

Development of ECCSEL-R.I. Italian facilities: user access, services and long-term sustainability

D7.3.1 – Monitoring evaluation plan

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TABLE OF CONTENTS

Summary	3
1 Monitoring evaluation methodology.....	4
1.1 Main elements.....	4
1.1.1 Purpose and objectives	4
1.1.2 Criteria and indicators.....	5
1.1.3 Data collection methods.....	5
1.1.4 Reporting and communication.....	5
1.2 Templates	6
1.2.1 Reporting template table for deliverables.	6
1.2.2 Reporting template table for intermediate objectives	18

SUMMARY

The ECCSELLENT project is focused on technological innovation of most of the Italian facilities involved in the CCUS field (CO2 Capture, Utilisation, Transport and Storage). It involves 8 operating units (OU) from 5 institutions and a great number of researchers. To achieve the project results and ensure the technological advancement in the field of intervention, a significant number of scientific instrumentation and technological equipment will be acquired implying an administrative effort from the side of the subjects involved. Yet, the strong interconnection among the 4 Work Packages dedicated to technological implementation of the research infrastructure, complemented with 2 additional WPs (“Fair data and related digital services” and “Technical and business long-term sustainability”), add complexity to project implementation. For all these reasons, a precise and accurate monitoring and evaluation system is needed to help partner organizations to identify potential problems before they become critical, and adjust strategy or resources accordingly.

The deliverable here illustrated is related to the definition of a monitoring evaluation methodology not only to monitor and support partners to respect deadlines, but also to harmonize work, and facilitate passage of information among partners that can avoid or mitigate any critical risks and address any gaps during the project implementation phase.

The methodology, drafted by the project Lead Partner, OGS, and shared and discussed with the project Steering Committee, provide partner organizations with a structured framework aimed to appraise the impact and the success of the initiative. It also provides with specific guidelines to collect, analyze, and interpret data so that informed judgments and decisions can be taken by organization partners.

The evaluation methodology includes the following key elements:

- *Purpose and Objectives: clearly defining the goals and objectives of the evaluation to ensure alignment with the overall purpose of the project.*
- *Criteria and Indicators: identifying relevant criteria and indicators that will be used to assess the performance or effectiveness of the subject under evaluation. These criteria serve as benchmarks for measurement.*
- *Data Collection Methods: determining the methods and instruments for collecting data, which may include surveys, interviews, observations, document analysis, or quantitative metrics.*
- *Reporting and Communication: defining how the evaluation findings will be communicated to stakeholders, including the format and content of evaluation reports, presentations, or other dissemination methods.*

1 MONITORING EVALUATION METHODOLOGY

The deliverable here illustrated is related to the monitoring and evaluation of the implementation of project activities and the achievement of intermediate objectives (hereinafter I.O.). The document has been drafted by the project LP, OGS, and was shared and discussed with the project Steering Committee (SC).

During the process of application, OGS along with co-applicants defined the need of constant monitoring of the project implementation of the administrative and financial issues, deadlines matching for results and OI, activities implemented, and deliverables fulfilled. The main indicators to be assessed and evaluated during the project lifetime are the production of deliverables, with regards to the implementation of project activities, and financial indicators related to the “reimbursement claims” submitted by partner organization.

Measures to address any gaps in the implementation of the project will be suggested within each monitoring evaluation report. As mentioned before, the complexity and the close interconnection of activities requires an effective passage of information and a cohesive working group capable of understanding and addressing any change of plan as well as mitigating any risks. The final Evaluation Report defining any broader, longer-term changes that have occurred will be added to the Final Project Report (IO 7.2.3) delivered at the end of the project.

1.1 MAIN ELEMENTS

Monitoring evaluation methodology is a versatile tool, and its purpose is to enhance accountability, inform decision-making, and contribute to continuous improvement by providing an evidence-based understanding of the project under evaluation. The specific methodology chosen depends on the nature of the evaluation, the goals of the assessment, and the context in which it is conducted. As mentioned above, the methodology includes a set of elements deemed necessary to fulfill its purpose.

1.1.1 PURPOSE AND OBJECTIVES

The starting point to create a Monitoring and Evaluation Plan is to highlight and recall the project goals and objectives laid out by the logical model adopted during the project submission phase. It is also necessary to monitor Intermediate Objectives to help track successful steps on the way to the overall program goal.

