PRIORITY THEMATIC AREA FOR CROSS BORDER CO₂ NETWORKS

Projects of Common Interest (PCI) and Projects of Mutual Interest (PMI)

2022 First PCI call under the Revised TEN-E

PCI CALLISTO - MEDITERRANEAN CO₂ NETWORK
## List of acronyms

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>ALFI</td>
<td>AIR LIQUIDE FRANCE INDUSTRIE</td>
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<tr>
<td>BOG</td>
<td>Boil off gas</td>
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<tr>
<td>CCS</td>
<td>Carbon Capture and Storage</td>
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<tr>
<td>CCU</td>
<td>Carbon Capture and Utilization</td>
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<tr>
<td>CCUS</td>
<td>Carbon Capture, Utilisation and Storage</td>
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<tr>
<td>E&amp;P</td>
<td>Exploration and Production</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EII</td>
<td>Energy Intensive Industry</td>
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<td>EPC(i)</td>
<td>Engineering, Procurement, Construction &amp; Installation</td>
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<td>ETS</td>
<td>European Union Emissions Trading System</td>
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<td>FEED</td>
<td>Front-End Engineering and Design</td>
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<td>FID</td>
<td>Final Investment Decision</td>
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<td>GHG</td>
<td>Green-house Gas</td>
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<td>HC</td>
<td>Hydrocarbons</td>
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<td>IEA</td>
<td>International Energy Agency</td>
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<td>IRR</td>
<td>Internal Rate of Return</td>
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<td>JV</td>
<td>Joint Venture</td>
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<tr>
<td>kt</td>
<td>Kilotonnes</td>
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<tr>
<td>ktpa</td>
<td>Kilotonnes per year</td>
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<td>LCO₂</td>
<td>Liquid CO₂</td>
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<td>LDAR</td>
<td>Leak Detection and Repair</td>
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<td>LNG</td>
<td>Liquefied Natural Gas</td>
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<tr>
<td>LYONDELLBASELL or LYB</td>
<td>Can be used in the text to replace the 2 applicant names which are part of LYONDELLBASELL group ie Lyondell Chimie France &amp; Basell Polyoléfines France SAS</td>
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<td>Mt</td>
<td>Megaton</td>
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<tr>
<td>MTA or Mtpa</td>
<td>Megatonnes per year</td>
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<td>MWh</td>
<td>Megawatt hour</td>
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<td>PFRK</td>
<td>Parallel Flow Rotating kKin</td>
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<td>PIMF</td>
<td>PetroIneos Manufacturing France</td>
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<td>SMR</td>
<td>Steam Methane Reformer</td>
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<td>TRL</td>
<td>Technical Readiness Level</td>
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## Definitions of generic terms

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<th>Definition of this term for this application form</th>
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<td>“Main Scheme”</td>
<td>Priority facilities foreseen in the CCS chain related to this PCI. These facilities are described in parts I and II and only these facilities are included in the CBA in part III.</td>
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<tr>
<td>“Options”</td>
<td>Facilities not currently foreseen as priority in the CCS chain related to this PCI. Such facilities can either complete or replace the priority facilities described in the Main Scheme after further studies. These facilities are described only in part II.</td>
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</table>
| “Cluster”, “emitters cluster” or “CO\textsubscript{2} emissions cluster” | Geographical area including several major CO\textsubscript{2} emitters. At least one of these emitters is:  
* applicants of the PCI as promoters, affiliated organisations,  
* or supporting the PCI application via letter of support  
**Remark:** other CO\textsubscript{2} emitters in these clusters, part of the European Union emissions trading System are not applicants or supporting this PCI yet but will have the possibility to connect to the open access facilities described in this PCI. |
| “Primary liquid transport facilities”     | Set of facilities regrouped on one site to laid, unload CO\textsubscript{2} from several emitters, liquefy the CO\textsubscript{2}, then store, load and transport the liquid CO\textsubscript{2} to a “Hub”. A primary liquid transport facility typically includes fixed facilities for liquefaction, buffer storage and loading stations (for trucks, trains, barges or small ships (for coastal shipping). |
| “Terminal”                                | Set of facilities regrouped on one site to load, unload, liquefy and store the CO\textsubscript{2} collected from several emitters. A Terminal typically includes fixed facilities for liquefaction, buffer storages, converters of CO\textsubscript{2}, loading and unloading stations, quays for ships, and is transporting the collected CO\textsubscript{2}:  
* by pipeline to geological storages of CO\textsubscript{2}  
* or by sea ships to receiving terminals connected by pipelines to geological storage facilities. |
| “Hub” or “CO\textsubscript{2} Hub”       | The “Terminal” and local pipelines network, located a few km around the site can be included in the term “Hub” or “CO\textsubscript{2} Hub” |
INTRODUCTION


Part I – General information
    I.1 General Project Information
    I.2 General Information on the Applicant Organisation
PART I: GENERAL INFORMATION

I.1 GENERAL PROJECT INFORMATION

a) Title of project

CALLISTO (« CArbon Liquefaction, transportation and STOrage ») - MEDITERRANEAN CO2 NETWORK

The Project of Common Interest (PCI) CALLISTO aims at developing open access multi-modal CO2 Hubs in the Mediterranean, supported by dedicated onshore transport infrastructures, with the purpose of enabling decarbonization of various industrial emitter clusters through CO2 capture, aggregation, transportation and permanent storage of CO2.

