



STRATEGY CCUS

A viable **solution** for a **sustainable** future

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STRATEGIC PLANNING OF REGIONS AND TERRITORIES IN EUROPE FOR
LOW-CARBON ENERGY AND INDUSTRY THROUGH CCUS

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Executive summary

STRATEGY CCUS is a 3 year European H2020 CSA project which aims at developing strategic plans for CCUS development in the South and East of Europe in the short term (up to 3 years), medium term (3-10 years) and long term (more than 10 years). The strategy consists in elaborating local CCUS development plans, with local business models, for eight promising start-up regions and making use of existing infrastructures to favour connection plans between local CCUS clusters. The last component is to improve performance and reduce costs, and contribute to build a Europe-wide CCUS infrastructure.

After a year and a half, it is possible to make a first assessment of the progress of the STRATEGY CCUS project. Despite the Covid 19 pandemic outbreak, the objectives for the period were globally reached and the work plan effectively carried out, with some adapting to the situation. As a result, with no major delays affecting the current results, the pursuit of activities and actions remains promising for the next project working period.

Besides, action and outputs of this period have added value for CCUS development at National level in each promising region through dissemination and communication actions. Local teams were able to publish and disseminate the inventory of the current statement of CCUS in their regions taking into account views and opinions of key regional and national stakeholders. This first appraisal at local and regional level paved the ground for the economic and environmental analysis and the elaboration of regional CCUS deployment scenarios coming next in the project roadmap.

Wide dissemination actions, such as public Webinars and social media posting, enhanced visibility of the project at European and International level and brought about contacts with industries and stakeholders interested in STRATEGY CCUS project outputs.

The current publishable report aims at providing an overview of the work and outputs during this first period to a larger non-scientific public interested in carbon reduction activities.

All public deliverables are available on the project website (<https://www.strategyccus.eu/>), as well as an insight of the promising regions studied, news about the project and the subscription to our Newsletter.

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List of partners

STRATEGY CCUS BENEFICIARIES

PARTICIPANT N°	Short Name	PARTICIPANT ORGANISATION NAME	COUNTRY
01	BRGM	Bureau de Recherche Géologique et Minières	France
02	IFPEN	IFP Energies Nouvelles	France
03	TOTAL	TOTAL	France
04	UEVORA	Universidade de Evora	Portugal
05	IGME	Instituto Geologico y Minero de Espana	Spain
06	CIEMAT	Centro de Investigaciones Energéticas Medio Ambientales y Tecnicas	Spain
07	UNIZG-RGNF	University of Zagreb	Croatia
08	GeoEcoMar	National Institute for Research and Development of Marine Ecology and GeoEcology	Romania
09	CERTH	Center for Research and Technology Hellas	Greece
10	GIG	Główny Instytut Górnictwa	Poland
11	UEDIN	Universty of Edinburgh	UK
12	NORCE IRIS	International Institute of Stavanger AS	Norway
13	Fraunhofer ISI	Fraunhofer Institute for Systems and Innovation Research	Germany
14	NOVA	Universidade Nova de Lisboa	Portugal
15	SNSPA	National School of Political Studies and Administration	Romania
16	CIMPOR	Industria de Cimentos SA	Portugal
17	DGEG	Direção Geral de Energia e Geologia	Portugal

Abbreviations and acronyms

Abbreviation	Description
AB	Advisory Board
CDE	Communication-Dissemination & Exploitation Strategy
CCUS	Carbon Capture Use and Storage
CLSF	Carbon Sequestration Leadership Forum
DX.X, DXX	DeliverableX.X as numbered in Annex1; DeliverableXX as numbered by EC
DoA	Description of Action
EC	European Commission
GA	General Assembly
IC	Industry Club
LCA	Life Cycle Assessment
R&D	Research and Development
RSC	Regional Stakeholder Committee
TEA	Techno-Economic Assessments
TERR	Techno-Economic Resource-Reserve
TRL	Technology Readiness Level
WP	Work Package

Table 1-1. Abbreviations and Acronyms

1 Work carried out by the beneficiaries and Overview of the progress

1.1 Objectives

The **overall objective** of the STRATEGY CCUS project is to develop strategic plans for CCUS development in the South and East of Europe in the short term (up to 3 years), medium term (3-10 years) and long term (more than 10 years).

To this end, STRATEGY CCUS project is focusing on **the elaboration of local CCUS development plans**, with local business models, within promising start-up regions and **the development of connection plans** with transport corridors between local CCUS clusters, and with the North Sea CCUS infrastructure, in order to improve performance and reduce costs, and contribute to build a Europe-wide CCUS infrastructure.

Eight promising regions, within seven countries representing 33% of the European (+UK) industry and energy emissions in 2018, are studied in the STRATEGY CCUS project. They were selected according to criteria relevant for the development of CCUS in Europe: presence of an industrial cluster, possibilities for CO₂ storage and/or utilization, potential for coupling with hydrogen production and use, previous studies already carried out, and a political willingness.