Defining project goals start with answering three questions:

1. What problem is the project trying to solve?
2. What steps are being taken to solve that problem?
3. How will project staff know when the program has been successful in solving the problem?

Answering to these questions will help identify what the project is expected to do and how staff will know whether or not it worked.

1.1.2 CRITERIA AND INDICATORS

Indicators are of great importance for M&E. They enable the measurement of actual achievement against planned or expected results, in terms of quality, quantity, and timeliness. They always include at least one variable. Therefore, indicators can be quantitative (i.e. have a numerical value) or qualitative (i.e. reflect perception, judgements or attitudes)

Thus, indicator development is a core step in building a monitoring evaluation plan, and this drives all subsequent data collection, analysis, and reporting.

For each WP a set of Key performance indicators have been identified. These are essential for measuring progress toward specific goals.

1.1.3 DATA COLLECTION METHODS

At the beginning of the monitoring period, data need to be collected to establish a baseline to which future monitoring data can be compared. Interviews, questionnaires and surveys, observations, documents and records, focus group are the most common collection methods that will be used throughout the project implementation.

1.1.4 REPORTING AND COMMUNICATION

Taking into account the project nature and objectives, monitoring reports, produced at least every 6 months, will include a series of quantitative and qualitative assessments for implementation progress, finances, identification of potential risks and problems, deviations and modifications and set up early corrective measures.

The monitoring evaluation report will be structured in three sections, in order to specifically assess each of the following aspects, further detailed in the sub-sections:

- Report on administrative progress
 - Situation after the Reporting Period and forecast
 - Overall administrative progress
 - Problems and possible solutions
- Report on financial progress
 - Situation after the Reporting Period
 - Overall financial progress compared to budget forecast
 - Problems and possible solutions

- Report on intermediate objectives, activities implemented, and deliverables fulfilled
 - Situation after the Reporting Period and forecast
 - Evaluating impact on stakeholders
 - Problems and possible solutions
 - Detailed overview of deliverables

The following questions will be used as well to synthetically evaluate the content of each section; the answers could either be Yes, Partially or No:

- Has the project been efficiently and effectively managed?
- Were the resources used as described in the Application Form?
- Is the progress reported in line with objectives and work plan as specified in the Full proposal?
- Does the work carried out follow the plan detailed in the Full Proposal?

1.2 TEMPLATES

1.2.1 REPORTING TEMPLATE TABLE FOR DELIVERABLES.

ECCSELLENT	Deliverables	Date achievement	of	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
WP1 - ENHANCEMENT STORAGE TECHNOLOGIES FOR CO2 STORAGE SITE SELECTION AND MONITORING – OGS				
Activity 1.1: Enhancement of ECCSEL Panarea NatLab-Italy with geophysical technologies - OGS NATLAB				
IO1.1.1 - Instrumentations tender and purchase	D1.1.1 - Report of installation of a portable system for ground motion monitoring [M24];			
IO1.1.2 - Instrumentation, installation, settings and testing	D1.1.2 - Report on test data recording and data preparation and metadata creation [M30];			

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO1.1.3 - Fiber optic iDAS System and fiber optic cable installation	D1.1.3 - Report on fiber optic cable installation and fiber optic iDAS System testing [M30]		
IO1.1.4 - On shore cabin for interrogator installation on Panarea Island			
IO1.1.5 - Multibeam, Side scan Sonar, Sea Magnetometer, 24 channels Streamer	D1.1.4 - Report on testing and training of the Multibeam, Side scan Sonar, Sea Magnetometer and 24 channels Streamer [M30]		
IO1.1.6 - Multifunction system of UAVs for coastal monitoring	D1.1.5 - Report on Multifunction UAV systems, for coastal monitoring [M30]		
Activity 1.2: Enhancement of PITOP facility - OGS GEO			
IO1.2.1 - Site operations and installations design and tenders	D1.2. - Report on Civil and Scientific Installations and on the testing of synergistic use of the instrumentations and tools including the new infrastructures of the PITOP		
IO1.2.2 - Finalization of the Facility's Instrumentations Enhancement			
IO1.2.3 - Site operations and Installation's completion			

