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EXECUTIVE SUMMARY

The environmental impact assessment presented in this report shows that there are grounds for issuing of a decision on the environmental constraints of implementation of a demonstration plant for CO_2 capture, fully integrated with the new 858 MW power unit at PGE Bełchatów Power Plant- (synchronized for the first time with the national power grid), taking into account the recommendations included in the environmental impact report for the investment.

Environmental decisions related to the storage place and to CO_2 transport systems can only be issued after more specific geological recognition of the CO_2 storage locations, and also after ensuring compliance of the said investments with the relevant local land use plans.

PROJECT SUMMARY

The CO2Europipe project aims at paving the road towards large-scale, Europe-wide infrastructure for the transport and injection of CO_2 captured from industrial sources and low-emission power plants. The project, in which key stakeholders in the field of carbon capture, transport and storage (CCTS) participate, will prepare for the optimum transition from initially small-scale, local initiatives starting around 2010 towards the large-scale CO_2 transport and storage that must be prepared to commence from 2015 to 2020, if near- to medium-term CCS is to be effectively realized. This transition, as well as the development of large-scale CO_2 infrastructure, will be studied by developing the business case using a number of realistic scenarios. Business cases include the Rotterdam region, the Rhine-Ruhr region, an offshore pipeline from the Norwegian coast and the development of CCS in the Czech Republic and Poland.
This report is one of two reports on the development of a CCS project in Poland (the other report is D4.2.2).

The project has the following objectives:

1. describe the infrastructure required for large-scale transport of CO_2, including the injection facilities at the storage sites;
2. describe the options for re-use of existing infrastructure for the transport of natural gas, that is expected to be slowly phased out in the next few decades;
3. provide advice on how to remove any organizational, financial, legal, environmental and societal hurdles to the realization of large-scale CO_2 infrastructure;
4. develop business case for a series of realistic scenarios, to study both initial CCS projects and their coalescence into larger-scale CCS infrastructure;
5. demonstrate, through the development of the business cases listed above, the need for international cooperation on CCS;
6. summarise all findings in terms of actions to be taken by EU and national governments to facilitate and optimize the development of large-scale, European CCS infrastructure.

Project partners

Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek- TNO	Netherlands
Stichting Energieonderzoek Centrum Nederland	Netherlands
Etudes et Productions Schlumberger	France
Vattenfall Research & Development AB	Sweden
NV Nederlandse Gasunie	Netherlands
Linde Gas Benelux BV	Netherlands
Siemens AG	Germany
RWE DEA AG	Germany
E.ON Benelux NV	Netherlands, Belgium, Luxemburg
PGE Polska Gruppa Energetyczna SA	Poland
CEZ AS	Czech Republic
Shell Downstream Services International BV	Netherlands, United Kingdom
CO2-Net BV	Netherlands
CO2-Global AS	Norway
Nacap Benelux BV	Netherlands
Gassco AS	Norway
Anthony Velder CO_2 Shipping BV	Netherlands
E.ON Engineering Ltd	United Kingdom
Stedin BV	Netherlands

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1 ENVIRONMENTAL IMPACT AND RISKS OF CO_2 STORAGE FACILITIES IN POLAND

1.1 Introduction- CO_2 capture plant in the area of PGE Bełchatów Power Plant

Fossil fuels constitute a very significant primary fuel both in the European Union and in the rest of the world. In relation to this, strategies aimed at combating climate changes should focus on a radical reduction of emissions of carbon dioxide produced during the combustion of these fuels. Among the technologies that already exist and that are still being developed, which could potentially limit greenhouse gas emissions, a key role can potentially be played by carbon capture and storage technologies. Large-scale use of CCS in power plants may become profitable in about 10 to 15 years, making CCS an important technology used to reduce CO_2 emissions by approx. 2020 or slightly later.
In order to make this possible, construction of demonstration facilities should be initiated urgently, so that the technology can be improved in order to reduce energy losses in the process and to reach an acceptable level of operating costs. Such facilities include the demonstration CCS system at the 858 MW power unit at the Bełchatów Power Plant.
Among the capture methods that were suitable, the investor selected a "post combustion" system adapted to the individual conditions of the project.
Bearing in mind the time frame required for the CCS project at the Bełchatów Power Plant, the technology selection was focused on the Alstom Chilled Ammonia Process (CAP) and on the Advanced Amine Process, since these technologies have the highest development potential and are closest to commercialisation.
Initially, three various sizes of the CO_2 capture plant were considered, namely with a 15%, 30% and 45% capture of CO_2 emission from the 858 MW power unit. Analyses demonstrated, however, that it would only be possible to install a 30% system in the area available. When 30% of CO_2 emission is captured from the 858 MW power unit, 33.3% of the flue gas stream is sent for treatment with a 90% capture efficiency. This can be achieved if a single CO_2 absorption pass is used.

