

CAPABILITY STATEMENT
**CARBON CAPTURE,
TRANSPORTATION,
UTILIZATION
AND STORAGE**

2021

X0102-ILF-UEO-OD-0012 | Revision 03

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1

GROUP PROFILE & PHILOSOPHY

GROUP PROFILE

The ILF Group is an international engineering and consulting firm that has been helping its clients successfully execute technically demanding industrial and infrastructure projects for **more than 50 years**.

With over **2,500 highly qualified employees** at **more than 40 office locations** across five continents, the companies of the ILF Group have a strong regional presence.

This enables ILF to locally interact with clients and project parties. At the same time, close cooperation within the network of the ILF Group makes it possible to call upon leading international experts and make use of their special experience, processes and tools.

This combination of local and international expertise, as well as ILF's complete independence – as a company privately owned by the founding families, which has no affiliation to manufacturers, suppliers, or financing institutions – ensures that clients' needs are best met.



“ILF combines local presence and international expertise to best serve clients' needs.”

Klaus Lässer, CEO

ILF's main business areas are:

- Energy & Climate Protection
- Water & Environment
- Transportation & Urban Spaces
- Oil, Gas & Industrial

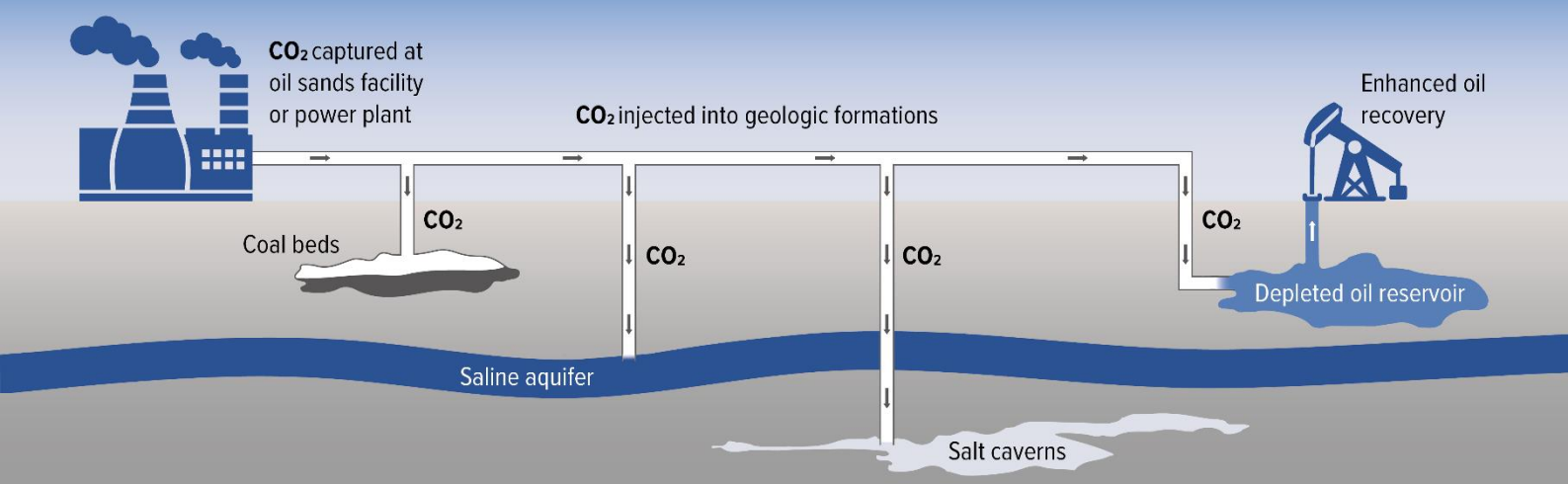
VISION, VALUES & BELIEFS

ILF is passionate about **contributing to a better quality of life** around the globe. This vision is the driving and motivating force behind ILF's activities.

The company's ongoing endeavor to achieve **"market leadership through quality"** is why ILF adopts a structured approach and strives for continuous improvement. Integral to this endeavor are the people at ILF, as they are the ones who make the difference. **Respect, honesty, reliability and fairness** form the basis for all of ILF's interactions.

ILF's focus on providing **Engineering Excellence**, as well as its independence, enable ILF to offer creative solutions whilst acting in the best interest of its clients.