They are listed below and illustrated in Figure 1:

1. Paris basin in France (including Paris urban area, Ile de France and Loiret area)
2. Rhône valley in France (including the Fos-Berre/Marseille CCU cluster targeted by the EU SET Plan Action 9 (as a Flagship Project), and Lyon métropole)
3. Ebro basin in Spain (including Tarragona industrial area, North Castellón and North Teruel areas)
4. Lusitanian basin in Portugal (including the CO₂ sources in the Leiria -Figueira da Foz axis, and extending to Lisbon and Setubal))
5. Northern Croatia (including Zagreb and the Croatian part of Pannonian basin)
6. Galati area in Romania (including Galati, a port town on the Danube river, and its surroundings)
7. West Macedonian area in Greece (including the Kozani and Ptolemaida industrial areas).
8. Upper Silesia in Poland (including the industrial areas of Katowice, Rybnik and Bedzi)

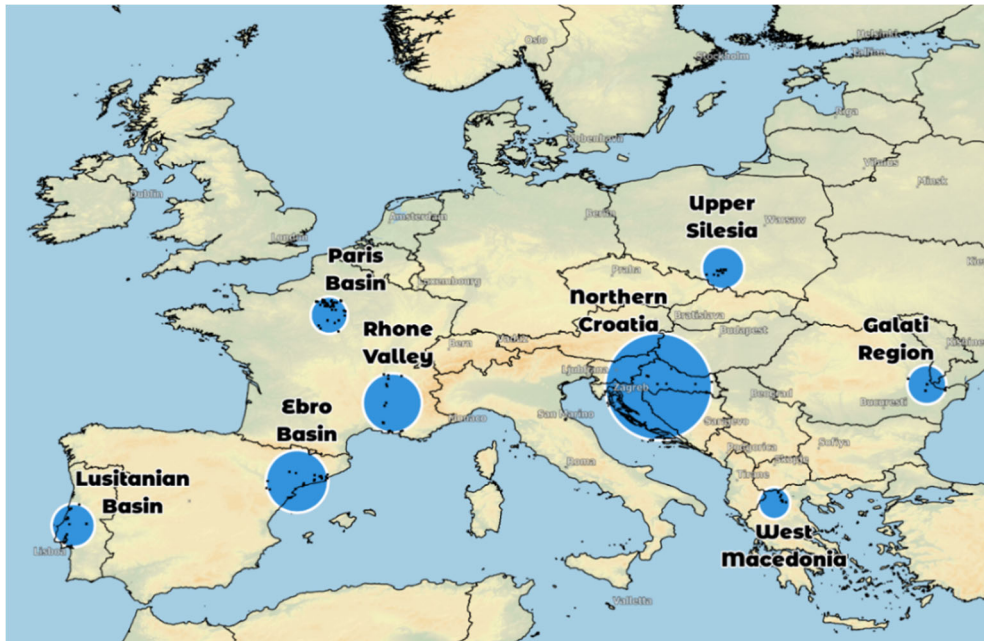


Figure 1: STRATEGY CCUS promising regions in Southern and Eastern Europe.

STRATEGY CCUS adopts a bottom-up approach to the construction of roadmaps in the selected promising regions, making first scenarios for CCUS clusters in sub-national regions in order to favor industrial symbiosis and circular economy, and then considering connection of clusters at national and transnational level in a longer term. The current CCUS state-of-play in each of these regions was evaluated following the approach and methodology currently used for CCUS clusters around the North Sea.

In the three most promising regions, chosen based on the existing conditions and available data, Lusitanian Basin, Ebro Basin and Rhone Valley, the agreed methodologies evaluate environmental impact assessment using Life Cycle Analysis (LCA), and social-economics factors using MRIO analysis in order to estimate how CCUS deployment would stimulate the economy and the employment considering the direct and indirect effects.

STRATEGY CCUS carries out cost assessment considering possible various CO₂ utilisation options in order to improve the business models (e.g. conversion into synthetic fuels using H₂, CO₂ delivery to greenhouses, aggregates, construction materials, CO₂ –EOR etc.). Economies of scale will be sought through industrial symbiosis and shared transport and storage infrastructure. Synergies with other technologies will also be explored, for example with geothermal energy (recovery of heat) and energy storage in connection to power-to-gas processes. Local specifics will be taken into account such as job creation, taxes, and subsidies. Reduced costs will include avoidance of EU-ETS carbon quota purchases and transactions within the CCUS value chain, considering the separation between capture, transport, utilisation and storage liabilities.

In all promising regions, regional stakeholders, including industries, are cooperating in the elaboration of the roadmaps, as they are the first actors involved in the expected CCUS developments in their territory. A regional stakeholders committee was set-up for each promising start-up region in order to involve them actively in the construction of the detailed CCUS plans for their region. National and regional surveys will also be conducted to assess the perceptions of the general public.

The Consortium also rely on the support of two external bodies, the Advisory Board and the Industry Club, to provide feedback and guidance on project monitoring and targets. Both these boards are regularly addressed and/or consulted whenever necessary, and bilateral communication is ensured when acknowledging and discussing their propositions and suggestions. A dedicated page was created for each body on the project website, to raise members' profile using information they provided. Pages can be found here:

- <https://www.strategyccus.eu/about-project/advisory-board>
- <https://www.strategyccus.eu/about-project/industry-club>.

1.2 Project Progress

During the first period, the Consortium tended to gathering the preliminary elements required to develop strategic plans for CCUS deployment in the eight promising regions and to identifying main stakeholders playing an important role in CCUS deployment at local and national level.