1.1.1 Air protection

The CO_2 capture plant is designed in such a way as to treat 1/3 of the total flue gases from the new 858 MW power unit, which should make it possible to capture approx. 1.8 million tonnes of CO_2 annually.
It should be taken into account that, with an average annual quantity of CO_2 captured in the Bełchatów capture plant, of approx. 1.8 million tonnes per year, 36-38% of that amount of CO_2 will be emitted in other electricity generation sources to compensate for the production that was reduced in the 858 MW power unit due to the operation of the capture plant.
Calculations that were performed related to the propagation of pollutants showed that after constructing the CCS system in the 858 MW power unit, the predicted

concentrations of air pollutants emitted in the vicinity of the Bełchatów Power Plant would stay at a similar level. This conforms to acceptable levels of concentration in the air, with a safety margin.
The emission of amine compounds in the requested variant, used in the process of CO_2 capture, will not lead to the occurrence of significant concentrations in the air, either. Assuming an amine concentration of 10 mg/Nm3 in flue gases leaving the plant, the computed average-per-annum concentration values will be 0.03 µg/m3 in and 3.09 µg/m3 as an hourly maximum. Assuming, for calculation purposes, that the amines emitted into the air will be composed entirely of ammonia, the computational concentration values will constitute, respectively: 0.06% of the acceptable average annual concentration and 0.77% of the acceptable maximum hourly concentration. The emissions, therefore, are not significant from the point of view of the system's impact on the degree of air pollution.

1.1.2 Water protection

The impact of the CCS system on surface waters will not be significant. The system's demand for water will be satisfied in part by water present in the flue gases delivered to the CO_2 capture plant. The water from the flue gases will be condensed and sent to a CO_2 absorber and to a precooler. The rest is demineralised water in the amount of 24 m3/h. That water will be used in the system to dilute the condensed amine solution. The demineralised water will be delivered from the existing water treatment stations at the Bełchatów Power Plant. Waste water from the CO_2 capture plant is not expected to be drained into surface waters.
Waste water from the amine regeneration column and condensate from the flue gas cooler will be treated before subsequent disposal in dedicated wastewater treatment plants constituting an integral part of the CO_2 capture plant.
Waste water from amine regeneration, concentrated by evaporation to 20% salt content, will be handed over to authorised third parties for thermal neutralisation.
Condensate from the flue gas cooler, after removing pollutants, will be reused in the circuit. Since the chemical composition of wastewater from regeneration is currently difficult to predict, the method disposal may change.
Other wastewater, including oily sewage after pre-treatment, rainwater sewage from roofs and road surfaces within the boundaries of the plant and sanitary sewage will be collected and sent to the sanitary and rainwater sewerage network in the area, and further on to the Lignite Open Pit Mine waste water treatment plant. Their quantity and impact on the quality of waters of the Struga Żłobnicka (part of the open pit drainage system) will not be significant.

1.1.3 Waste management

The CO_2 capture plant will be constructed nearby the new 858 MW power unit. Management of operation waste will be a part of the existing waste management system applied in the area of PGE Bełchatów Power Plant. The plant will be constructed in an area that has been levelled and in otherwise empty. The following types of process waste will be generated as a result of using the CO_2 capture plant.

- used activated coal

- dust filter inserts
- sludge from amine regeneration

Additionally, waste will be generated as a result of operation of equipment and facilities and performance of repair and maintenance works. Such waste will include: used oils, detergents, sorbents, filtration materials, protective clothing and other waste generated as a result of office work and site maintenance.