2 PROFESSIONAL COMPETENCE IN CARBON CAPTURE, TRANSPORTATION, UTILIZATION AND STORAGE

At ILF we support our clients with a strong team of experts familiar with the full value chain of carbon capture, compression, transportation, utilization and sequestration projects.

ADDED VALUE

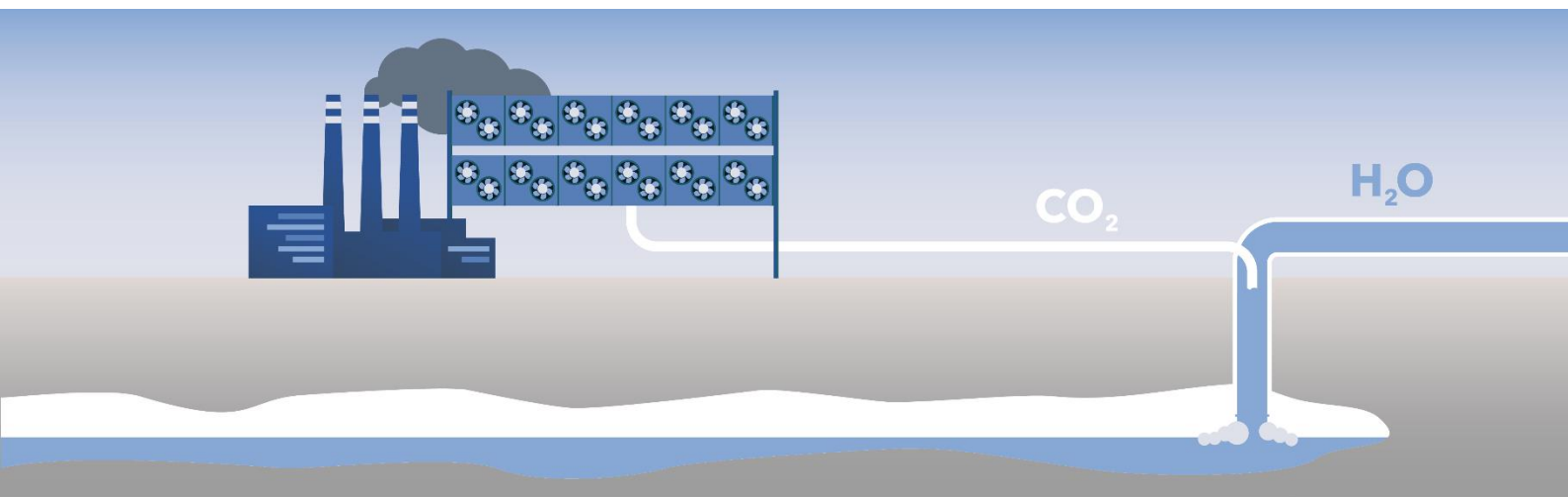
ILF adds value to clients' projects through its holistic approach and experience in the design and construction of carbon capture, compressions, transportation, utilization and sequestration projects, including process optimization, engineering design, technical safety, environmental and permitting aspects, project risks and project management

ILF:

- has **extensive experience** – ILF team members have played an integral role in the development of industry leading recommended practice reference documents and federal standards governing the CO₂ pipeline systems and gas pipelines carrying predominantly CO₂ and have held various leading roles in CCS/CCUS projects.
- is experienced in performing **techno- economic analyses** to sustain the selection of the **optimum pump driver**. ILF is furthermore able to cover all design phases for the various possible driver types.
- is skilled in developing **digitalization strategies** and implementation of digitalization in the design in order to **optimize the operation and maintenance** of CCS/CCUS assets and operations.
- covers **all areas of expertise** required to design pipeline systems **in-house**.
- provides **consultancy and engineering services throughout the project lifecycle**, from the early feasibility and concept selection phases until the construction and commissioning.