The “CALLISTO PCI”, “CALLISTO Project” or “CALLISTO” terms will be used throughout this document to refer to the project.

b) Type of project / infrastructure items [please choose from the list below the type of project is submitted]

EU 869/2022, Annex II.5

The CALLISTO project supports the development of the overall CCS value chain which includes all the following facilities in the scope of this PCI:

- dedicated CO2 pipelines, other than upstream pipeline network, used to transport CO2 from more than one source, for the purpose of permanent geological storage of CO2 pursuant to Directive 2009/31/EC2;
- fixed facilities for liquefaction, buffer storage and converters of carbon dioxide in view of its further transportation through pipelines and in dedicated modes of transport such as ship, barges, truck, and train;
- Surface and injection facilities associated with infrastructure within a geological formation that is used, in accordance with Directive 2009/31/EC, for the permanent geological storage of CO2, where they do not involve the use of CO2 for the enhanced recovery of hydrocarbons and are necessary to allow the cross-border transport and storage of CO2;
- Other equipment or installation essential for the system in question to operate properly, securely and efficiently, including protection, monitoring and control systems.

In particular, in its Main Scheme, CALLISTO includes (see figure below):

- Collection of CO2 from emitters clusters in Italy and France
- Two main CO2 Hubs, located in Italy and France:
  - In France, the Fos - Marseille Hub will gather the CO2 coming from Rhône Valley and Fos - Marseille zones emitter clusters, to be then transported, by ship, to the Ravenna Hub. Collection and transport of the CO2 from Rhône Valley and Fos - Marseille emitters clusters to Fos - Marseille Hub is mainly based on the repurposing and extension of existing pipeline network, mainly belonging to Société du Pipeline Sud Européen (SPSE), and the extension of the activities of the Liquefied Natural Gas terminal of ELENGY to CO2.
  - In Italy, the Ravenna Hub will receive CO2 coming from Italian emitter clusters and from the Fos-Marseille Hub. The CO2 will be then transported to the permanent geological storage, located offshore the

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1 In the context of CO2 transport and storage infrastructure, “upstream” means those pipelines that directly connect an emitting source, i.e. a producer of CO2 emissions, to the main transporting pipeline that is potentially shared across multiple sources and/or recipients. In other words, pipelines that connect a single source to a broader network should be considered to be upstream and excluded from the application form.

Adriatic Sea (all together the Ravenna CCS Project developed and to be operated by Eni S.p.A.). A dedicated onshore transport network will be developed and operated by Snam S.p.A.

- The Surface and injection facilities of the offshore geological storage of Ravenna CCS Project in Italy

![PCI CALLISTO CO2 routes - Main Scheme](image)

These facilities in the scope of the PCI will be described in detail in this application form. Other facilities, not part of the PCI, not “open access”, but part of the overall CCS chain will also be described to provide a global vision and ensure the consistency of the CALLISTO Project.

Only the open access facilities, included in the scope of the PCI, will be considered in the Project Cost-Benefit Analysis (CBA). The open access facilities are planned for one or more launching emitters (which are either applicants or support of this PCI) and designed with sufficient overcapacities to collect CO2 from other emitters located in the clusters.

In this application form, the Main Scheme will be described in part I and II and Options will be described in part II. For part III, only the Main Scheme will be considered.

In the Main Scheme, all the CO2 is sent to the facilities of Adriatic Sea geological permanent storages operated by Eni through Ravenna CCS Project. Other geological storages in the south of Europe are at a lower stage of maturity of Ravenna’s geological storage and transport of CO2 from South of Europe to North Sea CO2 facilities is likely not competitive.

The facilities in the scope of this PCI are described in the sections below.

i. **dedicated pipelines**, other than upstream\(^1\) pipeline network, used to transport CO2 from more than one source, for the purpose of permanent geological storage of CO2 pursuant to Directive 2009/31/EC\(^4\);

**France - Main Scheme**

In France, the CALLISTO Project includes an onshore CO2 pipelines network connecting CO2 emitters to the CO2 Terminal of Fos - Marseille:

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\(^1\) In the context of CO2 transport and storage infrastructure, “upstream” means those pipelines that directly connect an emitting source, i.e. a producer of CO2 emissions, to the main transporting pipeline that is potentially shared across multiple sources and/or recipients. In other words, pipelines that connect a single source to a broader network should be considered to be upstream and excluded from the application form.

● one long distance transport pipeline (“PL2” pipeline, several hundreds of km length) situated between the Rhone Valley and Fos - Marseille zones
● Local collection pipelines network (several tens of km length) , especially in the Fos - Marseille zone
● CO₂ compression stations for injection into the CO₂ gaseous pipelines network (mainly existing pipelines repurposed for CO₂ transportation) at each emitter’s site. Whenever possible, these compression stations will be open access and mutualized.

The repurposing of existing pipelines previously used for the transportation of hydrocarbons (liquid hydrocarbons or natural gas) will be the Main Scheme. Some portions of new pipelines will also be built to fill gaps between the repurposed pipelines and between the CO₂ emitters and the pipeline network.
Italy - Main Scheme

In Italy, CALLISTO project includes:

- Onshore CO2 pipeline network: the onshore pipeline network will be developed according to the project phases and is constituted as follows:
  
  i) a dedicated new approx. 15 km long 26 inch pipeline connecting Ravenna and the Casalborsetti compression station;
  
  ii) a dedicated new approx. 70 km long 26 inch pipeline connecting Ferrara and Ravenna;
  
  iii) a dedicated new approx. 80 km long 24 inch pipeline connecting Marghera and Ferrara.