- Develop local CCUS development plans, with local business models, within promising start-up regions;

1.2.1 Mapping technical potential of CCUS in the eight promising regions

To build the Roadmaps, STRATEGY CCUS partners considered a number of technical features relevant to describe the potential for developing CCUS clusters, i.e., i) emissions; ii) area; iii) industry; iv) transport infrastructures; v) storage; and vi) ongoing and potential utilizations for CO₂. Local teams collected data to map the local CCUS potential key parameters of every promising region, and implemented a methodology to produce a preliminary overview of the technical potential to develop CCUS clusters and networks.

Various methodologies for storage resource assessment were looked at (in particular SPE SRMS methodology used in both Norway and UK), and CO₂ uses with meaningful climate mitigation impact taken into account. Best practices recommendations were provided to the local teams, focusing on quality and suitability of data.

Regional partners assessed CO₂ sources and industrial cluster potential, presence of geological sinks and their capacity, possibilities for CO₂ uses through distinct technologies and TRL, presence of corridors for transport and links to other regions at national and transnational scales.

The description of maturity and confidence level of storage resources in every region followed a common methodology compatible with existing schemes (CSLF TERR, SPE SRMS), allowing outcomes to be transferred to equivalent classifications if required. Relevant working groups internally discussed the manner to face the lower level of maturity of storage resources and the need to have bankable storage resources for planning CCS deployment at commercial scale.

This inventory allowed to estimate the current development and possibilities of CCUS deployment. This was useful to perform the **selection of regions for detailed characterisation** at the General Assembly. Further to this major milestone, Local Teams in the selected regions (Ebro Basin, Lusitanian Basin and Rhone Valley) were asked to engage in collecting higher level information about each source and in identifying the potential uses with a meaningful mitigation impact. Information gathered were to fuel activities for the other project activities, i.e. the economic and environmental assessment of CCUS implementation, and detailed design of the CCUS networks at

various time scales. Local Teams could identify **possibilities for CO₂ utilization** likely to have an impact in each region, and to gather information in regional and national roadmaps and strategies.

1.2.2 Social Acceptance Stakeholders mapping and engagement

The **social aspects to CCUS deployment** were also taken into account in the Road Maps and they refer to the needs and concerns of stakeholders who are playing a role in the CCUS technology at local and national level. Through on (Lusitanian Basin, Ebro Basin and Rhone Valley) going cross-sectoral and multi-stakeholder participation, the objective is to explore the challenges and opportunities to develop CCUS projects in the region, hence the setting up of three RSC workshops in each region in the course of the project. Each of the three workshops will set a different focus. The RSC workshops allow attendees to communicate their views (incl. expectations and concerns) and policy needs, to develop a network of relevant stakeholders that should even live beyond this project, to work together to identify drivers and barriers for CCUS in the region and to find policy proposals to address them, to receive information about the STRATEGY CCUS project to act as informants in the region about the project and the CCUS plans.

Based on a research and practice, relevant stakeholders were identified in the following categories: supply (development, operation, i.e., providers of CCUS technologies; transport); demand (large CO₂ emitters, storage operators, CO₂ re-use providers and their customers); politics & policies; research & education; support organisations; influencers.

A set of initial interviews were conducted to offer an initial mapping of stakeholder's concerns, needs and interests. The following aspects were considered for each stakeholder interview: general evaluation and level of acceptance of CCUS technologies and their implementation, perceived benefits and risks, conditions for acceptance, preference for alternative options. Additionally, we conducted four interviews with key stakeholders at European level to cover not only the regional and national but also the European perspective on these aspects.

Main stakeholders (approx. 10 to 15) were then invited to participate in the Regional Stakeholder Committees (RSC) established in each promising region.

The first set of RSC workshop focused on providing a common ground. Its aim was to connect the invited key stakeholders by getting to know each other and becoming familiar with the project: The RSC members received up-to-date information on the progress of STRATEGY CCUS and on the interview results from this region. Moreover, they actively provided additional regional concerns that need to be considered in the strategic planning and were not covered by the interviews. Half-way through the project, the first series of workshops between RSC and project partners is ongoing, and five out of eight are already completed. In the first half of the project following RSC workshops have been held : France (Rhone Valley), Croatia, Spain, Greece and Poland.

1.2.3 Methodological developments for mapping environmental and economic drivers

Among the various aspects considered within the STRATEGY CCUS project framework, we aim at **providing decision-support for the sustainable development of CCUS** in South and East of Europe and their integration into a European infrastructure. To that end, partners planned to carry out TEA and LCA to assess economic and environmental performance with a focus on 3 particular regions selected on a range of criteria.

The whole life cycle analysis (LCA) of different CCUS processes to understand and evaluate the various environmental impacts of the production processes is being evaluated for the three most promising regions. For these 3 regions, a TEA for assessing the costs of various CCUS technologies, and a Socio-Economic Assessments through MRIO analysis will examine the impact of CCUS deployment scenarios on the economy of the regions involved (e.g. gross domestic product (GDP) growth, job creation). For LCA, a special attention is given to the consideration of CO2 flow dynamics, and to incompleteness of process based LCA. Departing from the scenarios proposed and the TEA estimations, the MRIO analysis will answer where (in which sectors and regions) socio-economic impacts (both direct and indirect) are originated. Besides, different environmental interactions will also be assessed, such as emissions of pollutants in the air or water consumption, to complement the LCA's detailed results with the completeness of MRIO.

