

## **RELIABLE LONG-TERM CO2 STORAGE AS CLATHRATE HYDRATES: THE CO2-RESTO PROJECT**

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Carbon capture and storage refers to the separation and capture of carbon dioxide (CO2) from anthropogenic emissions and its permanent storage. Recently, the possibility of storing CO2 as clathrate hydrate (CH) has been investigated. CO2 storage as CH is supported by the millennial stable occurrence of natural gas hydrates in marine sediments and permafrost that have been extensively studied. This is an important starting point for the feasibility of the hydrate-based CO2 storage solution. In this context, the CO2RESTO project aims to

develop a technological solution for CO2 sequestration in the form of CH both in seawater and under the seafloor.

<b>OBJECTIVE 1:</b> Theoretical survey of the approaches for CO <sub>2</sub> storage as clathrate hydrates	⇒	WHO: OGS, UNICAM, UNIPG HOW: Theoretical studies RESOURCES: Personnel
<b>OBJECTIVE 2:</b> In-lab reproduction of CO <sub>2</sub> CH in water and determination of the effect of chemical and thermodynamic parameters	•	WHO: UNIPG, UNICAM HOW: Experimental studies on lab apparatuses RESOURCES: Personnel, lab facilities, lab materials
<b>OBJECTIVE 3:</b> In-lab reproduction of CO <sub>2</sub> CH in under-seafloor sediments and determination of the effect of chemical and thermodynamic parameters	•	WHO: UNIPG, UNICAM HOW: Experimental studies on lab apparatuses RESOURCES: Personnel, lab facilities, lab materials, consulting services for mechanical properties tests
<b>OBJECTIVE 4:</b> Theoretical model applicable on CO <sub>2</sub> CH formations and energy/environmental evaluations on the proposed technological solution	•	WHO: UNIPG, OGS, UNICAM HOW: Theoretical studies, design processes, lab tests RESOURCES: Personnel, new equipment, lab materials
<b>OBJECTIVE 5:</b> Management and Dissemination	⇒	WHO: UNIPG, OGS, UNICAM HOW: Theoretical studies RESOURCES: Personnel, Plans

The following activities are planned to achieve this goal:

- Theoretical survey of the approaches for CO2 storage as clathrate hydrates;
- Laboratory reproduction of CO2 CH in water and determination of the influence of chemical and thermodynamic parameters;
- Laboratory reproduction of CO2 CH in under-seafloor sediments and determination of the influence of chemical and thermodynamic parameters;
- on CO2 CH model applicable Theoretical formations and energy/environmental evaluations on the proposed technological solution.





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CO<sub>2</sub> hydrate stability versus salinity by using HYDOFF code



Salinity versus depth of the CO2 hydrate stability zone from seafloor

Geothermal gradient versus depth of the CO2 hydrate stability zone from seafloor



The black dots indicate the area in which CO2 hydrate is stable

The expected results will be:

## 0 50 Salinity (‰)

## CO<sub>2</sub> hydrate stability versus salinity at different temperatures (°K)

- New knowledge on the CO2 CH stability in natural conditions;
- Development of an efficient technological solution for CO2

injection in the sediment.