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
Activity 1.3: Development of a mobile and portable facility for onland geophysical investigation - OGS GEO			
IO1.3.1 - Finalization of Mobile Instrumentations Enhancement	D1.3 - Report on Instrumentation Enhancement Finalization and Testing [M30]		
Activity 1.4: Enhancement of Aircraft facility - OGS GEO			
IO1.4.1 - Finalization of remote sensing facility	D.1.4 - Report on the acquisition, installation and testing of remote sensing and aircraft instrumentation [M30]		
IO1.4.2 - Finalization of aircraft facility			
Activity 1.5: Enhancement of BioMarineLab facility - OGS OCE			
IO1.5.1 - Laboratories design and tender	D.1.5.1 Report describing the actual implementation of the wet laboratories structures of the ECCSEL BioMarineLab facility [M22]		
IO1.5.2 - Biogeochemistry laboratories implementation	D.1.5.2 - Report on the characteristics of the incubators and the related testing and operational phases [M30]		
IO1.5.3 - Thermostatic wet laboratories installation			
IO1.5.4 - Instrumentations tender and purchase	D.1.5.3 - Report on the acquisition and the installation of microscopes and reactors [M30]		

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO1.5.5 Instrumentations installation, settings and testing	n.a.		
Activity 1.6: Non isothermal numerical simulation of CO2 geological storage with pore surface – fluids interaction characterization - UNI BO			
IO1.6.1 - Purchase and installation of the optional equipment on existing NMR equipment	D.1.6.1 - Report containing the results of the preliminary testing of the upgraded NMR system [M18]		
IO1.6.2 - Purchase development and implementation of the different software	n.a.		
WP2 - ENHANCEMENT CAPTURE TECHNOLOGIES - POLIMI			
Activity 2.1: CO2 capture with solvents - POLI MI			
IO2.1.1 - Invitation to bid, technical specifications of the pilot plant fully defined	D2.1.1 - Preliminary design and publication of the Invitation to Bid [ITB] [M0-M6]		
IO2.1.2 - European public tender closure and contractor selection	D2.1.2 - Pilot unit purchase [M6-M12]		
IO2.1.3 - Facility purchased, available on-site and ready for commissioning	D2.1.3 - Pilot unit procurement and installation [M12-M18]		

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO2.1.4 - Facility continuously tested for at least 1 day, commissioning completed and at least 2 re	D2.1.4 - Pilot unit commissioning, start-up and young researcher's training [M18-M30]		
IO2.1.5 - Digital Model validated against pilot plant data at steady state	D2.1.5 - Report describing digital twin model validation [M0-M30]		
Activity 2.2: CO2 capture with membranes - UNI BO			
IO2.2.1 - Adaption of the laboratories for the set-up of the test rigs and laboratories	D2.2.1 - Report containing information on the activities for the adaption of the site for the installation of the different test rigs and Laboratories. [M0-M16]		
IO2.2.2 - Purchase of the main instrumentation for the test rigs and laboratories for membrane production and characterization lab	D2.2.2 Report on the installation and testing of the different instrumentation related to the membrane production and membrane characterization lab [M0-M26]		
IO2.2.3 - Instrumentations installation, settings and testing			

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO2.2.4 - Instrumentations installation, settings and testing	D2.2.3 - Report containing the results of the calibration and preliminary testing of the different Test Rigs for membrane characterization in pre and postcombustion application. [M16-M30]		
Activity 2.3: CO2 capture with low temperature sorbents - CNR STEMS			
IO2.3.1 - Publication of the Invitation to Bid [ITB]	D2.3.1 Publication of the Invitation to Bid [ITB] [M1-M10]		
IO2.3.2 - Scientific instrumentation purchase	D2.3.2 - Experimental plant and scientific instrumentation purchase [M11-M16]		
IO2.3.3 - Scientific instrumentation and experimental plant installation and calibration	D2.3.3 - Experimental plant and scientific instrumentation procurement and installation [M17-M21]		
IO2.3.4 - Scientific instrumentation and experimental plant calibration and measurements runs	D2.3.4 - Report containing the validation of the experimental plant and scientific instrumentation [M22-M24]		
IO2.3.5 - Final operational testing [28 - 30]	n.a.		