All waste generated will be subjected to recovery or neutralisation processes in a manner which is safe for the environment and complies with the legal regulations in force. Due to the presence of amine pollutants in the waste generated, the latter has been classified as hazardous waste.

In relation to the above, in the case of used mechanical filter inserts and sludge from amine regeneration, thermal conversion should be chosen as the method of waste management, safe for the environment.

In the case of used coal, this should be handed over to the producer for recycling and reuse or thermal conversion.

1.1.4 Protection of earth and soil surface

The plant described here will be located entirely on the premises of PGE Bełchatów Power Plant, in an area used for industrial purposes. The impact on soil will only be significant during construction when excavations are made for the new facilities. After construction and installation activities, reclamation is planned, including levelling of the investment area.

1.1.5 Acoustic climate protection

Acoustic impact at the stage of construction and installation works will be limited to the construction site, its back-up facilities and access roads; bearing in mind the significant distance to the nearest housing, the said impact will not the acoustic conditions outside the construction area. During that phase, the time of construction should be kept as short as possible.

Since operation of the CO_2 capture plant is linked with the production of electric energy, the plant will work continuously. Consequently, it is not allowed that the plant will exceed the acceptable values for daytime or night time noise for the nearest areas subject to acoustic protection.

Model calculations of noise emissions that were performed to determine the impact of new facilities and equipment showed that the CCS system would not cause a significant increase of the acoustic impact on protected areas.

1.1.6 Impact on humans, animals and plants

The planned investment will be provided with protective measures which make it possible to comply with the applicable standards of environmental pollution emissions. Due to the location and properties of the plant, the nuisance it will cause in the period of construction and operation will not be significant for the inhabitants of the surrounding areas. Consequently, the impact of the investment on human health is judged as insignificant.

1.1.7 Nature conservation

The plant described here will be located entirely on the premises of PGE Bełchatów Power Plant, in an area used for industrial purposes. The plant will not have an impact on vegetation or animal species, throughout the operation period. Location on the PGE premises, compliance with the requirements related to environmental emissions and appropriate waste management will make it possible to maintain the existing natural assets. The construction activities carried out will not have an impact on vegetation or animal species located in areas subject to conservation (including areas belonging to the Natura 2000 network). Any impact will be limited to the construction site and may occur only to a slight extent outside that area, due to increased road traffic and circulation of machines in the construction site itself. No protected plant or animal species occur in the area of the construction site.

1.2 System for transporting CO2 from the area of PGE Bełchatów Power Plant to the storage places

The impact will essentially be limited to the installation strip and to the construction stage.

The impact of pipeline operation on the earth surface (including the soil) will not be significant.

Construction of the CO_2 transmission pipeline will require an excavation to be made with a depth of approx. 1.5 metres and a length varying depending on the method selected. After the pipeline has been laid, reclamation of the area will ensue. The site topography will not change compared to the conditions before construction.

The impact caused by pipeline completion limited to concentration in the installation strip area. Most biotic components (animals, plants, biotopes) interfered with during installation activities should regain their earlier functions. In all three variants of the CO_2 pipeline location it will be necessary to cut out trees in wooded areas. For the time of construction works, a strip of land will need to be deforested with a width of 10.5 metres, of which permanent deforestation will result on a strip with a width of 4 metres.

The pipeline route will run through land not subject to nature conservation (including Natura 2000 network areas). Implementation of the plant will not have a negative impact on protected areas. Before follow-up activities, inventory studies and valuation surveys will be performed, in order to determine the full scope of impact of the project and to specify actions to minimise, limit and compensate for the negative impact of the project on the avifauna and on vegetation.

CO_2 transport pipelines are not systems causing hazards of industrial failure. The medium they transport, i.e. condensed carbon dioxide, is not classified as a hazardous substance. It is non-flammable and it is not ecotoxic.

Normal operation of the system will not cause hazards to humans or to the environment.

Normal operation of the CO_2 transport system will not cause emissions to the environment. Such hazards could only occur in emergency situations such as pipeline failure and release of the CO_2 transported.