- performs a **diverse range of activities, in various roles, for different types of clients across the globe**. These clients include:
 - » Public clients – oil and gas majors and energy suppliers
 - » Private clients – investors and project developers
 - » Construction companies and/or contractors
 - » International banks and financial institutions
- is a **full-service provider** – interdisciplinary and fully integrated development of CCS/CCUS projects providing comprehensive solutions by
 - » ILF's **in-house experts** who cover all disciplines (e.g.: process engineering, mechanical and piping engineering, electrical and control engineering, civil and structural engineering, environmental engineering, etc.).
 - » the flexibility, but also the continuity and reliability of ILF's project teams.
 - » close cooperation with the industry on special topics (e.g.: model tests) including the development of new technologies to improve energy or environmental efficiency.
 - » putting a focus on **safe, environmental, social and sustainability aspects**, as well as the authority approval process in close coordination with the in-house engineering team, therefore assuring common acceptance of projects.
 - » ILF's integrated design approach, which takes account of technical, economic and environmental, as well as social and sustainability aspects, to ensure overall project optimization.
 - » ILF's **Occupational Health and Safety (OHS)** standards, centered on the prevention of accidents and damages to persons, assets and the environment, as well as the continual improvement of ILF's Health, Safety and Environmental (HSE) performance – for clients, project stakeholders and ILF employees.
 - » ILF's occupational **Health, Safety and Environmental Management System (HSEMS)**, which follows the international standards ISO 14001:2015 and ISO 45001:2018.
- is a perfect match for **international advisors, third party consultants and authorities**, due to its highly independent technical expertise.





3 **FIELDS OF EXPERTISE**

Carbon Capture and Storage

Carbon capture and storage or carbon capture and sequestration (CCS) is the process of capturing carbon dioxide (CO₂) from point industrial sources before it enters the atmosphere, often com-pressing and transporting it, and storing it in underground geological formations.

CCS can be applied to a vast number of industries comprising fossil fuel based power plants, oil refineries, natural gas processing, petrochemicals, cement production, steelmaking, synthetic fuel plants and fossil fuel-based hydrogen production plants (Blue Hydrogen).

CO₂ Capture

Although the absorption or carbon scrubbing with amines is the dominant capture technology in various emission intensive industries, ILF has the capability to do a comprehensive due diligence on other emerging technologies such as adsorption, membrane, chemical looping, and metal-organic frameworks to ensure that we provide the best cost effective fit-for-purpose solutions to our clients.

CO₂ Pipeline Transportation

ILF team members have played an integral role in development of industry leading recommended practice reference documents and federal standards governing the CO₂ pipeline systems and gas pipelines carrying predominantly CO₂.

Our team supports clients in the techno-economic studies of the projects, concept development, FEED and detailed design, materials selection, fracture control, risk assessment, equipment selection and spacing, pressure regulating and measuring stations, and fitting components of CO₂ pipeline systems. Our team also brings a rich back-ground in dense phase pumping, hydraulics, and multiphase hydraulic analysis to the table.

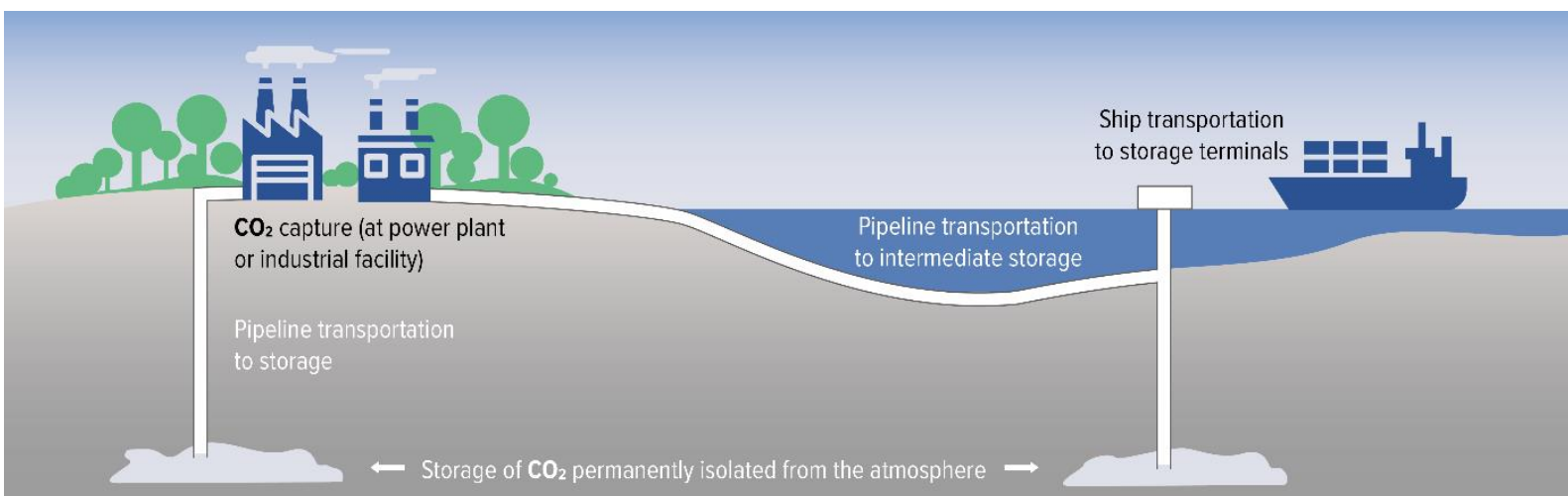
CO₂ Utilization, Storage / Sequestration