Activity 2.4: Enhancement of ECCSEL ZECOMIX research infrastructure - ENEA

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO2.4.1 - Invitation to for economical offer, technical specifications of the changes to implement i	D2.4.1 - Enhanced dual fluidized bed [DFB] system [M1-M18].		
IO2.4.2 - DFB upgraded and ready for commissioning	D2.4.2 - Commissioning and field tests of the DFB system [M18-M30].		
IO2.4.3 - Formulation of suitable numerical models and preliminary design of the mock-up models	D2.4.3 - Scale up tools [M6-M30].		
IO2.4.4 - Invitation for economical offer, technical specifications of equipment for the powder manu	D2.4.4 - Equipment for granulation of suitable batches [M6-M30].		
WP3 - ENHANCEMENT TRANSPORT TECHNOLOGIES - UNI BO			
Activity 3.1: Testing polymeric materials for CO2 transport - UNI BO			
IO3.1.1. - Set-up the laboratories for high pressure and supercritical CO2	D3.1.2 - Report of installation mechanical and relaxational characterization [M22]		
IO3.1.2 - Instrumentations tender and purchase	D3.1.3 - Report of installation of chemical analysis of polymers [M24]		
IO3.1.3 - Instrumentations installation, set-up and verification			

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO3.1.4 - Inspection of instrumentation capability and reliability	D3.1.4 - Report on testing CO2 sorption and permeation in polymeric materials for CO2 transport D3.1.5 - Report on testing the mechanical and chemical behaviour of polymers in contact with high pressure CO2		
Activity 3.2: Production of MOF-based materials for CO2 transportation – CNR STEMS			
IO3.2.1 - Publication of the Invitation to Bid [ITB]	D3.2.1 - Publication of the Invitation to Bid [ITB] [M10]		
IO3.2.2 - Scientific instrumentation purchase	D3.2.2 - Scientific instrumentation purchase [M16]		
IO3.2.3 - Scientific instrumentation installation and testing	D3.2.3 - Report on scientific instrumentation installation and testing [M22]		
WP4 - ENHANCEMENT UTILIZATION TECHNOLOGIES - CNR			
Activity 4.1: Design and preparation of catalytic materials for CCU applications - CNR ITAE			
IO4.1.1 - Successfully preparation of 3D printed structures and spray/dip/spin coated materials	D4.1 – Report on design and preparation of novel materials for CCU applications [M18]		
Activity 4.2: Structural, morphological and surface characterization of innovative materials for CO2 utilization - CNR ITAE			

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO4.2.1 - Advanced characterization of novel materials for CCUS applications	D4.2 – Physico-chemical characterization of materials effective in CO2 conversion [M24]		
Activity 4.3: Production of electrical energy via co-electrolysis of CO2 and water in low temperature electro-chemical devices - CNR ITAE			
IO4.3.1 - Optimization of electro-catalysts	D4.3 – Performance assessment of the optimized electro-catalysts [M30]		
Activity 4.4: Performance of structured materials during catalytic CO2 conversion into fuels at TRL 4 - CNR ITAE			
IO4.4.1 - Go/No Go decision for the most suitable systems for CO2 utilization at TRL 4 and possible	D4.4 – CO2 hydrogenation measurements at TRL4 and operational conditions for the production of fuels [M30]		
WP5 - FAIR DATA AND RELATED DIGITAL SERVICE - OGS			
Activity 5.1: Digital data service development and deployment - OGS GEO			
IO5.1.1. - Activation of remote nodes [Latera and Panarea]	D5.1 – Functional specifications of the Digital data services [M8]		
Activity 5.2: Data policy - OGS GEO			
IO5.2.1 - Central hub on line	D5.2 – Data policy specifications [M12]		
Activity 5.3: Data pilot - OGS GEO			
IO5.3.1 - Data management	D5.3 – Data pilot implementation [M28]		
Activity 5.4: Project web portal - OGS GEO			