- Offshore pipelines between Casalborsetti compression station and offshore geological storage in the Adriatic Sea: two dedicated 14” and 20” will be laid to reach the injection reservoirs.
ii. fixed facilities for liquefaction, buffer storage and converters of carbon dioxide in view of its further transportation through pipelines and in dedicated modes of transport such as ship, barge, truck, and train;

France - Main Scheme

The CALLISTO project includes the Fos - Marseille Hub. The main facilities of this Hub are schematized in the figure below:
- Local CO2 pipelines network
- CO2 terminal including:
  - CO2 pretreatment /liquefaction units
  - CO2 buffer storages
  - Loading station for ships
  - Quays and all associated infrastructures for ships

Italy - Main Scheme

Italian facilities located within Ravenna area include:
• Ravenna Terminal, CO2 receiving / offloading facilities including the following main equipment:
  ○ Quays and all associated infrastructures for ships’ mooring
  ○ Ship offloading Facilities
  ○ Liquid CO2 tank farm
  ○ Pumping station of the liquid CO2
  ○ Vaporizer/Heaters of the pumped CO2
  ○ Electrical Substation
  ○ Metering Station

• Casalborsetti CO2 compression facilities to inject CO2 in the offshore pipeline and ultimately in the permanent storage. The CO2 compression facility includes the following main equipment:
  ○ Compressors and related KO drum and air cooler
  ○ Chilling unit
  ○ Power distribution
  ○ Metering Station

iii. without prejudice to any prohibition of geological storage of CO2 in a Member State (MS), **surface and injection facilities associated with infrastructure within a geological formation** that is used, in accordance with Directive 2009/31/EC, for the permanent geological storage of CO2, where they do not involve the use of CO2 for the enhanced recovery of hydrocarbons and are necessary to allow the cross-border transport and storage of CO2;

**Italy - Ravenna - Main Scheme**

The depleted gas fields, located offshore in the Adriatic Sea approximately 8 km from the coastline in front of Ravenna, have been selected as the main candidates to support the Ravenna CCS project, based on the current CO2 storage potential and its appropriate characteristics.

Depleted gas fields currently are operated through fixed platforms with residual production and a considerable number of plugged production wells. Surface facilities on board existing platforms that will be used for CO2 injection are:
- piping tie-in to the offshore pipeline connecting Casalborsetti compression station with safety and manual valves;
- Flowrate metering;
- Safety control system and telecom
- Safety CO₂ vent
- Injection well and wellhead control panel

Focusing on the wells, which are accessible from a fixed platform deck, Eni has an extensive knowledge of the original design, the modifications, the numerous interventions for production optimization or plug and abandonment over the gas production decades. After studies on the existing well characteristics and having excluded the possibility of reusing them and considering the unavailability of free slots on platforms, the CO₂ injectors are planned as sidetracks of the existing wells with new completion and new CO₂ proof well-heads. The plug and abandonment activity with CO₂ proof technologies is planned for all the other wells present in the field. The injector wells trajectories are designed starting from the sidetrack of existing wells on platforms to reach optimized targets.

iv. any equipment or installation essential for the system in question to operate properly, securely and efficiently, including protection, monitoring and control systems.

France

All infrastructure associated with CALLISTO will include the control and monitoring equipment and installations required for proper, secure, and efficient operations. These equipment and installations are also site dependent and will be in line with what is required by the local, national, and international rules and regulations.

Italy

Monitoring and control equipment and installations required for proper, secure and efficient operations will be installed in each plant associated with the CALLISTO Project. In particular, it will be essential to control the CO₂ pressure and flow rate at the inlet of the CO₂ pipelines. As per Oil and Gas Standard and best practices for gas pipeline, the monitoring of leaks along the CO₂ transport pipeline is envisaged on the continuous control of the process parameters (pressure, temperature and flow rate) upstream and downstream each pipeline and sealine. In more detail pressure and flow rate will be monitored in the Ravenna Hub, Casalborsetti plant and in each reinjection platform. The monitoring is based on a monitoring plan designed by the operator, based on the plan described in II.1.a) vii.

c) Application for PCI status or PMI status

Rationale, in terms of:
- PCI: the project is used to transport and, where applicable, store anthropogenic CO₂ originating from at least two Member States and the potential overall benefits of the project: outweigh its costs, including the long term.
  o Specify the Member States involved
- PMI: the project can be used to transport and store anthropogenic CO₂ by at least two Member States and a third country and the potential overall benefits of the project: at Union level outweigh its costs within the Union, including the long term.
  o Specify the Member States and the third country involved

Note: the plan for the project development must involve at least two Member States (see also EU 869/2022, Annex III.2.6). This plan is to be presented to the European Commission separately in order for the project application to proceed.

The CALLISTO PCI involves 2 European Union (EU) Member States: France and Italy.

These Member States include CCS in their national roadmaps:
- France in “STRATEGIE NATIONALE BAS CARBONE”
- Italy in “PIANO PER LA TRANSIZIONE ECOLOGICA”

5 Assessed in accordance with the relevant specific criteria in paragraph 3(c) of Article 4, EU 869/2022.
These 2 members states also issued a Mediterranean CCS strategic plan, including also Greece.

The CALLISTO project provides access to CCS capabilities to the Mediterranean, enabling the Member States France and Italy to decarbonize a wide range of industrial processes in a cost and time effective manner.

The usage of CCS as a method of decarbonization fits within the broader range of technologies for a net zero economy, to be used in conjunction with demand-side measures, energy efficiency improvements, electrification of heat, using hydrogen (made with zero-carbon electricity) as feedstock or fuel, using biomass as feedstock or fuel, and other innovations. The optimum mix of decarbonization solutions depends greatly on local factors.

The most important factors are access to low-cost zero-carbon electricity and access to a suitable kind of sustainably produced biomass, and access to CCS, because most industrial processes have significant energy- and energy-carrier-related feedstock requirements that could be replaced by one or both of these alternatives.

With CALLISTO, CCS as an abatement technology becomes available to the Mediterranean, allowing for the projected abatement up to 6.4 Mtpa in phase 2 (after 2033).

The value of CCS as a decarbonization solution is fundamentally linked to its role in avoiding emissions of industrial sectors known as hard-to-abate, including the production of cement, lime, steel, and chemicals among others. These activities either require temperatures that cannot currently be reached with electrification or produce greenhouse emissions that are predominantly linked to the chemical-physical transformations that are inherent to the product. This is the case, for example, of cement production, where over 60% of CO2 is produced from the transformation of limestone in calcium oxide, which is the main constituent of cement. As such, significant emissions reductions can only be achieved only by capturing the CO2 before the emissions reach the atmosphere.

