

## DEMONSTRATION OF A MOBILE UNIT FOR HYBRID ENERGY STORAGE BASED ON CO<sub>2</sub> CAPTURE AND RENEWABLE ENERGY SOURCES

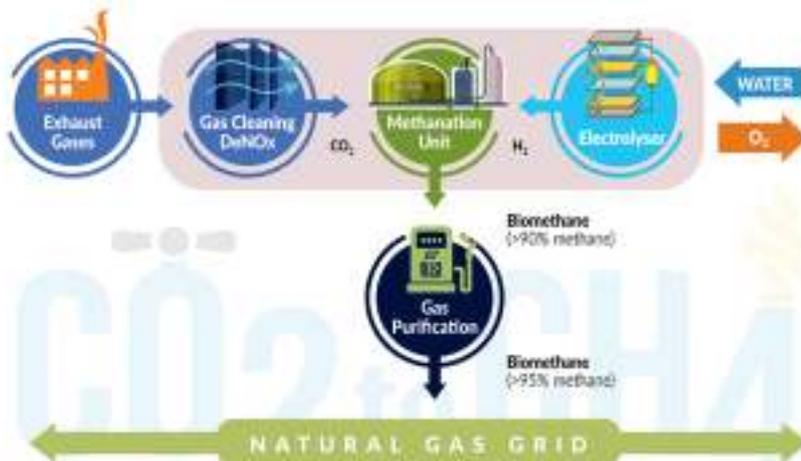
# 1<sup>ST</sup> NEWSLETTER

MAY 2022

### THE PROJECT

LIFE CO<sub>2</sub>toCH<sub>4</sub> aims to develop and demonstrate an innovative, integrated, and sustainable industrial process for simultaneous energy storage and CO<sub>2</sub> capture and utilization (CCU). The ultimate goal of the project is to construct, test and operate (TRL8) a smart mobile unit for hybrid energy storage able to be installed in remote energy systems that commonly have low capacity (e.g. remote areas or islands that are

#### LIFE CO<sub>2</sub>toCH<sub>4</sub> Mobile Unit for Hybrid Energy Storage



not connected to the central energy grid). The technology innovation relies on the fact that the RES (Renewable Energy Sources) to be used for water electrolysis and subsequently, the produced H<sub>2</sub> will be biologically converted into methane (as a non-fossil biofuel) together with CO<sub>2</sub> from exhaust gasses.

### PROJECT BENEFICIARIES



PUBLIC POWER CORPORATION RENEWABLES S.A. - PPCR



ARISTOTLEIO ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΟΝΙΚΗΣ  
ARISTOTLE UNIVERSITY OF THESSALONIKI -  
SPECIAL ACCOUNT FOR RESEARCH FUNDS - AUTH



HELLENIC AGRICULTURAL ORGANISATION DIMITRA - ELGO



NEVIS - NOVEL ENVIRONMENTAL SOLUTIONS S.A.



NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA



PUBLIC POWER CORPORATION - PPC



UNIVERSITA DEGLI STUDI DI PADOVA - UNIPD

## CLIMATE PROBLEM TARGETED

As part of the European Green Deal, the Commission proposed in September 2020 to raise the 2030 greenhouse gas emission reduction target, including emissions and removals, to at least 55% compared to 1990. Specifically, the key targets for 2030 dictate: **a)** 40% cuts in greenhouse gas emissions (from 1990 levels), **b)** 32% share for renewable energy, and **c)** 32.5% improvement in energy efficiency. As it is clearly visible the transition to the EU's climate strategy is passing through all sectors, including increased energy efficiency and renewable energy. Thus, EU starts the process of making detailed legislative proposals by June 2021 to implement and achieve the increased ambition. Furthermore, the EU aims to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions. This objective is at the heart of the European Green Deal and in line with the EU's commitment to global climate action under the Paris Agreement.

Since there is no silver bullet for the climate change challenge, all economic sectors will have to contribute to materialising the objectives of the EU Strategy. To this end, LIFE CO<sub>2</sub>toCH<sub>4</sub> project deals with all the main issues raised in the power sector in regard to carbon dioxide emissions as it will:



**Tackle** the issue of precisely balancing the supply with the electricity grid by using an integrated system that uses impure CO<sub>2</sub> sources, and harnesses microbial consortia for producing biomethane.

**Achieve** substantial reduction of CO<sub>2</sub> emissions with only one mobile unit for hybrid energy storage using impure CO<sub>2</sub> sources as input material.