At the eve of the 2nd year of the project, during the 1st GA, the Consortium proceeded to the selection of the 3 regions. After a technical and societal presentation of the CCUS potential in each region, participants were invited to vote for the three most promising region where CCUS could be deployed at short/mid-term time scale (up to 10 years). The voting procedure involved project partners and external body members and the result of the Vote brought up 3 southern Europe countries as the most promising areas for CCUS deployment: Rhône Valley (France), Ebro Basin (Spain), Lusitanian basin (Portugal).

The three regions are now to benefit from the deep LCA and TEA analysis which will lead to enhance the feasibility of the scenarios being elaborated for their future implementation. The selected regions did provide the most interesting cases for full chain industrial CCUS deployment in the near future, offering a diversity of scenarios that can be of interest even beyond STRATEGY CCUS. However, the Consortium reflected that a further interesting scenario could result from CO2 utilization for CO2-EOR purposes in Northern Croatia, even if this region has a less compelling case for Industrial CCUS cluster development. Eventually, after the reassessment of resources, it was decided to elaborate a more detailed Road Map for Northern Croatia, focusing on the study of relevant CO2-EOR scenarios.

According to plans, the methodology for LCA and TEA assessment has been defined, and although it will be assessed in 3 selected regions only, other beneficiaries should be able to apply it in their respective regions. An important step was to establish a consistent list of emitters, capture technologies, transport technologies, CO2 use technologies and storage technologies specifically suited to each region and then start to assess and evaluate the various results. Collected information will contribute to the building of regional scenarios.

For the second period (M18-M36) Environmental aspects (CO2 Life Cycle Assessment-LCA of the CO2's life cycle) and Techno-Economic Assessments of the Road Maps are to be evaluated in detail for the selected three most promising regions. For the other 5 regions, , only the economic analysis will be conducted in the deployed scenarios.

Eventually, sound insights and a comprehensive diagnosis of the potential local business models associated with the different CCUS options will be given. On the one hand, it will rely on a scenario for Europe CO2 pricing at short, medium and long term provided by WP5; on the other hand, local specifics will be considered: job creation, taxes, and subsidies. Sensibility on storage capacity will be assessed in order to take into account the uncertainty related to storage capacity assessment performed in previous project activities. A global estimation of total costs and possible revenues (from CO2 utilisation and CO2 allowances avoided) creating business cases will be performed for

all scenario in all the eight European regions. Different scenario options and sensitivities will be performed to identify the most sensitivity parameters on total costs.

1.2.4 Establishing realistic detailed plans and techno economic evaluations for CCUS at different geographical and timescales.

In order to elaborate realistic economic scenarios of CCUS deployment from 2025 to 2050 for each promising start-up regions of Eastern and Southern Europe, the priority is to look first at local, endogenous, solutions before considering possible connections between regions at national level or cross-borders at transnational level. If beneficial, connections to the North Sea CO₂ infrastructures will be considered.

Scenarios will be elaborated for each of the 8 promising regions in the South and East Europe, based on data previously collected across the various project technical, socio-economic activities, and in close relation with the relevant teams and the Regional Stakeholder Committees which started meetings in October 2020. Economic evaluation of each scenario will provide the main Key Performance Indicators (KPIs) required for each scenario.

A dedicated tool has been developed from scratch to assess business case scenarios based on Capture, Transport and Storage modules and to create a brand new CO₂ Utilisation module. The set of KPIs including factors like cumulated CAPEX/OPEX, additional energy cost, total amount of CO₂ avoided, total costs of CO₂ avoided or removed, etc. will serve for all the scenarios.

In the second period of the project (M18-M36), the performed economic analysis will evaluate the cost for each scenario and for each industrial installation per ton of avoided CO₂. The transport corridors will consider multiple time scales to identify the most cost-effective development of transport network, starting at the local level and evolving in the short to medium term to national and transnational levels. The costs of transport by pipeline will be estimated based on the amount of CO₂ to be transported from each hub, and the generic design of pipelines, including the pipeline diameter, number of booster stations, and operational costs.

For the purposes of the analysis a set of financial assumptions will be adopted with values relevant with regard to the discount rate, the uncertainty interval regarding costs, the costs of operations, materials, etc. and scenarios for energy prices. National scenarios will be developed from the short to the long term and compared to the greenhouse gases reduction targets of the countries. An economic impact assessment will be performed at national and European level in terms of volumes (and costs) of quotas avoided for industries included in the European Emission Trading Scheme (EU ETS), and in terms of possible impact on the EU ETS carbon price.

- Develop connection plans with transport corridors between local CCUS clusters, and with the North Sea CCUS infrastructure, in order to improve performance and reduce costs, and contribute to build a Europe-wide CCUS infrastructure.

The first step toward local assessment of technical parameters was achieved during this 1st period. These key parameters of Road Maps are have now been gathered and further, the connections between plans will be studied in this incoming period (M18-M36). A global estimation of total costs and possible revenues (from CO₂ utilisation and CO₂ allowances avoided) creating business cases will be performed for all scenario in all the eight European regions. Different scenario options and sensitivities will be performed to identify the most sensitivity parameters on total costs.