In addition to its contribution to decarbonization of hard to abate industry, CCUS can also have a major role in energy security, especially in an energy transition scenario characterized by an increasing share of renewables. In fact, frequent fluctuations in demand and the intermittent nature of energy supply from renewables require a rapidly responding solution to maintain the balance of the electric grid. Maintaining a share of thermoelectric power generation capacity can make up for periods of unavailability of renewable energy production; at the same time, incorporation of CCS in these power plants can minimize their greenhouse gas emissions. This approach to the decarbonization of the electric system has also been shown in literature to be more cost effective than a transition strategy based on 100% renewables.

For the longer term, the connection between the CCS chain and power generation from biogenic sources allows for the potential for negative emissions in addition to the continuance of the advantages of thermoelectric power generation. While the market for negative emissions is still in its infancy, the application of Bio Energy CCS, has the potential to be a cost effective technology to generate negative emissions, especially

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6 Go for net zero: A practical plan for reliable, affordable, low-emissions electricity (grattan.edu.au)
The EU is working towards carbon neutrality by 2050. As with the International Energy Agency (IEA), there is a consensus that this target will be near impossible to reach without rapid industrial decarbonisation by Carbon Capture, Utilisation and Storage (CCUS) technology. Heavy industries account for almost 20% of global CO₂ emissions. Yet so-called hard-to-abate sectors are strategic to maintain the EU industrial capabilities. Some industries, such as cement production, have very few means by which to reduce their carbon footprint and CCUS is virtually the only technological solution to help. In other cases, such as iron, steel, and chemical manufacturing, CCS is an available cost-effective solution for reducing emissions in the interim, whilst they transition to a low/zero carbon process. This is especially the case for steel. In addition, captured CO₂ is a critical part of the supply chain for chemical products using CO₂ and hydrogen and therefore a valuable commodity for non-energy processes.

CCUS is supported by the European Green Deal vision proposed by the European Commission and embraced by the EU in Dec. 2019 where this technology is identified as one of the priority areas that “climate and resource frontrunners” have to develop to achieve the 2030-2050 EU climate objectives. The EU strategy for 2050 is “A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy”. Within this strategic vision to achieve climate neutrality by 2050, CCUS is identified as having a key role, not only to achieve neutrality, but also to enable negative emissions.

The efforts to combat climate change are pursued at EU level but necessarily driven and complemented by consistent national strategies in EU Member States. In France, the objectives set at EU level are translated into its own National roadmap, “Stratégie Nationale Bas Carbone”7, and the same goes for Italy with the “Strategia italiana di lungo termine sulla riduzione delle emission dei gas a effetto serra”8, which explicitly acknowledge CC(U)S applications.

To achieve this ambitious goal, the industrial sector, responsible for a quarter of global emissions, faces a huge challenge. According to the IEA, CCS is a necessary lever, and 1300Mtpa of CO₂ need to be captured by 2030 to achieve the agency’s net zero roadmap, while the total potential capacity is estimated to be between 8000 and 55.000Gt in total. CCS could help to potentially reduce the overall carbon emissions by 15%, especially in industry sectors whose processes are intrinsically emitting, such as lime, steel, cement or petrochemicals. Yet, the technology has already proven its reliability, with 50 years of experience: 45Mt of CO₂ are already captured and stored each year.

Thus the European Commission adopted in December 2021 the Communication “Sustainable Carbon Cycles”, which re-assesses the need to foster a new industrial value chain for a sustainable capture, recycling, transport and storage of carbon as essential to establish sustainable carbon cycles. It states that “the lack of sufficient capacity for transport and storage of CO₂ can become an important bottleneck in the use of [CO₂ capture] technologies as infrastructure needs to undergo lengthy permitting processes and may not advance due to uncertainties related to cross value chain risk”. It also rightly points to the benefit of a ‘CCUS Hubs’ approach, where many CO₂ emitters can benefit from a common and conveniently located infrastructure, served by an open-access CO₂ transport network crossing national “because not all Member States have access to suitable storage sites”. Yet, until now, industrial development of CCS value chains including CO₂ transport and storage facilities has been initiated in the North of Europe and more precisely around the North Sea. Even if academic studies have been performed on CCS chains in the South and East of Europe, no PCI has been filed yet to develop such industry in the South of Europe.

Finally, the EU has been investing in CCS research and innovation via its various programmes and notably Horizon2020/Europe for many years now and the time has come to bring the benefits of that investment to fruition with industrial scale applications across the EU Member States.

7 https://www.ecologie.gouv.fr/strategie-nationale-bas-carbone-snbc
In this context and being very much aligned with the role identified for CC(U)S by the EU policies and the EU’s broader decarbonisation and industrial competitiveness goals, the CALLISTO PCI aims at kicking off the development of the first industrial CCS chain in the South of Europe and in particular in the Mediterranean. More precisely, CALLISTO will focus on the development of open access multi-modal CO₂ Hubs in the Mediterranean, supported by dedicated onshore transport infrastructures, with the purpose of enabling decarbonization of various industrial emitter clusters through CO₂ capture, aggregation, transportation and permanent storage of CO₂.

All the participants included in the PCI, the promoters, the affiliated organisation and the actors supporting the project, including Member States, have a strong interest in decarbonising their activities and/or territories and are acting now to deploy CCS at industrial scale in Europe.

ii. National and Regional Strategic Context

In France

At French level, CCS (including BECCS Bio Energy Carbon Capture and Storage) is one of the key technologies identified in the "Stratégie Nationale Bas Carbone" which is defining the national roadmap toward carbon neutrality in 2050.

