements: Experience in simulating, testing, and manufacturing palladium membrane systems

2. CHARACTERIZATION OF SOLID MATERIALS AND ANALYSIS OF SORBENTS FOR CONTAMINANTS €15,000 OR2

Description: Perform analytical techniques such as SEM-EDS and XRD to evaluate potential degradation effectsIl presente documento costituisce il Capitolato Tecnico relativo all'affidamento di servizi per lo svolgimento del Progetto BEMARS - Sistema di Reforming Assistito a Membrane e gestito Elettricamente per la produzione di idrogeno verde e pulito da Biogas/biosyngas/biometano. Process-induced decomposition/deactivation (e.g., carbon deposits, sintering) on the materials tested in the BEMARS project (e.g., catalysts). Evaluate, both from a material and sizing perspective, pollutant conditioning systems (e.g., H2S, HCl) considering membrane and catalyst contaminant limits.

Technical Requirements: Experience in analytical techniques and sorbent analysis for contaminants.

3. ANALYSIS OF REFORMING AND MEMBRANE CONFIGURATIONS (€10,000 OR2, €15,000 OR3)

Description: Considering the different power sources for the BEMARS system (biomethane, biogas, and biosyngas, taking into account the different plant configurations indicated in the project, to be evaluated in terms of their different BoP and technical and economic performance) and the different power sources with different renewable energy systems for the electric resistors (for the reforming heat supply), evaluate both reforming catalysts and palladium membranes and PSA systems for hydrogen separation at different temperatures and pressures, defining the related conditioning and auxiliary systems for the technical and economic performance of the different configurations.

Technical Requirements: Experience in the analysis (feasibility studies, design, construction) of energy conversion systems, particularly renewable energy systems (e.g., solar, biomass).

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Alessio Acomanni
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