1.2.5 Strategic communication and dissemination for CCUS development

Communication and dissemination represent an important aspect of STRATEGY CCUS project as they provide the channels to bring forward and deliver strategic communication and dissemination activities not only to project's partners, but to our main targets: the CCUS community, policy makers at European level and local authorities, industry and the public in promising start-up regions.

In the first period the consortium set up a strategy and a communication plan, developed several tools and used various channels to reach these goals.

The communication team brought expertise and technical support to project partners to share project results. This was particularly valuable when it came to adapt and extend the use of virtual tools to held online meetings in the place of physical encounters cancelled due to the Covid pandemic situation.

A project website (www.strategyccus.eu/) was specially designed to showcase the project activities, which also acts as a platform for information sharing. The [News and Events part](#) features 13 news articles published during the M1 to M18 period which are listed in Annex. These pieces of news reflect project commitments, at national, regional and local level, regional focuses and stakeholders' views. It also provides information on specific events or conferences like COP 25, and project public webinars.

Social Media : The project has a Twitter and a LinkedIn accounts from which it announce any new activities, and news related to the project. Other channels like YouTube also serve as means to spread information.

1) **Twitter account** = @strategyccus

The project has posted 271 tweets of its twitter accounts where it has 198 followers – our tweets lead to 2185 impressions.



2) **LinkedIn account** (www.linkedin.com/company/strategy-ccus)

The project has 197 followers on LinkedIn.

3) Videos, and post on YouTube

Six videos were produced during the first 12 months of the project.

- 1) Carbon Brief interview on the readiness of CCS storage resource in Europe;
- 2) 2) Project webinar one (WP2)

- 1) Project webinar two (WP3)
- 2) STRATEGY Regions video – introducing the start-up regions, as part of the Stakeholder Toolkit uploaded on STRATEGY website
- 3) Video explaining CCUS to the general public
- 4) Video to advertise WP3 webinar

They deliver information in a lively way, inducing further proximity with our Stakeholders and are good tools to animate and enliven communication.

Webinar platform: The project is using a webinar platform to facilitate internal communication and exchange data between partners (online webinars), and to disseminate project outputs and findings to stakeholders outside the project (public webinars).

So far 2 public webinars have been held to present and share project results with our stakeholders and various CCUS

- **Webinar 2.** This open access webinar focused on the scientific and industrial community engaged in CCUS research and development, **aiming to present the best practices and methodologies** to be pursued in STRATEGY CCUS. It took place on January 21, 2020, **and with 86 people registered and 62 attendees reached an attendance rate of 72%, which is a good result. This public webinar is now available on the website:**
<https://strategyccus.eu/news-and-events/events/webinar-1-methodology-ccus-planning>
- Webinar 3. This open access webinar aimed to disseminate key information on mapping stakeholder views on CCUS technologies in Southern and Eastern Europe. The webinar disseminated results scoping on acceptance issues. It was held on 17th of September 2020, 99 people registered and 58 attended, the attendance rate reaching 59%. This public webinar is now available on the website : <https://www.strategyccus.eu/news-and-events/events/webinar-2-mapping-stakeholder-views-ccus-technologies-southern-and-eastern>

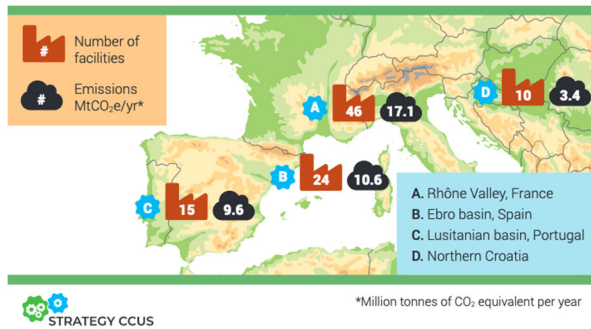
Stakeholder Engagement toolbox: This predominantly digital resource is prepared to allow project partners to run local/regional events and meetings, relevant to local stakeholders and their needs. Some of these tools are only available to partners and **others**, such as videos, infographics or the project briefing leaflet translated in 7 project languages (of promising regions), are shared with our stakeholders and followers.

It contains:

1. Project branding
2. Report template
3. Presentation slide pack template
4. Project poster
5. **Project briefing leaflet** – translated in the languages of the 8 start-up regions (French, Portuguese, Spanish, Polish, Greek, Romanian and Croatian).
<https://www.strategyccus.eu/about-project/regions>
6. **Video presenting the project and the start-up regions.**
<https://www.strategyccus.eu/toolbox>

7. Map infographics

<https://www.strategyccus.eu/sites/default/files/SCCS%20STRATEGY%20Infographic%20-%20selected%20regions.pdf>



The communication teams also brought valuable expertise and technical support to partners when it came to adapt and extend the use of online communication tools to face the upcoming of Covid pandemic situation.

All these activities contributed to a gradual increase in users, strengthen project network and foster communication with external stakeholders and other projects.