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO5.4.1 - E-Research collaboratory active	D5.4 – Digital data services system deployment report [M30]		
WP6 - TECHNICAL AND BUSINESS LONG TERM SUSTAINABILITY - OGS			
Activity 6.1: Strengthen the national node - OGS OCE			
IO6.1.1 - Inclusion process for the two CNR facilities in ECCSEL-ERIC	D6.1.1 Report on inclusion process for the two CNR facilities in ECCSEL-ERIC, [M16]		
IO6.1.2 - Bilateral meetings between the node representatives and the facility owners	D6.1.2 Report on enhancement and activities of the National Node during the project framework, [M30]		
IO6.1.3 - Inclusion process for other new Italian facilities			
Activity 6.2: Develop a capacity-building programme - OGS GEO			
IO6.2.1 - Start of Capacity Building Programme	D6.2.1 Report on Capacity building strategy [training needs, mapping existing courses, courses curriculum, H&S issues], [M12]		
IO6.2.2 - Completed training courses covering some key topics of CCUS	D6.2.2 Summary report of the course arranged including synthesis of the course material for the ECCSEL public website, [M30]		

Activity 6.3: Scientific Diving Summer School at Panarea ECCSEL-NatLab Italy - OGS NATLAB

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO6.3.1 - Deliver of the first edition [funded by ECCSELLENT] of the Scientific Diving Summer School	D6.3.1 Report on participation, activities and students feedback related to 1 st [M12] and 2 nd funded editions [M24] of the International Scientific Diving Summer School		
IO6.3.2 - Deliver of the second edition [funded by ECCSELLENT] of the Scientific Diving Summer School	n.a		
Activity 6.4: International School on CO2 Utilization for the Production of Alternative Clean Fuels via Green Catalytic Technologies [CO2CAT] - CNR ITAE			
IO6.4.1 - Deliver of the two sessions of the international sessions of the international school on CO2 Utilisation	D6.4.1 Report on participation, activities and students feedback related to the CO2CAT School [M30]		
Activity 6.5: Improve access to Italian ECCSEL Facilities - OGS NATLAB			
IO6.5.1 - Completion of the 1st Info Day and 1st workshop	D6.5.1 Report on National info days and Workshops feedbacks and Improved Access [M30]		
IO6.5.2 - Launch of the call for access	n.a.		
IO6.5.3 - Completion of the 2nd Info Day and 2nd workshop	n.a.		

Activity 6.6: Dissemination - OGS GEO

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO6.6.1 - Deliver of the dissemination plan	n.a.		
WP7 – MANAGEMENT - OGS			
Activity 7.1 - Coordination of the project - OGS GEO			
IO7.1.1 - Key figures recruitment and SC rules of procedures	D7.1.1 - Key figures recruitment [M1] D7.2.1 – SC Rules of procedure and management plan [M3]		
IO7.1.2 - Report on the internal meetings	D7.1.3 - SC Meeting and minutes [M6-M9-M12-M15-M18-M21-M24-M27-M30] [every 3 months]		
Activity 7.2 Day to day management - OGS GEO			
IO7.2.1 - IT tools for internal communication	D7.2.1 - IT tools for internal communication [M3]:		
IO7.2.2 - Progress on periodic reporting	D7.2.2. - Periodic Reports [every 2 months]		
IO7.2.3 - Final report	D7.2.2. - Periodic Reports [every 2 months]		
Activity 7.3 - Project monitoring - OGS GEO			
IO7.3.1 - Definition of evaluation methodology	D7.3.1 - Monitoring evaluation plan [M3]:		
IO7.3.2 - Evaluation reports	D7.3.2 - Monitoring evaluation reports [M6-M12-M18-M24-M30]:		
IO7.3.3 - Sustainability plan: definition of key elements	D7.3.3 - Sustainability Plan [M3]:		

ECCSELLENT	Deliverables	Date of achievement	Status (Complete/Not started/Behind schedule/Proceeding according to plan)
IO7.3.4 - Sustainability plan: final release	D7.3.4 - Sustainability Plan [M30]: final release.		

Table 1: Reporting template table for deliverables.