1.3 CO_2 storage places

The impact of potential CO_2 leaks mainly affects the air layer closest to the Earth's surface. This impact will disappear quickly on flat open land which is present in all the variants. It is extremely important to protect underground and ground waters against potential leaks of carbon dioxide injected into deeper geological layers and against saline solution leaks.

A serious industrial failure may potentially occur if human activity interferes with geological factors: for instance, if excessive quantities of CO_2 are injected, this may compromise the integrity of well sealing within a short time, leading to the migration of CO_2 towards further potential ways of escape.

The impact of leaks (failures) on the soil is not that significant, nor is their impact on surface waters; however, the condition of ground waters is more important, since the consequences of their pollution are relatively long-lasting.

The impact on humans and larger animals may be significant; however CO_2 tends to accumulate near the Earth's surface. Smaller animals (such as rodents), however, may potentially not survive.

A concentration of 5% is harmful to health, while the fatal concentration is 16%, but the amounts of CO_2 needed to achieve such rates are improbable.

2 RISKS OF THE CCS PROJECT

2.1 General risks of CCS project

General risks of CCS project	Contingency plan
Public acceptance for CCS influences project schedule, general possibility to do any geological field work intensified by some local NGO's	- establishment of a team on governmental level dedicated to public outreach and education for carbon storage projects in Poland establishment of team within Belchatow PP's CCS organisation team dealing with public acceptance issues meetings with local communities and authorities, distribution of informative leaflets
Overall legislative context influences project schedule: • Polish public procurement procedures • Implementation of geological EU storage directive into Polish law	comprehensive analysis and discussion with key partners aiming to organise the implementation with „best value for money" option and Polish public procurement law difficult discussions with international companies with established market position
Geological issues exposed to the risk that no selected site good enough for CO_2 storage structure	Comprehensive research programme during two first phases of storage component will be carried out: site selection and site characterisation
Permitting - Interactions with local authorities - Land acquisition for storage site and pipeline sitting	putting in every effort in order to acknowledge for CCS project status of the public purpose investment with national importance use of experience from transmission line for 858 MW unit permitting and construction
Technical risks Scaling up from pilot to large scale project (equipment sizing) Energy consumption due to CCS integration into base plant	use of experience from pilot projects use of experienced vendors optimisation process commenced at the early stage of engineering activities
Innovative and R&D project character causing delays on implementation	Not possible to avoid and elaborate 100% successfully mitigation plan

2.2 Financial risks:

1. **Overestimation of revenues:**
- **CO_2 European Emission Allowances Pricing** – Risk that the price of the right to emit CO_2, which presently does not cover forecasted CCS operation, maintenance, financing and capital costs, does not increase adequately to cover forecasted CCS operation, maintenance, financing and capital costs, undermining the economics of the investment. (Inability to Recover Costs)
- **CO_2 European Emission Allowances Legislation** – Risk that CO_2 emissions legislation that adequately supports the price of CO_2 emissions rights is not implemented, preventing Bełchatów Power Plant from covering the CCS operation, maintenance, financing and capital costs from the savings that Bełchatów Power Plant achieves by reducing emissions of CO_2. (Inability to Recover Costs)
- **Electricity Price-CO_2 European Emission Allowances Price Divergence** – Risk that the price of electricity and the price of emitting CO_2 diverge such that it is more cost effective for Bełchatów Power Plant to sell the electricity used to capture, transport and store the CO_2 than to generate the costs savings by reducing CO_2 emissions. (Inability to Recover Costs)

2. **Underestimation of Costs:**
- **Energy Intensity** – Risk that the electricity required to capture, process and store the CO_2 is materially higher than presently forecasted generating operating costs and preventing PGE Bełchatów Power Plant from recovering its CCS-related operation, maintenance, financing and capital costs. (Increase in Costs, Inability to Recover Costs)
- **Capital Expenditures** – Risk that the actual capital costs are materially higher than presently forecasted requiring materially higher CO_2 emissions prices to enable PGE Bełchatów Power Plant to recover its CCS-related operation, maintenance, financing and capital costs. (Increase in Costs, Inability to Recover Costs)
- **Operation and Maintenance Costs** – Risk that the operating and maintenance costs are materially higher than presently forecasted preventing Bełchatów Power Plant from recovering its CCS-related operation, maintenance, financing and capital costs. (Increase in Costs, Inability to Recover Costs)