2 Expected Outcomes and impact

Results of the first period of the STRATEGY CCUS project include methodology and best practices for CCUS assessment at local scale, as well as methodology and workflow to assess LCA, TEA and MRIO. STRATEGY CCUS revised the current engagement of CCUS technology in seven countries and has delivered outputs to foster the further development of CCUS in these countries using common methodology, defining and sharing standards, key data and challenge issues, enabling an open discussion on the technology and avoiding stranded assets.

The main outputs of STRATEGY CCUS will be: roadmaps at regional, national and transnational scales and social acceptance findings. For each of the eight targeted promising regions, STRATEGY CCUS' outputs expect to accelerate investment opportunities for the deployment of a CCS or CCUS pilot or demonstration project operating in the next 3-10 years, as STRATEGY CCUS will deliver the necessary basis for decision making to prepare a pre-FEED study and to design the infrastructure for hubs and clusters.

The systematic approach followed by STRATEGY CCUS will facilitate the appraisal of other promising regions and the creation of connection among them for the deployment of CCUS Europe-wide.

Methodology and outputs of STRATEGY CCUS are relevant also for the industry outside Europe as they provide a solution for sustainable industrial growth and market potential, which will indirectly increase opportunities for employment. Contacts have been created with a Program Manager of CEATI, a Canadian organization (located in Montreal, Canada) that provides a networking, information sharing, and collaboration platform for energy companies (production, transportation and distribution) in North America, and the whole world. Established contact with STRATEGY CCUS over the summer 2020 and would be interested in hearing about the CCUS roadmap. An agenda for a webinar to take place in February 2021 has been drafted and round tables and technical exchanges will be organised.

Table 2-1: DoA – Impact summary table

STRATEGY CCUS output	Short-term (<3 years) expected impacts	Medium-term (3-10 years) expected impacts	Long-term (>10 years) expected impacts
Detailed plans at national and Transnational scales	Assessment of costs and impacts of CCUS to reach National targets of greenhouse gases reduction goals of the country	Investment opportunities Inclusion of CCUS in the National Determined Contributions (NDC) of countries	Connections between regional CCUS clusters at national and transnational scales Lower decarbonisation cost than if CCUS is not applied
Detailed plans and Roadmaps at regional scale	FEED study for pilot or demonstrator Providing enabling actions Including CCUS in regional plans for climate, energy and industry	Design infrastructure for hubs and clusters Full chain CCUS pilot/demo projects operating. Deployment of Projects of Common Interest (PCI) for construction of transnational CO2 infrastructures	Regional CCUS clusters in operation
Methodology and Best Practices for CCUS assessment at local scale	Defining standard, key data and challenge issues	Policy support and Regional incentives. Proposition of improvement on National and European policies and regulatory issues	Adapted regulatory framework at local, national and European level.
Local business models Techno-economic assessment (TEA) MRIO analyses LCA analyses	Common European methodology to estimate economic and environmental drivers	Easy update of economic evaluation Same methodology used for the potential assessment in new regions	Deployment of CCUS whole chain
Public acceptance findings	Improved perception of the technology Avoiding stranded assets	Policy support and Regional incentives	Strong and sustained government support for the development of CCS, including policy incentives

















3 CONCLUSION

After 18 months running, STRATEGY CCUS Project is well on tracks and partners are now well engaged and working together to implement the workplan. Despite some delays due to the Covid 19 situation and successive lock-downs, the consortium managed to performed all the required activities adapting to circumstances.

4 Acknowledgements

The STRATEGY CCUS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 837754. (<https://strategyccus.eu/>)

ANNEX 1 Overview of the project progress and results towards specific objectives

WP	Objective	Progress	outputs
WP2	1-The current and planned CO2 sources, nature and longevity;		D2.2; D2.4
	2-The current and planned CO2 infrastructure for transport		D2.2
	3-The methodologies and resulting CO2 storage capacities estimated in previous projects;		D2.1; D2.3
	4-The CO2 utilisations options, including for EOR purposes and expected development of hydrogen industry and the possibilities of coupling it with CCUS;		D2.2
	5-The emission trade system and the CO2 quotas at individual, cluster and national scale.		D2.4
WP3	1- To identify key stakeholder groups considering the regional, national and European level.		D3.1
	2- To map stakeholders perceptions, attitudes and interests in CCUS (=‘social acceptance’) leading to a scoping of relevant issues and needs.		D3.2
	3- To develop and explore implementation of specifically developed participatory formats on the regional, national and European level incl. regional stakeholder committees.		(D3.4)
	4- To measure public acceptance.		(D3.3)
	5-To deliver recommendations for stakeholder participation beyond the lifetime of the project.		(D3.4)
WP4	1 - methodology developments needed to perform both economic and environmental assessment of CCUS scenarios		D4.1; D4.2
	2 - common methodology for bankable storage capacity, Life Cycle Assessment (LCA), Multiregional Input Output (MRIO) analysis and Techno-Economic Assessment (TEA) designs		D4.1; D4.2
	3 - LCA and MRIO assessment		D4.3; D4.4; D4.5
WP5	CCUS scenario (roadmap) from 2020 to 2050 for each of the promising regions Key Performance Indicators (KPIs) such as cumulated CAPEX/OPEX required for each scenario, the cost breakdown per CCUS stakeholder, or for example the global costs expressed in €/t CO2 avoided per scenario Recommendation plans will be elaborated at national level Economic impact assessment will be performed at national and European levels		
WP6	1- Communication of the STRATEGY CCUS project by providing bespoke communication activities to facilitate the flow of information between project’s partners and with regional stakeholders.		D6.1; D6.2; D6.6; D6.9
	2- Exploitation and dissemination of the project’s results and findings, by addressing relevant end-users (industry and policy makers), in order to pave the way for the operational implementation of CCUS clusters and providing targeted information to multiple audiences (including the media and the public) and favouring dialogue, with a public policy perspective.		D6.2; D6.4; D6.6; D6.9