1.2.2 REPORTING TEMPLATE TABLE FOR INTERMEDIATE OBJECTIVES

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
WP1 - ENHANCEMENT STORAGE TECHNOLOGIES FOR CO2 STORAGE SITE SELECTION AND MONITORING – OGS			
IO1.1.1 - Instrumentations tender and purchase	9	List of KPIs to monitor the activities planned in WP1 <i>Objective 1: Facility implementation</i>	
IO1.1.2 - Instrumentation, installation, settings and testing	12		
IO1.1.3 - Fiber optic iDAS System and fiber optic cable installation	10		
IO1.1.4 - On shore cabin for interrogator installation on Panarea Island	14		
IO1.1.5 - Multibeam, Side scan Sonar, Sea Magnetometer, 24 channels Streamer	9		

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO1.1.6 - Multifunction system of UAVs for coastal monitoring	14	KPIs: 1. Number of instruments purchased compared to the asset plan - Percentage	
IO1.2.1 - Site operations and installations design and tenders	6	2. Installations completion - Number 3. Testing completion - Number	
IO1.2.2 - Finalization of the Facility's Instrumentations Enhancement	14	4. Measurements reproducibility - Range 5. Quantify the overall facility enhancement- Percentage	
IO1.2.3 - Site operations and Installation's completion	15	<i>Objective 2: Timing compliance</i> KPIs:	
IO1.3.1 - Finalization of Mobile Instrumentations Enhancement	12	1. Deviation in time from the intermediate objectives timesheet - Number 2. Number of instruments purchased in the project timeframe related to bimonthly reporting - Number	
IO1.4.1 - Finalization of remote sensing facility	6		
IO1.4.2 - Finalization of aircraft facility	12	<i>Objective 3: Budget compliance</i> KPIs:	
IO1.5.1 - Laboratories design and tender	6	1. Effective expenditures related to the budget of the activity - Number	
IO1.5.2 - Biogeochemistry laboratories implementation	7	2. Budget and intermediate objectives in plan/deviations Percentage – Narrative	
IO1.5.3 - Thermostatic wet laboratories installation	9		
IO1.5.4 - Instrumentations tender and purchase	10		

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO1.5.5 Instrumentations installation, settings and testing	15		
IO1.6.1 - Purchase and installation of the optional equipment on existing NMR equipment	9		
IO1.6.2 - Purchase development and implementation of the different software	12		
WP2 - ENHANCEMENT CAPTURE TECHNOLOGIES - POLIMI			
IO2.1.1 - Invitation to bid, technical specifications of the pilot plant fully defined	3		
IO2.1.2 - European public tender closure and contractor selection	6		
IO2.1.3 - Facility purchased, available on- site and ready for commissioning	9		
IO2.1.4 - Facility continuously tested for at least 1 day, commissioning completed and at least 2 re	15		

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO2.1.5 - Digital Model validated against pilot plant data at steady state	15	List of KPIs to monitor the activities planned in WP2 <i>Objective 1: Facility implementation</i>	
IO2.2.1 - Adaption of the laboratories for the set-up of the test rigs and laboratories	8	KPIs: 1. Number of instruments purchased compared to the asset plan - Percentage	
IO2.2.2 - Purchase of the main instrumentation for the test rigs and laboratories for membrane production and characterization lab	10	2. Installations completion - Number 3. Testing completion - Number 4. Measurements reproducibility - Range 5. Quantify the overall facility enhancement – Percentage	
IO2.2.3 - Instrumentations installation, settings and testing	13	<i>Objective 2: Timing compliance</i> KPIs: 1. Deviation in time from the intermediate objectives timesheet - Number	
IO2.2.4 - Instrumentations installation, settings and testing	15	2. Number of instruments purchased in the project timeframe related to bimonthly reporting – Number	
IO2.3.1 - Publication of the Invitation to Bid [ITB]	5	<i>Objective 3: Budget compliance</i> KPIs:	
IO2.3.2 - Scientific instrumentation purchase	8	1. Effective expenditures related to the budget of the activity - Number 2. Budget and intermediate objectives in plan/deviations - Narrative	
IO2.3.3 - Scientific instrumentation and experimental plant installation and calibration	11		

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO2.3.4 - Scientific instrumentation and experimental plant calibration and measurements runs	12		
IO2.3.5 - Final operational testing [28 - 30]	15		
IO2.4.1 - Invitation to for economical offer, technical specifications of the changes to implement i	3		
IO2.4.2 - DFB upgraded and ready for commissioning	10		
IO2.4.3 - Formulation of suitable numerical models and preliminary design of the mock-up models	12		
IO2.4.4 - Invitation for economical offer, technical specifications of equipment for the powder manu	12		
WP3 - ENHANCEMENT TRANSPORT TECHNOLOGIES - UNI BO			
IO3.1.1. - Set-up the laboratories for high pressure and supercritical CO2	8	List of KPIs to monitor the activities planned in WP3 <i>Objective 1: Facility implementation</i>	
IO3.1.2 - Instrumentations tender and purchase	9	KPIs:	