In 2020, a report of the French national agency “ADEME” (Agence Nationale de l’Environnement et la Maîtrise de l’Energie) highlighted Fos - Marseille & Rhône Valley zones (PACA/SUD and AuRA regions) as the ones (with Dunkirk / Hauts de France Region) with the largest amount of CO₂ emitted from industrial sources with a potential 15 Mtpa of CO₂ for CCS.

In this report, the lack of mature CO₂ geological storages which could be connected to the Fos - Marseille and Rhône Valley zones was highlighted. More recently, the STRATEGY CCUS project funded by HORIZON Europe, identified some potential geological storages for these zones. Most of them are at early stages of development with no industrial start up currently foreseen. On the contrary, the recent development of Ravenna’s geological storage and Hub in Italy, planned to start in 2027 represents a major opportunity to deploy an industrial project for a CCS chain for the clusters located in these zones.

In Italy

According to art. 15 of EU Regulation 2018/1999, in January 2021 Italy’s Ministry of the Environment published The Italian long-term strategy on the reduction of greenhouse gas emissions.

The document identifies the possible paths to reach a condition of "climate neutrality" in Italy by 2050. Towards this goal, CCS has been identified as one of the four fundamental levers to be integrated with energy efficiency actions. Moreover, CCS is regarded as a solution to contain both combustion and process emissions and it acquires significant value when connected to the hard to abate industry. Finally, in order to implement a significant use of CCS, the Strategy recalls the importance of resolving critical aspects of the general system, including the transport of CO₂ from the generation plants to the reuse or geological storage sites.

The document is the result of an ample collaboration, launched in 2019, between public administration first level executive bodies (i.e. the Ministry of the Environment, the Ministry of Economic Development, the Ministry of Infrastructure and Transport and the Ministry of Agricultural Food and Forestry Policies), Italian public institutions and companies (The Higher Institute for Environmental Protection and Research- ISPRA; Research on Energy System- RSE; Gestore dei Servizi Energetici- GSE), Italian Government-sponsored research and development agency (The Italian National Agency for New Technologies, Energy and Sustainable Economic Development- ENEA), the academia (Politecnico di Torino) as well as research centres (CMCC- The Euro-Mediterranean Center on Climate Change).

Along the above mentioned "inter-ministerial control-room", a set of technical working groups have been organized with representatives of Think tanks, Trade Unions and

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9 ADEME "Avis technique - Le Captage et Stockage géologique du CO2 (CSC)en France, 2020 & "Strategy CCUS" project funded by the European Union’s Horizon 2020 research and innovation programme under grant agreement No 837754
main environment-related players belonging to the so-called third sector and non-governmental nonprofit organizations. Through this approach, that also included a public consultation, in Italy different competencies and professionalism have been brought together to systematize and enhance the different knowledge in an interactive and flexible way.

On an operational level, the development of the Italian Strategy ensures continuity with the Piano Nazionale Integrato per l’Energia e il Clima (PNIEC) that traced the "first section" of the decarbonization path for the 2021-2030 phase. For the environmental assessment of the PNIEC projects, art. 50 of the D.L. 76/2020 introduced a specific discipline, while art. 60-bis of the same Decree contains simplifications for the geological storage of Co2. In particular, the decree establishes that offshore depleted hydrocarbon fields are suitable sites for the geological storage of CO2. The regulation explicitly states that, for these sites, the holders of the petroleum concessions can be authorized to carry out experimental programmes.

In this contest, Italy can rely on the storage capacity of the depleted reservoirs located offshore the Adriatic coast (the “Ravenna CCS Project”). With more than 500 million tons of CO2, the Italian Adriatic coast represents an important geographical area suitable for the development of leading decarbonization that can provide Italy and the EU with one of the most important CCS Hubs in the world and central to the Mediterranean.

### iii. Industrial context France

**Air Liquide France Industrie (ALFI)**

Air Liquide France Industrie (ALFI) supplies gases and innovative technologies for industry and the environment to industrial customers in France. ALFI is part of the Air Liquide group, a world leader in gases, technologies and services for Industry and Health. Air Liquide is present in 78 countries with approximately 64,500 employees and serves more than 3.8 million customers and patients. Carbon dioxide, Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide’s scientific territory and have been at the core of the company’s activities since its creation in 1902. Air Liquide’s revenue amounted to 23.3 billion euros in 2021 and its solutions that protect life and the environment represented more than 40% of sales.

Decarbonizing is at the heart of “Advance”, Air Liquide’s new strategic plan for 2025: reducing CO2 emissions is a major challenge for key players in industry, representing a market for which the Group has a comprehensive portfolio of technology and service solutions to support its customers’ decarbonization efforts around the world, from the supply of low-carbon industrial gases to CO2 capture and management and industrial process transformation. ALFI is already an actor in the CO2 market operating related assets like CO2 capture plants, trucks, trains, installations to deliver CO2 at customers’ facilities,… and wants to become an actor to sell or invest and operate CO2 infrastructures (capture plants, Liquefiers, CO2 transportation means,… for CCS service.

For CCS service, AIR LIQUIDE group developed and implemented specific technologies like Cryocap™. Cryocap™ is a technological innovation for CO2 using a cryogenic process (use of low temperatures, approximately -50°C, to separate the gases) world level. Cryocap™ can be combinations of Air Liquide technologies specific to each of its applications: CO2 capture from steel mills (Cryocap™Steel), thermal power plants (Cryocap™Oxy), cement and lime plants (Cryocap™FG), hydrogen production units (Cryocap™H2) or large liquefaction units (Cryocap™XLL). Cryocap™ has filed several patents and illustrates the innovation capacity of the Air Liquide Group.