CO₂ sequestration and CO₂-EOR screening, field trial, and development require an in-depth knowledge of reservoir storage capacity, well injectivity, caprock integrity, reservoir dynamics, monitoring protocols, regulatory requirements, and future

development opportunities. At ILF, we take a fully integrated approach towards reservoir system characterization, well performance analysis, injection/production scenario assessment, development planning, and well/reservoir performance forecasting.

Highlights:

- Overall carbon footprint reduction for major upstream operator in Russia.
- CO₂ capture technology studies
- CAPEX & OPEX simulation models depending on CO₂ concentration
- ILF drafting & contributing to CO₂ transportation and storage industry standards and norms





4 SERVICES

4.1 PROJECT DEVELOPMENT AND CONSULTING

The successful implementation of a CCUS project depends on a well selected and coordinated project execution strategy. Our profound experience in project development enables us to provide related consultancy services from the early stages of the project up to the operation phase.

The individually tailor made project execution strategy will result in an overall project assurance model defining critical key activities, milestones and control gates as well overall content of decision support packages.

The supporting strategies, plans and procedures comprise and outline amongst others:

- Client objectives, project overview, scope and - justification
- Regulatory and market environment
- Commercial structures and financing
- Technical basis including system concept and pipeline corridors
- Environmental, social and sustainability considerations
- Financial and economic considerations
- Procurement and contracting
- Risk analysis including mitigations strategy
- Implementation and schedules

4.2 ENGINEERING

The engineering process ILF is following the usual project lifecycle and increasing its level of engineering step by step:

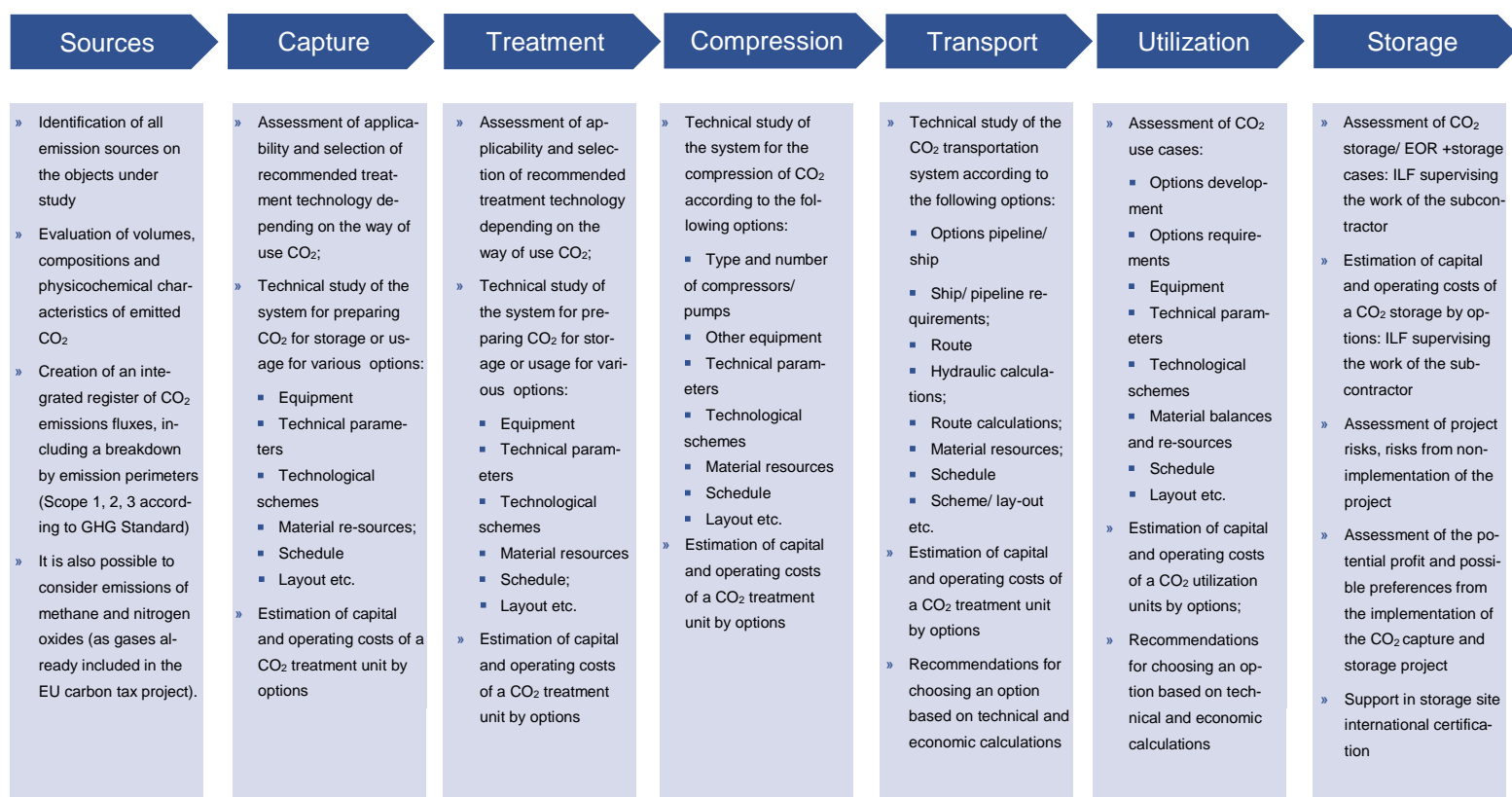
- Select e.g. Feasibility Studies
- Define e.g. Basic Engineering and/or Front End Engineering Design (FEED)
- Execute e.g. Detail Design