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO3.1.3 - Instrumentations installation, set-up and verification	12	1. Number of instruments purchased compared to the asset plan - Percentage 2. Installations completion - Number	
IO3.1.4 - Inspection of instrumentation capability and reliability	14	3. Testing completion - Number 4. Measurement reproducibility - Range	
IO3.2.1 - Publication of the Invitation to Bid [ITB]	5	5. Quantify the overall facility enhancement – Percentage	
IO3.2.2 - Scientific instrumentation purchase	8	<i>Objective 2: Timing compliance</i> KPIs: 1. Deviation in time from the intermediate objectives timesheet -	
IO3.2.3 - Scientific instrumentation installation and testing	11	Number 2. Number of instruments purchased in the project timeframe related to bimonthly reporting – Number <i>Objective 3: Budget compliance</i> KPIs: 1. Effective expenditures related to the budget of the activity - Number 2. Budget and intermediate objectives in plan/deviations - Narrative	
WP4 - ENHANCEMENT UTILIZATION TECHNOLOGIES - CNR			
IO4.1.1 - Successfully preparation of 3D printed structures and spray/dip/spin coated materials	9	List of KPIs to monitor the activities planned in WP4	

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO4.2.1 - Advanced characterization of novel materials for CCUS applications	12	<i>Objective 1: Design, preparation and characterization</i> KPIs: 1. Software toolkit – Process modelling (State of the art), Advanced simulation on	
IO4.3.1 - Optimization of electro-catalysts	15		

IO4.4.1 - Go/No Go decision for the most suitable systems for CO2 utilization at TRL 4 and possible

15

single path (ECCSELLENT), Surface dynamics of elementary steps (Post)

2. Preparation procedures - High metal dispersion (State of the art), Nanoparticle immobilization (ECCSELLENT), Single-atom catalysis (Post)
3. Enhancement of characterization techniques - Ex-situ (State of the art), In-situ/operando (ECCSELLENT), In-situ/operando (Post)

Objective 2: Catalytic hydrogenation

KPIs:

1. Energy efficiency (MJ/ton) - Dependent on the process (State of the art), 20-30% reduction (ECCSELLENT), >30% (Post)
2. Catalyst & reactor design - TRL 3 (State of the art), TRL 4-5 (ECCSELLENT), >TRL 6 (Post)
3. Catalyst durability (hrs) - 100 (State of the art), 1000 (ECCSELLENT), >10000 (Post)
4. CO₂/H₂ feed (NL/h) – stoichiometric (State of the art), stoichiometric (ECCSELLENT), industrial point source (Post)

Objective 3: Electro-catalytic conversion

KPIs:

1. overall IR-free single cell voltage (mA/cm²) – 200 (State of the art), 300 (ECCSELLENT), 500 (Post)
2. Stack durability (hrs) – 500 (State of the art), 1000 (ECCSELLENT), >3000 (Post)

25



TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
WP5 - FAIR DATA AND RELATED DIGITAL SERVICE - OGS			
IO5.1.1. - Activation of remote nodes [Latera and Panarea]	4	List of KPIs to monitor the activities planned in WP5	
IO5.2.1 - Central hub online	6	<i>Objective 1: Digital data services</i> KPIs:	
IO5.3.1 - Data management	15	1. Remote nodes - Sensors not connected (State of the art), Development of	

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO5.4.1 - E-Research collaboratory active	15	<p>interfaces and local storage to connect with central data hub (ECCSELLENT), Sensors connected and sending data to central hub (Post)</p> <p>2. Central data Hub - Data not accessible (State of the art), Gather, harmonize data within the project (ECCSELLENT), Data accessible form hub (Post)</p> <p>3. E-research Collaboratory - Personal communication, e-mail (State of the art), Development of a virtual collaboratory to organize remote research (ECCSELLENT), Researchers are able to use communication facilities (Post)</p> <p>4. Data policy - No data policy adopted (State of the art), Definition of data policy (ECCSELLENT), Consistent data policy and implementation (Post)</p> <p>5. Data pilot - Organization of a specific workspace for a datatype used within the project (ECCSELLENT), Easy collaboration (Post)</p> <p>6. Web portal - Current web portal do not refer to data (State of the art), Develop access to data services (ECCSELLENT), Info on the project are available from one place. Allows also to access data products within a FAIR approach. Entry point for the e-research facility (Post)</p>	