ANNEX 2 - Summary of Deliverables

In general, project milestones were successfully achieved and deliverable delivered timely. However some delays due to the COVID-19 pandemic resulted in postponing the delivery of a few of them (with no impact on the quality of the deliverable).

Below is presented the list of Deliverables, with a short synthesis, produced during the first period of STRATEGY CCUS project to share progress and results in the various areas. Public deliverables are available on the STRATEGY CCUS website in the output section¹, while the confidential deliverables are only accessible to the consortium.

Deliverable D2.1 - Methodologies for cluster development and best practices for data collection in the promising regions

Deliverable D2.1 reviews and describes best practices and tools for characterising carbon dioxide (CO₂) emission sources, transport options, uses and storage sites in European regions holding promise for the deployment of carbon capture utilisation and storage (CCUS). The report comprises two parts: the first part addresses industrial CCUS clusters and CO₂ transport systems; the second part addresses CO₂ storage resource assessment.

Deliverable D2.2 - Key data for characterising sources, transport options, storage and uses in the promising regions

Local Teams in each of the regions conducted assessments related to the technical features and implemented a methodology to produce a preliminary overview of the technical potential to develop ICCUS clusters and networks.

The report includes in Appendix I a set of maps for each region about: i) with the location and main features of the sources; ii) with the main features of the storage sites, and; iii) indicating the main features relevant for defining collection and transport networks.

Deliverable D2.3 - Maturity level and confidence of storage capacities estimates in the promising regions.

STRATEGY CCUS synthesized and homogenized storage capacities in each region giving the level of maturity and confidence of storage resources knowledge. Starting from the data about previous assessments collected by local teams, on which a gap analysis was conducted, the project harmonized the estimates of storage capacity and undiscovered resources based on the methodology and recommendation set up in the deliverable D2.1.

Deliverable D2.4 - Databases filled for each promising region including ETS data: partially delayed

This deliverable D2.4 is a confidential deliverable, accessible to consortium members only. It comprises the databases and spatial information that was collected by Local Teams to characterise the technical potential for deploying CCUS in each promising region.

¹ <https://strategyccus.eu/project-outputs>

The best practices were disseminated in a webinar “[STRATEGY CCUS Webinar 1: Methodology for CCUS planning](#)”², and also integrated in the report D2.1 and implemented in the software tool to be completed by Local Teams.

D3.1 Stakeholder mapping report

This deliverable aimed to provide a first description of the stakeholder structure in the innovation system of CCUS as outcome of Task 3.1. The stakeholder mapping served as a basis to prepare the social acceptance studies (Task 3.2, 3.3 and 3.4) but also inform the consortium and further deliverables.

D3.2 Report on scoping on acceptance issues

The deliverable entitled "Stakeholders' views on CCUS developments in the studied regions", summarizes the results from the stakeholder interviews as outcome of Task 3.2. It maps stakeholders' views and beliefs regarding CCS and CCU technologies as a mitigation option to climate change - including perceived benefits and risks, conditions for acceptance and preference for alternative options.

Public Online Webinar 3

This milestone was successfully achieved with a small delay due to the pandemic (and consequently the results of D3.2). **The open access webinar entitled “Mapping stakeholder views on CCUS technologies”** was conducted on September 17th, 2020 with Fraunhofer ISI and CIEMAT presenting the results of the deliverable/report D3.2. The webinar had 99 people registered and 58 attendees (attendance rate 59%). All those registered received the link to the [recording](#) which is also available from the website Events' page.

D 4.1: Data template to build model for Life Cycle Assessment (LCA) and Techno-Economic Assessment (TEA) - (initially planned on M12 delivered on M17)

The deliverable 4.1 is a public deliverable and presents the needed data to build models for Life Cycle Assessment and Techno Economic Assessment. It is composed by 9 chapters and three parts:

- Part I, chapter 1 and 2, focus on introduction and a common description of data template structure.
- Part 2, chapter 3 to 7, each focus on one main categories of processes, with each data sheet per technology:
 - o CO₂ emissions sources
 - o CO₂ capture technologies
 - o CO₂ transport
 - o CO₂ use
 - o CO₂ storage.

² <http://www.strategyccus.eu/news-and-events/events/webinar-1-methodology-ccus-planning>

For each studied promising region (France - Rhone valley-, Spain –Ebro basin- and Portugal - Lusitanian basin -), a list of potential technologies is proposed for the different listed categories.

Note that the construction of the list of inputs and emissions has been done with WP2 “Mapping the technical potential of promising start-up regions” and WP5 “Establishing realistic detailed plans for CCUS at different geographical and timescales”.