Engineering Services would entail the full range of deliverables encompassing the

- Selection of Emission Sources
- Capture Processes
- Treatment Processes
- Compression
- Transportation
- Utilization
- Sequestration

Integration of all parts of the project including support in certification / PMC



4.3 PROJECT MANAGEMENT CONSULTANCY

One of ILF's Project Management Consultancy (PMC) capabilities lies in the ability to effectively set up projects on behalf of clients and subsequently provide all the functions and skills required for project objectives to be met in terms of scope, schedule, budget and quality.

ILF has the flexibility to make adaptations according to the respective client's contracting strategy, internal organization and the specifics of the industry and market in which they operate.

Upon the award of contract, ILF's project management experts initiate the **project set-up**, which comprises:

- preparation of project management plans and procedures, including but not limited to communication-, interface-, time-, cost- and risk management
- preparation of engineering review plans and procedures
- draft preparation of the construction and commissioning procedure
- preparation of the document management system to be used during project execution

In order to enable the expectations and needs of the respective client, as well as the project requirements, to be met, ILF implements a consistent project management system, covering all phases of the project and based on ILF's self-developed in-house Project Management System (PMS).

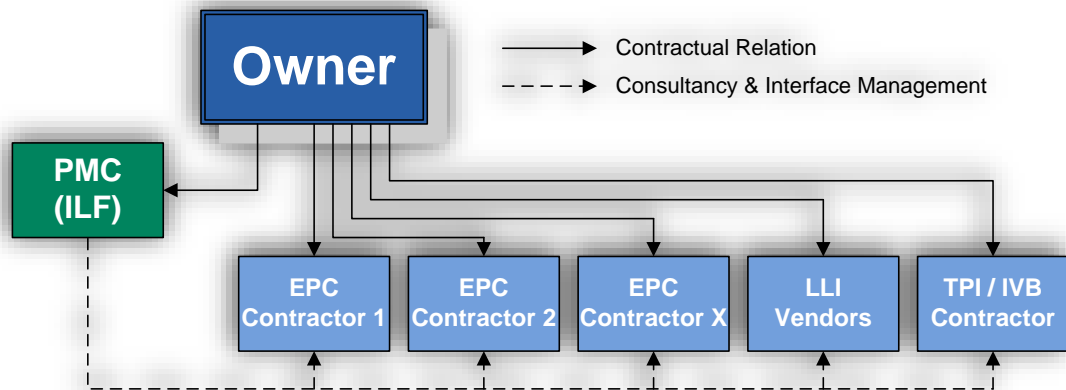
The experience gained, as well as the PMC methodology and best practices developed during more than 50 years of successfully executing major projects, are applied in this PMS. Furthermore, by including developed systems and the lessons learned from various projects within the PMS, the system can also be continuously improved.