WP6 - TECHNICAL AND BUSINESS LONG TERM SUSTAINABILITY - OGS

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO6.1.1 - Inclusion process for the two CNR facilities in ECCSEL-ERIC	7	List of KPIs to monitor the activities planned in WP6	
IO6.1.2 - Bilateral meetings between the node representatives and the facility owners	10	<i>Objective 1: Strengthen of the national node</i> KPIs: 1. Number of new facilities included in ECCSEL - Number 2. No of meetings between the node representatives and the facility owners - Number	
IO6.1.3 - Inclusion process for other new Italian facilities	14		
IO6.2.1 - Start of Capacity Building Programme	6	3. No of meetings attendees - Number 4. Budget compliance - Narrative	
IO6.2.2 - Completed training courses covering some key topics of CCUS	12		
IO6.3.1 - Deliver of the first edition [funded by ECCSELLENT] of the Scientific Diving Summer School	6	<i>Objective 2: Develop a capacity-building programme</i> KPIs: 1. No of training events - Number 2. No of attendees to the training events - Number 3. Level of satisfaction of attendees to the training events (1-5) - Number 4. No of internships for master thesis - Number 5. No of PhD students - Number 6. No of peer-reviewed publications - Number	
IO6.3.2 - Deliver of the second edition [funded by ECCSELLENT] of the Scientific Diving Summer School	12		
IO6.4.1 - Deliver of the two sessions of the international sessions of the international school on CO2 Utilisation	14	7. No of conference papers - Number 8. Budget compliance – Narrative	

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO6.5.1 - Completion of the 1st Info Day and 1st workshop	5	<i>Objective 3: Implement services and test access to facilities, in order to widen the user base</i> KPIs: 1. Call for pilots on selected facilities - Number 2. Duration of the open call - Time	
IO6.5.2 - Launch of the call for access	6		
IO6.5.3 - Completion of the 2nd Info day and 2nd workshop	12		

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO6.6.1 - Deliver of the dissemination plan	4	<p>3. No of user teams outside ECCSEL applying to access call - Number</p> <p>4. No of proposals received - Number</p> <p>5. Proposals success rate - Percentage</p> <p>6. Proposal completion rate - Percentage</p> <p>7. Level of satisfaction by users (1-5) - Number</p> <p>8. Level of satisfaction by facility owners - Number</p> <p>9. Overall utilization rate of the infrastructure - Percentage</p> <p>10. New services offered - Number</p> <p>11. No of attendees to info days and workshops - Number</p> <p>12. Budget compliance – Number</p> <p><i>Objective 4: Dissemination</i> KPIs:</p> <p>1. No of social media followers - Number</p> <p>2. No of dissemination activities - Number</p> <p>3. No of dissemination material (flyers, poster, etc.) - Number</p> <p>4. Budget compliance – Narrative</p> <p>5. No of scientific articles - Number</p>	
WP7 – MANAGEMENT - OGS			
IO7.1.1 - Key figures recruitment and SC rules of procedures	2	List of KPIs to monitor the activities planned in WP7	

TITLE	BIMESTER	Objective, quantitative, and measurable indicators	Value
IO7.1.2 - Report on the internal meetings	15	<p>1. Financial indicator: the actual rate of use of the allocated resources will be compared with the forecasted plan of expenditure, so to assess and evaluate the financial performance and address any emerging deviations.</p> <p>2. Activity indicator: the level of implementation of the project activities will be assessed through the degree of completion of the foreseen deliverables, to identify and address any deviation from the correct plan of work.</p>	
IO7.2.1 - IT tools for internal communication	2		
IO7.2.2 - Progress on periodic reporting	8		
IO7.2.3 - Final report	15		
IO7.3.1 - Definition of evaluation methodology	2		
IO7.3.2 - Evaluation reports	15		
IO7.3.3 - Sustainability plan: definition of key elements	2		
IO7.3.4 - Sustainability plan: final release	15		

Table 2: Reporting template table for intermediate objectives.