**Project Context and Objectives**

IMPACTS is a collaborative project co-funded by the European Commission under the 7th Framework Programme.

The goal of IMPACTS is to close identified knowledge gaps related to transport and storage of CO2-rich mixtures from various CO2 sources to enable realisation of safer and more cost-efficient solutions for CCS. IMPACTS is addressing the impact of impurities in captured CO2, from power plants and other CO2-intensive industries, on CO2 transport and storage. This encompasses fluid properties, phase behavior and chemical reactions in the infrastructure complex and at the storage sites. Results from IMPACTS will help to ensure safe and reliable design, construction and operation of CO2 pipelines and injection equipment, and safe long-term geological storage of CO2.

By this, IMPACTS supports the objectives of the Innovation Union and contributes to the implementation of large-scale CCS and the competitiveness of the European CCS industry.

**The IMPACTS project structure was developed to support the proposed strategy and to ensure achieving the project objectives. IMPACTS comprised three R&D subprojects (SP1–SP3) and 11 subordinated work packages (WP’s). In addition, IMPACTS includes a sub project dedicated to overall project co-ordination, operational management including legal, financial and administrative issues, and dissemination (SP4).**

This IMPACTSobjectives were achieved by following the IMPACTS project concept:

1. Quantifying the fundamental properties and behavior of relevant CO2 mixtures (SP1)
2. Revealing the impacts of relevant impurities in the CO2 stream on the design and operation of the transport and storage infrastructure considering integrity of the whole chain (SP2)
3. Providing recommendations for optimized CO2 quality (SP3)
4. Disseminating the results and making a plan for exploitation (SP4, SP3)



The overall objectives are to quantify fundamental properties of relevant CO2 mixtures. This includes, but is not restricted to:

1. Phase behavior
2. Thermodynamics
3. Fluid flow
4. Chemical reactions.

This was pursued through pre-normative research in collection of existing data, experimental work and modelling. A sequential approach between experimental and modelling work will be employed to improve the understanding of the effects of impurities at a local scale and to upscale these impacts from laboratory to field scale.

The specific Objectives pursued in IMPACTS were:

* Quantification of fundamental properties of relevant CO2 mixtures, including phase behavior, thermodynamics, fluid flow and chemical reactions and to understand how these impacts scale from laboratory to field scale.
* To reveal the impacts of relevant impurities in the CO2 stream on the design and operation of the transport and storage infrastructure through techno-economic assessments. This will take into account pressure drops, flow capacity and possible blockage, increased compressor work, material degradation, miscibility and storage capacity as well as safety issues.
* To derive CO2 quality issues while considering integrity of the whole CCS chain.
* To provide recommendations for optimized CO2 quality on a case-by-case basis in the form of tolerance levels, mixing protocols and material selection which are seen relevant for large-scale deployment of CCS, abating CO2 from power plants and other CO2-intensive industries.
* To build knowledge critical for implementation of optimized safe and cost-efficient transport and storage of CO2 strengthening the competence within industry, academia and regulatory bodies.
* To disseminate IMPACTS results at international conferences and internally at annual seminars.
* To pursue innovation and uptake of results in the industry by close integration of vendors, standardization bodies and end-users in the project.

**SP1 project objectives (M19-M36)**

The main objective of SP1 is to quantify fundamental properties of relevant CO2 mixtures. This includes, phase behavior, thermodynamics, fluid flow and chemical reactions. Further, it is the objective of SP1 to build knowledge critical for implementation of optimized safe and cost-efficient transport and storage of CO2.

Specific objective of SP1 were to:

* Develop accurate and experimentally validated property models for CO2 mixtures
* Provide experimental data on phase equilibrium, density, and selected other thermo-physical properties of CO2 mixtures complementary to existing work
* Develop algorithms to enable robust modelling of phase behavior
* Assess the influence of CO2-mixture composition in relevant cases for operation and transient situations such as first fill or blowout.
* Evaluate the corrosion and stress corrosion degradation risks which may occur when CO2 mixtures are transported.
* Model the short- and long-term effects of impurities on CO2 storage by using improved geochemical models.
* Carry out sensitivity analyses to predict the geochemical effects of different CO2 mixtures as well as of different mineralogical compositions of reservoir and cap rocks and wellbore cements and their impact on injection and storage in main reservoir types.
* Derive a model (both for depleted gas fields and saline formations) that allows derive the relation between CO2 mixture and injection system requirements.

The main purpose of SP2 was to use the results of fundamental experimental work from SP1, together with applied experiments on transport and storage and other public and partner knowledge, to assess the techno-economic impacts of CO2 mixture composition on the transport and storage infrastructure design and operation, and also to evaluate possible consequences for HSE and propose an assessment framework..

Specific objective of SP2 for the second part of the project (M19-M36) were to:

* Study the effect of impurities on equipment and instrumentation mechanical behavior, material corrosion and depressurization processes for safe operations.
* Investigate the effects of impurities on the different materials (reservoir and caprock, cement fills, pipes and well casing) relevant to the transport, injection and storage operations.
* Assess the effect of impurities on different CO2 trapping mechanisms during the early phases of injection.
* Identify the impurities in CO2 mixtures that may have an adverse impact on the long-term stability and those impurities that could have positive effects.
* Assemble representative CCS Benchmark chains with technical and economic parameters
* Evaluate impacts of CO2 impurities on the technical performance and costs of CCS chains elements
* Create a CCS impurity economic impacts model
* Produce economic trade-off proposals for full CCS chains
* Propose a framework for CCS risk assessment taking HSE aspects, the impact of the quality of the CO2 and CCS chain integrity into account.
* Develop the knowledge base to help users to identify optimal case-to-case solutions

The main objective of SP3 was to synthesize the results of the project and to make them easily available to the users, both to the IMPACTS consortium and the CCS community.

Specific objective of SP3 for the second part of the project (M19-M36) are:

* Develop a framework for IMPACTS recommendations that will include the assumptions and limitations, and draw up the structure for the final recommendations report
* Based on the framework and the knowledge and tools developed in IMPACTS, write a summarizing report *IMPACTS recommendations* that will include guidelines on a range of practical issues
* Assess the impacts of impurities concentration on the capture-side requirements
* Establish an internationally accepted standard based on the property reference model
* Collect the data and models applied in IMPACTS and make them available to the partners as the IMPACTS toolbox
* Develop a draft, and later a final IMPACTS results exploitation plans
* Organize an IMPACTS workshop, in parallel with the TCCS-8 conference in Trondheim, Norway
* Organize an IMPACTS course, in Romania, for attendees from Universities and industry