During the execution of the project, ILF will provide a set of services that will comprise all the functions required in order to effectively manage the project on behalf of the client:

Project Management

- Project planning and scheduling
- Cost estimation and benchmarking
- Cost monitoring
- Document management
- Project risk management
- Progress monitoring and reporting
- Change management
- Contract management
- Communication management
- HSSE management
- Quality Assurance/Quality Control (QA/QC) management





In various development stages, **Engineering Management** is one of ILF's key strengths enabling project objectives to be met. Having 50+ years of consulting experience in a variety of business areas, ILF has developed the skills and methods required to effectively manage design contractors', vetting vendors' and designer's documentation', as well as to perform the integrative design elements required for PMC projects.

ILF has experienced procurement experts, who provide both **Procurement Support** to client procurement teams (including during tender preparation, evaluations and negotiations) and procurement supervision services, in order to monitor, audit and control various contractor's procurement activities.

During the project execution phase, ILF provides **Construction and Commissioning Management** services with the support of its team of international experts, experienced in the pipeline business as well as in construction and commissioning. These experts and their experience, combined with local expertise and ILF's construction management system and tools (i.e. pipe tracking and completions management) help clients' projects to reach successful mechanical completion and start-up.



5 CONTACT

CONTACT PERSON

ILF will be pleased to assist you with your projects and challenges.



Mr. Nima Ghazi

Vice President of Energy and Climate Protection

ILF Consulting Engineers Canada,
1800, 700 – 9th Avenue SW
T2P 3V4 Calgary, AB, Canada

Phone: +1 | 587 | 288 2600
E-mail: Nima.Ghazi@ilf.com

FURTHER INFORMATION

To learn more about us, please visit www.ilf.com



6 PROJECT HIGHLIGHTS

Please find below a selection of reference projects. To further confirm ILF's capabilities, a comprehensive references list as well as our selected references will be made available upon request.



MARKET DEMAND FOR CO₂ AND HYDROGEN, FEASIBILITY STUDY

Evaluation and description of the most common CCS/CCUS/hydrogen implementation technologies

The source of CO₂ is a plant for the production of (yellow) hydrogen

Main services: Calculation of the economic effects of the implementation of CCS/CCUS/hydrogen projects; CAPEX & OPEX benchmarking; Analysis of analog projects.



CO₂ SURFACE FACILITIES, FEASIBILITY STUDY

Capture of flue gases from gas turbine power plant and heaters at upstream oil facility CO₂ concentration 3 – 4 %, capacity 1,000 – 1,500 kt/year CO₂. CO₂ transport via pipeline (200 – 500 bar injection pressure)

Main services: Process simulation (flue gas gathering, CO₂ capture, CO₂ liquefaction, CO₂ transport)

CO₂ capture technology selection; Define main process equipment; CAPEX & OPEX estimation; Economic model



CARBON FOOTPRINT REDUCTION STUDY, UPSTREAM OPERATION

Gas-turbine engine – from 12 to 34 MW

Gas-reciprocating engine – 3,728 MW

Diesel power station – from 1 to 4 MW

Main services: Analysis of technologies to reduce the formation of a carbon footprint (CCS, hydrogen and etc.); CAPEX/OPEX estimate; Modeling of technological systems for decarbonization of industrial facilities



CO₂ STEAM CONVERSION AND RESERVOIR INJECTION, SAMBURGSKY, FEASIBILITY STUDY

Capacity up to 0,146 bln. m³ CO₂/year

Operating pressure 77 bar

Receiving of CO₂ by steam conversion

By-product – hydrogen

Main services: Development of main technical solutions; Development of a concept for the development of a CO₂ production and permanent injection line for the period of experimental-industrial operation; Elaboration of the placement of the projected objects according to the options; CAPEX & OPEX estimate



TECHNOLOGY SCREENING FOR CO₂ CAPTURE, FEASIBILITY STUDY

CO₂ flow: 300 – 500 kt/year

Sources of emissions: gas power generation plants, furnaces and heaters

Main services: Overview of CO₂ capture options; Cost benchmarking; Pre-screening of technologies; Technical assessment; Financial and economic models



DEVELOPMENT OF TECHNICAL SOLUTIONS FOR CO₂ CAPTURE AND TREATMENT OPTIONS

Main source of CO₂: the process gas of the ammonia plant

Development of technical solutions for the system of compression and transport of CO₂ to use / recycling / disposal facilities

CAPEX & OPEX estimate