**Use** renewable energy sources for producing electricity without worrying about destabilising the grid since energy is stored in a stable form.

**Overcome** the barrier of the inefficient and expensive storage of excess electricity by using a mobile unit for hybrid energy storage based on CO<sub>2</sub> capture and renewable energy sources.

**Confront** the issue of remote areas and islands concerning the high risk of a power outage by using a competitive procedure for storing energy in a mobile unit.



## THE PROJECT OBJECTIVES



### EFFICIENT ENERGY STORAGE AND CO<sub>2</sub> CAPTURE & UTILISATION

01

By constructing, testing and operating (TRL8) a smart mobile unit for the hybrid energy storage able to be installed in remote energy systems that commonly have low capacity.



### MAXIMISE EFFICIENCY

02

By developing technically advanced systems and control architectures based on microbial resource arrangement.



### PROCESS SUSTAINABILITY

03

By demonstrating system evaluation and assessment of environmental, economic and social impacts.



### MARKET EXPLOITATION

04

By identifying any safety, environmental, regulatory, or resource (economic) constraints that may affect its penetration into the market. By assessing the viability, cost and benefits of the proposed system.



### REPLICATION, TRANSFERABILITY

05

By defining business requirements and critical success factors that must be met.



### PROMOTE PUBLIC AWARENESS ON CLIMATE CHANGE MITIGATION & CIRCULAR ECONOMY CONCEPTS

06

By fostering employment growth and increasing capacity building in relevant technologies for increased competitiveness. By contributing to the implementation of the EU policy and legislation.

## TECHNICAL PROJECT PROGRESS UP TO DATE

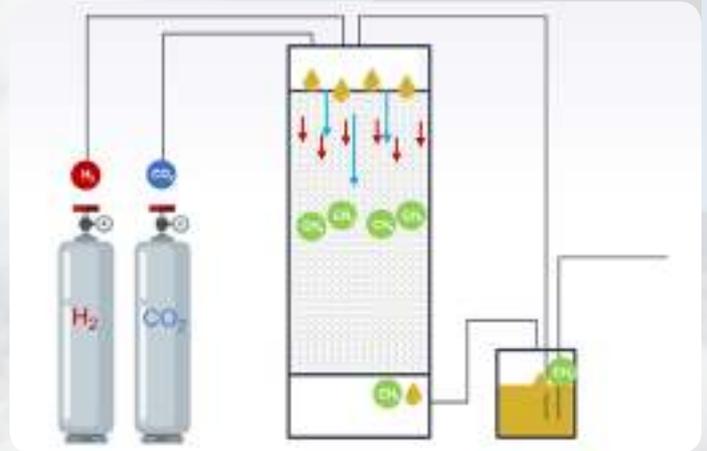
### ➤ PREPARATORY ACTIONS

During the first year of the project implementation, project partners focused on the technical preparation design of the pilot demonstration elements:

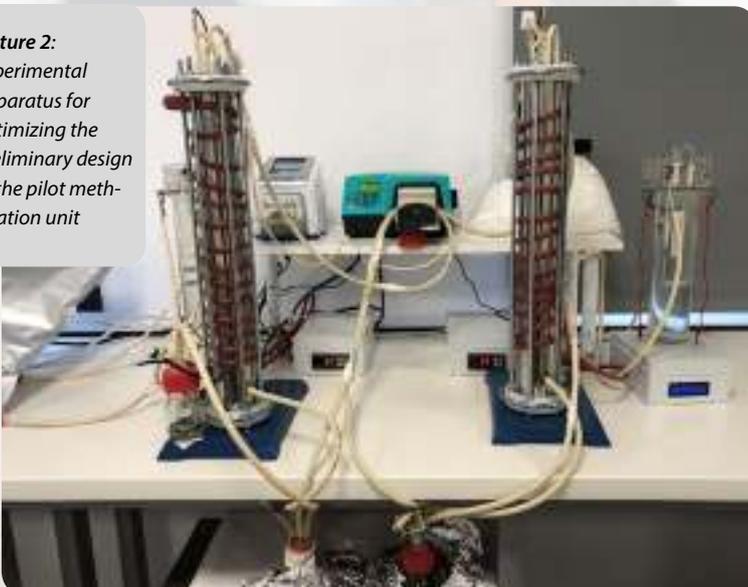
- Electrolyzer
- Flue gas storage and supply system
- Flue gas purification system
- Ex-situ methane reactor

Detailed plant energy, materials stream analysis and energy flow engineering simulations took place for the integral parts that compose the autonomous mobile unit. This way technical characteristics were specified. In addition, a technology catalogue of the existing biological methanation systems was compiled in order to identify the most significant reactor systems used for Biological Hydrogen Methanation. Moreover, a preliminary study of the prototype system with the operation of each sub-unit of the autonomous mobile unit is close to being finalised.