**ArcelorMittal Méditerranée**

**Elengy**

An expert in the LNG sector for more than 60 years, Elengy owns and operates three LNG terminals in France with the terminal of Montoir-de-Bretagne, close to Saint-Nazaire on the Atlantic coast and those of Fos Tonkin and Fos Cavaou on the Mediterranean coast.
One of Elengy’s strategic axes aims at becoming a CO₂ operator and to develop shared infrastructures for the benefit of users of CCS chains, in particular the CO₂ Hub. The expertise that Elengy has developed for more than 50 years in the Liquefied Natural Gas (LNG) field is particularly adapted to these developments:

- Technical & operations: maritime expertise, liquefaction and cryogeny, large facility operator, project management
- Position in the value chain: third party access with transparent, flexible and non-discriminatory services

GRTgaz

"Together, making a secure, affordable and climate-neutral energy future possible" is the "raison d'être" adopted by GRTgaz in October 2020 and enshrined in its statutes. This is why GRTgaz works with its industrial consumers to decarbonize their processes, offering solutions in line with their needs. In this field, one of the strategic axes for GRTgaz is to develop transport pipeline networks to collect and aggregate the CO₂ captured by industry and to transport it to geological storage sites.

GRTgaz's skills and experience as the European leader in the operation and management of natural gas transport network (more than 32 000 km) make it a key player in such developments:

- Technical and project management experience recognized for the realisation of large-scale network projects in the most complex environments, with controlled costs and deadlines
- Experience in the value chain based on third party access, transparent and non-discriminatory transmission network services
- Experience in the design and operation of pipeline networks with high safety standards, maintenance and integrity management, 24/7 dispatching teams
- Activities carried out within a regulated framework and oriented towards the development of the territories.

The challenge of decarbonation is huge in the zone of Fos - Marseille which is the second most emitting zone in France and a pipeline network will allow to aggregate a massive amount of CO₂ and to reduce the cost of CO₂ transport to geological storage sites.

The CO₂ network will connect the CO₂ emitters to the developed Fos - Marseille CO₂ Hub. It will consist of pipelines to be converted (previously carrying petroleum products - see SPSE section) and portions of new pipelines to be laid. The infrastructure will include the necessary compressor stations, interconnections, and metering stations at the interface with the sending sites and the outlets.

GRTgaz, specifically, will participate in the overall design and construction of the pipeline networks and associated equipment.

Lafarge Ciments (LC)

LES CHAUX DE LA TOUR & LES CHAUX DE PROVENCE (LHOIST Group)

LYONDELLBASELL group (Fos cluster Site)

LYONDELLBASELL (BERRE cluster site)

Société du Pipeline Sud Européen (SPSE)

Société du Pipeline Sud Européen (SPSE) is a company which transports liquid hydrocarbons by pipelines from the Fos-sur-Mer and Lavéra port facilities (South of France). It is also a storage company, operating a tank farm of 2.26 million m³ of capacity, located at Fos-sur-Mer. Initially almost exclusively dedicated to crude oil storage, SPSE has now expanded its business to naphtha and diesel storage.
Driven by a strong experience in pipeline transport and storage of petroleum products, SPSE's constant objectives are to operate safely, with respect for the environment, and to propose the best logistics solutions for the market and for its clients’ requirements. SPSE continues its investment policy and its strategic diversification.

Making the energy transition a reality by supporting its customers on the path of decarbonisation is one of SPSE's strategic objectives.

A way to achieve this quickly and on a large scale is to convert some of SPSE currently available mothballed crude oil pipelines (able to connect Rhône Valley & Fos - Marseille zones clusters but with the potential to connect the Fos - Marseille Hub to Karlsruhe in Germany) with the aim to provide the industrial community with a simple, economical and non-polluting CO2 pipeline network. SPSE has a very long experience in the management of industrial assets of common interest and in reactivation of mothballed assets.

PETROINFOS MANUFACTURING FRANCE (PIMF)

Ciments Calcia
Imerys
VICAT

iv. Industrial context - Italy

CABOT Italiana SPA - Ravenna Cluster

Eni

Eni is a global energy company, with a high technological content, present in 69 Countries with over 31,000 people, operating along the entire value chain. The company mission clearly expresses Eni's commitment to play a decisive role in the Just Transition process to guarantee access to efficient and sustainable energy by achieving the goal of net zero emissions by 2050, with a view to sharing social and economic benefits with workers, the value chain, communities and customers in an inclusive, transparent and socially equitable manner, taking into consideration the different level of development of the Countries in which it operates, minimising existing inequalities. This transition relies on a detailed decarbonization roadmap, with well-defined intermediate targets and a net zero goal across scope 1, 2 and 3.

Eni is engaged in the entire value chain: from the exploration, development and extraction of oil and natural gas, to the generation of electricity from cogeneration and renewable sources, traditional and bio refining and chemical, and the development of circular economy processes. Eni extends its reach to end markets, marketing gas, power and products to local markets and to retail and business customers also offering services of energy efficiency and sustainable mobility. Both CO2 capture and storage and Natural Climate Solutions initiatives will be implemented to absorb residual emissions. Consolidated expertise, technologies and geographical distribution of assets are Eni levers to strengthen its presence along the value chain. Along this path, Eni is committed to become a leading company in the production and sale of decarbonized energy products, increasingly customer-oriented. Decarbonization will be achieved through the implementation and strengthening existing technologies and activities such as:

- Efficiency and digitalization in operations and customer services;
- Renewables through increased capacity and integration with the retail business;
- Biorefineries with an increasing input of raw material from waste and from an integrated agri bio feedstock production chain not in competition with food production;
- Circular economy with increased production of biomethane, use of waste products and recycling of end products;
● Blue and green hydrogen to power highly energy-intensive industrial activities and sustainable mobility;
● Natural or artificial carbon capture to absorb residual emissions through Natural Climate Solutions, including REDD+ forest conservation initiatives and CCS projects.

Eni is actively involved in the development of major CCUS projects in Italy (Ravenna CCS project) and UK (Hynet North West) to provide hubs for the storage of emissions from nearby industrial clusters in depleted gas reservoirs.