- Part 3, chapter 8 and 9, conclusion and reference.

D4.2: General guidelines of LCA, TEA and MRIO methodologies applied to CCUS technologies - delayed (initially planned on M12) is a confidential deliverable available only for partners.

D6.4: Data Management Plan

The project data management plan was established following article 29.3 of the Grant agreement relating to open access to research data, taking account of the guidelines on FAIR data management in Horizon 2020 (online manual - http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm), and on Fair data principles (<https://www.force11.org/group/fairgroup/fairprinciples> and <https://www.nature.com/articles/sdata201618>). As part of the data management plan, we distributed a data management questionnaire to identify and categorise project’s data and identify any potential problem areas. This questionnaire was completed by WP leaders.

Newsletters and Editorial boards

Most of the active engagement with stakeholders is done by providing regular news about the project, the partners and the start-up regions. 13 news articles were published during the M1 to M18 period:

- 1) Regions in focus: CCUS potential in West Macedonia and the Ebro basin, Published: Tuesday, 25 August, 2020.
- 2) Stakeholder interviews yield regional perspectives towards CCUS, Published: Thursday, 13 August, 2020.
- 3) Milestone vote on CCUS roadmaps for Southern and Eastern Europe, Published: Tuesday, 30 June, 2020.
- 4) STRATEGY CCUS maintains momentum with online shift, Published: Thursday, 14 May, 2020
- 5) Partner profile: ‘Industrial symbiosis’ will open up promising regions to CCUS, Published: Monday, 27 April, 2020.
- 6) Statement on Covid-19 outbreak, Published: Friday, 20 March, 2020
- 7) Guloren Turan: : ‘Future CCS projects will be key to supporting Europe’s industrial transition’, Published: Thursday, 5 March, 2020
- 8) COP25: Partners present vital role of CO2 storage, Published: Wednesday, 4 December, 2019
- 9) Top science accolade for STRATEGY CCUS director, Published: Thursday, 28 November, 2019
- 10) Focus on CCUS stakeholder committees gets under way in promising regions, Published: Tuesday, 26 November, 2019
- 11) Blog: Putting stakeholders at the heart of CCUS dialogue, Published: Thursday, 25 July, 2019
- 12) Support for ‘promising regions’ of Europe in drive to develop low-carbon energy and industry, Published: Tuesday, 14 May, 2019

Most popular news/blogs:

- 5) Blog: Putting stakeholders at the heart of the CCUS dialogue - Unique page views: 94
- 6) News: Focus on CCUS stakeholder committees gets under way in promising regions - Unique page views: 61
- 7) News: Support for ‘promising regions’ of Europe in drive to develop low-carbon energy and industry - Unique page views: 43

The project produced two press releases during the first 18 months of the project;

- 1 - Press release to announce the start of the project;
- 2 - Press release on the Selection of Promising regions for LCA and TEA detailed analysis.



The following table illustrates the gradual increase in users during the M1 to M18 period, (as two sub-period: May to December 2019 and January to October 2020). The project main objective of the website is to facilitate the communication between the 17 partners and help partners communicate with external stakeholders. The following figures illustrate that the website is attracting a majority of users from outside the project – achieving both of our objectives.

Table 0-1: Statistics of website views

Period	May to Dec 2019	Jan to Oct 2020
Users	269	927
Page views	947	1694
Website traffic sources	Direct: 85.38% Referrals 2% (Baidu.com; sccs.org.uk; incarbon.uevora.pt) Network 4.68% (LinkedIn; Twitter, Facebook)	Direct 78.22% Referrals 2% (trafficbot4free.host ; rgn.unizg.hr; intranet.inogs.it ; baidu.com; co2geonet.com; isi.fraunhofer.de) Network referrals: LinkedIn; Twitter, Facebook

ANNEX 3 - External bodies representatives

Participants list of External Bodies

Table 0-1: Advisory Board Members

Advisor #	ORGANISATION Short Name	NAME	SURNAME
1	CONCAWE	Damien	VALDENNAIRE
2	ECRA-European Cement Research Academy	Dr.-Ing. Volker	HOENIG
3	EERC	Charlie	GORECKI
4	CO2 VALUE EUROPE	Anastasios	PERIMENIS
5	GLOBAL CCS INSTITUTE (GCCSI)	Angus	GILLESPIE
6	IOGP	Caterina	de MATEIS
7	BELLONA	Jonas	HELSETH
8	IASS Potsdam	Barbara	OLFE-KRÄUTLEIN
9	Leiden University	Emma	TER MORS
10	CEM BUREAU	Koen	COPPENHOLLE

Table 0-2: Industry Club Members

Advisor #	ORGANISATION Short Name	NAME	SURNAME
1	Aker	Jon Christopher	KNUDSEN
2	Mott MacDonald	Adina	POPA
3	HeidelbergCement AG	Rob	VAN DER MEER
4	LafargeHolcim	Vincent	MEYER
5	OFICEMEN (Agrupación de fabricantes de Cemento de España)	Pedro	MORA PERIS
6	GRTGaz	Nicolas	PEUGNIEZ
7	SIEMENS	Stefan	RAAB
8	Global CO2 initiative	Volker	SICK
9	Air Liquide	Fabrice	DEL CORSO