*Picture 1: Operation principle of the methanation unit*



*Picture 2: Experimental apparatus for optimizing the preliminary design of the pilot methanation unit*



### ➤ CONSTRUCTION OF THE OPTIMISED PROTOTYPE PILOT METHANATION UNIT

Based on a preliminary design of a pilot methanation unit, project partners elaborated on optimizing its compartments. Parameters under consideration for upgrading the system are amongst others: CO<sub>2</sub> purity, temperature, pH, influent gas feeding regimes, nutrient availability, packing material, microbial robustness etc. Considering the operation principle provided in **Picture 1**, an experimental apparatus has been developed at a laboratory scale, as shown in **Picture 2**.

## ADMINISTRATIVE PROGRESS UP TO DATE

### ➤ KICK-OFF MEETING 18/10/2021

The kick-off meeting of the LIFE CO2toCH4 project was held virtually via the Microsoft Teams platform, on Monday 18th October 2021. Project partners had the chance to meet virtually, present an overview of their project actions and discuss management and financial issues.



### ➤ 1<sup>ST</sup> MONITORING VISIT 28 /04/2022

The first monitoring meeting of the project took place on 28th April, 2022 at the Aristotle University of Thessaloniki premises in hybrid form.

The Project Manager Dr. Antoniadis as well as Beneficiaries' representatives, Prof. Zouboulis, Dr. Kougias, Prof. Treu, Mrs. Ampatzi, Dr. Psaltou, Dr. Roumpos provided thorough presentations for all project actions, while Mrs. Papageorgiou, the Monitoring Expert of the project (NEEMO) explained in detail LIFE Programme guidelines as well as project monitoring issues. Project beneficiaries representatives incl. Dr. K. Moustakas, Dr. Fr. Peleka, Mrs R. Ioannidou, Mrs M. Kassidoni, Dr. P. Gotsis discussed technical and financial issues of the project.



### ➤ PTOLEMAIS AREA, WESTERN MACEDONIA REGION SITE VISIT 29/04/2022



A visit to the wider area of Ptolemais where several Power Plants are located, was organised on the 29th of April, 2022. Project partners representatives had the chance to visit the premises of the Power Plant of Agios Dimitrios.

From left to right PPC experts from Agios Dimitrios plant, Mr Nimvriotis (PPC), Ms Ampatzi (NEVIS), Dr. Peleka (AUTH), Dr. Moustakas (NTUA), Dr. Gotsis (AUTH), Mrs Papageorgiou (Monitor Expert, Neemo), Mr Hatzis (AUTH), Professor Zouboulis (AUTH), Mr Kostaridis (PPC), Dr. Roumpos (PPC), Dr. Kougias (ELGO), Dr. Antoniadis (PPCR), Ms Asimakidou (PPCR), Dr. Kontogiannopoulos (ELGO), Dr. Psaltou (PPCR).

They were presented to the innovative and state of the art newly developed power plant in Ptolemaida, Power Plant V. Dr. Roumpos,



Dr. Antoniadis provided all the necessary information as well as site guidance.



They were also presented a part of the mining area where the plant Operation Plant Engineer, Mr Manolis Sakalis explained the establishment and all the steps of the mining process as well as an overview of the mining site and Dr. Roumpos offered an overview of the issues of concern at managerial level.



Finally, the team was presented the 15 MW Photovoltaic Parc that PPCR that has been developed and is operational by PPCR.



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## CO2TOCH4 SUMMARY PROJECT DATA

**TOTAL ELIGIBLE PROJECT BUDGET: 3,888,985 EURO**

**EU FINANCIAL CONTRIBUTION REQUESTED: 2,138,941 EURO**

**(= 55.00% OF TOTAL ELIGIBLE BUDGET)**

The project implementation started in October 2021 and it is expected to be completed by September 2025, in selected regions of Greece and Italy.

## CO2TOCH4 WEBSITE & SOCIAL MEDIA

For more news & updates please visit our website:

➤ <https://co2toch4.eu/>

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**The project is co-funded by LIFE, the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU.**