Enipower - Ravenna/Ferrara Cluster
Marcegaglia - Ravenna Cluster
Polynt - Ravenna Cluster

Snam is Europe’s leading operator in natural gas transport and storage, with an infrastructure enabling the energy transition. It ranks among the top ten Italian listed companies by market capitalization. Snam operates a pipeline network of approximately 41,000 km spanning from Italy, Austria, France, Greece and the United Kingdom and the company manages 3.5% of the world’s gas storage capacity. It is also one of the main operators in LNG (Liquified Natural Gas) regasification.

With its 80 years of experience in the management and development of networks and plants, Snam guarantees security of supply and promotes the energy transition across territories, through investments in green gases (biomethane, hydrogen) and energy efficiency.

Snam’s commitment to preventing climate change is evident in a challenging climate strategy aimed at achieving carbon neutrality by 2040. Snam’s Net Zero Carbon strategy is solid and concrete and includes intermediate reduction targets of -28% by 2025 vs. 2018 values, -40% by 2027 vs. 2018 values and -50% by 2030 vs. 2018 values for all direct (Scope 1) and indirect energy (Scope 2) CO2eq emissions. There are also a methane emission reduction target of -55% by 2025 and a plan to increase the use of green electricity by 2030.

In addition, in 2021 Snam set targets on Scope 3 emissions:

● - 46% of emissions from participated companies, fuel and electricity production, business travel and employee commuting by 2030 vis a vis 2019 values;
● - 55% tCO2e/M€ capex for suppliers by 2030 vis a vis 2019 values.

The Net Carbon Zero strategy is mainly based on:

● using natural gas as an energy source supporting decarbonization path. The use of natural gas instead of oil products or coal is one of the most beneficial and feasible ways of reducing carbon dioxide emissions (CO2) and can make a significant contribution to energy transition and to reach GHG emissions reduction target of the Country;
● Progressive replacement of gas turbines with electric compressors in the compressor stations. In this way it's possible to eliminate CO2 combustion emissions and purchasing electric energy from renewable sources emission reset is guaranteed;
● Gas natural emissions reduction by means of continuous monitoring, the introduction of Leak Detection and Repair (LDAR) programme, specialised gas recovery interventions and equipment replacement.
● using electricity from renewable sources, in 2021 Snam consumed 41% of electricity produced from renewable sources with respect to the total electricity purchased;
• promoting energy efficiency through the installation of photovoltaic panels in building construction;
• reduction of emissions related to company's buildings and the corporate fleet;
• collaboration with suppliers and associates for the containment of indirect emissions (Scope 3);
• offsetting of non-disposable emissions. The few remaining emissions will be reset with the purchase of certified carbon credits from select projects.

Additionally, the gas system could facilitate the solutions of decarbonisation and renewable consumption thanks to the introduction into the network of:

• renewable gases, such as biomethane, biosyngas and "green" hydrogen, obtained from anaerobic digestion and biomass gasification technologies, electrolysis of renewable electricity;
• low carbon natural gas and hydrogen, obtained from technologies that capture carbon and then store or reuse it (CCS/CCU).

In July 2022 Snam has kicked off a new business unit, named “Decarbonization Projects”, with the aim of defining strategies, objectives and technological needs in the fields of Hydrogen and CCS, which are identified as two elements of one unique integrated decarbonizing action. The evaluation of a strategical national CO2 transportation network is part of the scope of work of the BU, leveraging on the expertise of Snam in the natural gas transport system and the proximity to CO2 emitters all over the country.

Versalis - Ravenna Cluster

Yara - Ravenna/Ferrara Cluster
e) **Describe the project and its objectives**

The project aims at developing the following facilities of an integrated CCS network:

- dedicated CO₂ pipelines,
- fixed facilities for liquefaction, buffer storage and converters of carbon dioxide
- Surface and injection facilities associated with infrastructure within a geological formation
- Other equipment or installation essential for the system in question to operate properly, securely and efficiently, including protection, monitoring and control systems.

The other facilities, part of the global CCS chain, not included in the PCI are:

- CO₂ emitters facilities, mainly industrial facilities
- CO₂ capture facilities
- Liquid CO₂ transportation means like ships, trucks, trains and barges

In its Main Scheme, the Project of Common Interest CALLISTO includes:

- Collection of CO₂ from Emitters clusters in Italy and France
- Two main CO₂ Hubs, located in Italy and France:
  - In France, the Fos - Marseille Hub will gather the CO₂ coming from Rhône Valley and Fos - Marseille emitter zone clusters, to be then transported, by ship, to the Ravenna Hub. Collection and transport of the CO₂ from Rhône Valley and Fos - Marseille zones emitters clusters to Fos - Marseille Hub is based on the repurposing and extension of existing pipeline network, mainly belonging to Société du Pipeline Sud Européen (SPSE), and the extension of the activities of the Liquefied Natural Gas terminal of ELENGY to CO₂.
  - In Italy, the Ravenna Hub is designed to receive CO₂ both from gas pipelines and from ships in liquid phase. The CO₂ comes from Marghera, Ferrara and Ravenna emitter clusters and from the Fos-Marseille Hub and connects the permanent geological storage, located offshore the Adriatic Sea. The Ravenna CCS Project, operated by Eni S.p.A, includes the Ravenna Hub and the offshore geological storage located in the Adriatic Sea. The onshore gas pipeline transport, within the Italian boundaries, will be developed and operated by Snam using a dedicated pipelines network that connects the main emission clusters to the Casalborsetti Compression Plant. The Main Scheme to transport the CO₂ from Italian emitters to Ravenna Hub is via new pipelines.

- The Surface and injection facilities of the offshore geological storage of Ravenna CCS in Italy linked to the Ravenna Hub. CO₂ collected in Ravenna Hub is conveyed via pipeline up to this final storage site in the Adriatic Sea (see figure below).

The development of the facilities is planned in 2 phases

In line with the above stated objectives, this project will contribute to remove emissions by enabling the transport and geological storage of captured CO₂ from industrial emission points to an offshore storage site operated by Eni. It is estimated that more than 130 MT of CO₂ will be transported to the permanent storage in
Ravenna in over 23 years during the lifetime of operations of this PCI. Further details and predictions are provided in Sections B.2, B.3 of this application and the attached CBA document. The emissions reductions associated with this PCI will directly contribute towards the national targets in 2 EU-Member States and towards the ambitions as set out in the Paris Agreement.

The CALLISTO Project is a stepping stone in the development of the efficient cross-European CO2 infrastructure required to support Europe’s industry decarbonisation and achieve a climate-neutral European economy by 2050, as per the EU objective. This integrated project stretching across the Mediterranean will benefit all actors directly and indirectly involved, improving the reliability and robustness of the CCS value chain in Southern Europe.

Developing infrastructures on both ends of the CCS chain, situated close to important emitters and linked to geological storage locations is essential to establish and densify an effective, efficient, European and cross border CCS network and value chain. Developing capacities on both ends will benefit all actors along the value chain, reducing costs through economies of scale and improving reliability and the robustness of the European CCS value chain as a whole.

f) **Describe the extent of physical presence of infrastructure in each of the involved Member States / third countries**

No CO2 transport and geological storage infrastructures exist today in France and Italy. Some small capture plants of several tens of ktpa of CO2 are producing liquid CO2 which is transported mainly by truck and train for the existing Carbon Capture and Utilisation (CCU) supply chain.

For CCS, CO2 infrastructures are planned to be built in France:

- The first CCS facilities will probably be implanted in the North of France in Normandy and Dunkirk.
- CO2 infrastructures are also developed for CCS in the Southwest of France.

The facilities of this PCI will, whenever possible, reuse, repurpose and extend existing infrastructures:

- quays,
- pipelines: Crude oil, oil products, Natural Gas
- existing terminals for Cryogenic liquids such as LNG (Liquefied Natural Gas)

i. **France**

In France, one of the main objectives of the project is to convert to CO2 transportation, existing pipelines, previously used for the transportation of hydrocarbons (crude oil, oil products, Natural Gas) to transport the CO2 to Fos - Marseille Hub, specifically:

- Long distance pipeline “PL2” from Rhône Valley zone to Fos - Marseille Hub
- Local pipelines in the Fos - Marseille cluster

In case the transportation by pipelines would not be the optimal solution to transport the CO2, existing railways, roads and waterways would be used and where necessary enhanced by the CALLISTO PCI.

The location of Fos - Marseille Hub is planned to be located close to the current LNG terminals in the Fos harbour. The recovery of thermal energy (cold) from the LNG vaporisation to increase the energy efficiency of CO2 liquefaction will be studied and could lead to significant energy and cost savings. The existing facilities (ex : quays for the ships) and the availability of competent workers will benefit the local conditions for a local CO2 Hub.

ii. **Italy**

The following existing infrastructure will be relevant for the project:

- Petrochemical Plant located in Ravenna, in which it is foreseen to install the open access Ravenna Hub facilities to receive and offload CO2.
- Existing Platforms in the Adriatic Sea that will be used for CO₂ reinjection. The reinjection platforms that are preliminary selected are Porto Corsini Mare West C (PCWC)

**g) What is the implementation status**

**i. France**

For the CO₂ transport infrastructures part of this PCI, pre-Front End Engineering Design (preFEED) studies are estimated to start in 2024, Front End Engineering Design (FEED) studies are planned in S2 2025 - S1 2026 for Final Investment Decision in 2027.

**ii. Italy**

Currently, Eni is proceeding in the development of the early phase Ravenna CCS Project (Ravenna CCS FASE 1). In particular, the initial phase of the project foresees the capture of 25,000 tpa CO₂ emitted by Eni's Casalborsetti compressor station with storage to Porto Corsini Mare West site. The CO₂ storage licence is expected by the end of 2022. This authorisation would allow Eni to implement a full chain small scale CCS project where CO₂ will be captured from a gas processing plant, transported through a repurposed gas pipeline and stored in the offshore reservoir. The project is expected to be operational in Q1 2024 and it would allow the gathering of a substantial amount of data in order to confirm the performance of the transportation and storage system for the industrial development.

**h) What is the expected start and end date of construction phase**

**i. France**

For the transportation infrastructures, the construction is planned between 2027 and 2029.

**ii. Italy**

Construction starting date for Ravenna Hub is foreseen from 2025 and ending in 2027 for the gas phase, while the construction of all facilities for liquid phase will end by 2029.

**i) What is the expected the estimated start of operation**

**i. France**

With the current estimations, start of operations of the facilities is planned in 2029, for the first phase.

**ii. Italy**

The Ravenna CCS Project start-up is foreseen in 2027.

**j) What is the expected the estimated project lifetime**
The project lifetime is 23 years. The project starts operating in 2027 and is foreseen to end in 2050.

### I.2 GENERAL INFORMATION ON THE APPLICANT ORGANISATION

<table>
<thead>
<tr>
<th>a) Applicant organisation legal name</th>
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### OTHER AFFILIATED ORGANISATIONS

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**COORDINATING APPLICANT**

a) Coordinating applicant legal name
AIR LIQUIDE FRANCE INDUSTRIE

b) Coordinating applicant legal address
AIR LIQUIDE FRANCE INDUSTRIE
6, rue Cognacq Jay
75007 Paris
France

c) First point of contact for the EU or third country
Fabrice Del Corso - Project Director
d) Representatives authorised to sign this application

Signature forms for these applicants (project promoters) are provided in Annex.

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