3. **Technology:**
   - **Competitive/Alternative Technologies** – Risk that a competitive or alternative technology turns out to be more cost-effective negatively impacting the price of CO_2 emissions, and as a result, the Bełchatów power plant facility cannot compete on a relative CCS operation, maintenance, financing and capital cost basis nor can it generate adequate income. (Competitive Dislocation, Inability to Recover Costs)
   - **Technology Failure** – Risk that CO_2 capture or storage technology, such as equipment, chemical process, etc., are unable to sustain adequate operating levels, and as a result, Bełchatów Power Plant is unable to operate the

facility at levels that enable to recover its CCS-related operation, maintenance, financing and capital costs. (Inability to Recover Costs)

4. **Lack of Financing:**
   - **Financing from Preferential Sources** – Risk that Bełchatów power plant cannot achieve an adequate level of preferential funding, which would cause a negative assessment by undermining the economics of the investment and the investment decision. (Lack of Financing)
   - **Repayment of Preferential Financing** – Risk that preferential funds must be repaid or penalties paid due to a failure to achieve the environmental goals of CCS project or the necessity to abandon the CCS project due to causes beyond Bełchatów power plant's control, such as a failure to receive CO_2 storage permits. (Lack of Financing)
   - **Commercial Financing** – Risk that commercial financing institutions reject financing the CCS project as a result of a negative evaluation of this innovative demonstration investment. (Lack of Financing)

2.3 Risks related to CO_2 storage

As part of the National Programme entitled "Recognition of formations and structures for safe geological storage of CO_2 together with a programme for their monitoring", the Polish Geological Institute performed an analysis of the risk related to the storage of carbon dioxide from the CCS system in Bełchatów.

Storage of CO_2 in deep saline structures is a relatively recent technology. The basic problem related to structure selection is the limited amount of data available. In order to manage the risk related to the geological storage of carbon dioxide in saline strata of the Budziszewice-Zaosie structure (one of the planned storage places for Bełchatów), the individual risk factors needed to be identified.
The relevant risk analysis was based on the Quintessa FEP (Features, Events and Processes) knowledge base. The analysis showed that the highest risk related to CO_2 storage in the Budziszewice-Zaosie structure was associated with trap tightness.
Consequently, a map was prepared of the roof and of the thickness of the layer sealing the Lower Jurassic storage strata, since those strata have significantly better storage parameters than the Triassic level.
The Triassic stratum, in fact, was treated as a reserve storage level due to the significant surpassing of the hydrostatic pressure (by about 37%) during the storage of the gas quantities assumed. The storage parameters of the Lower Triassic level do not guarantee the possibility of injecting the carbon dioxide quantity assumed. Further on in the study by the Oil and Gas Institute, an analysis was presented of the impact of CO_2 storage on humans, animals and plants.
The investigations make it possible to draw the following conclusions:

- CO_2 storage in Jurassic strata involves a lower risk of the structure losing its tightness, due to the storage pressure exceeding hydrostatic values by about 20%;
- the Ciechocinek layers sealing the Jurassic level are composed of two shale series with a thickness of 30-40 metres each and a sandstone separating them,

with a thickness of 10-20 metres. In relation to this the cap rock tightness requires further scrutiny, since there is the risk of leaks associated with it.

- an analysis of the impact of CO_2 storage on humans, animals and plants showed that significant risks for human health and for animals could only occur in the case of well blowout. There is little probability of CO_2 blowout, however, due to the subsurface safety valves currently used.

2.4 Risks related to CO_2 transport

Impacts	Qualitative Gravity	Semi-Quantitative Gravity scales for each type of Impact					Contingency Plan
		Human Health (workers/pop.)	Environmental Impact	Technical damages Loss of performance	Financial Impact	Schedule Impact	
Design stage							
Absence of legal and technical regulations for designing transmission networks and systems for CO_2 in the liquid phase under conditions of supercritical pressure	4 – very high 3 – high 2 – moderate 1 – low			2			Application of design solutions analogous to those applied to high pressure gas pipelines and other transmission networks for liquid fuels. Selection of pipeline parameters according to the European standard PN-EN 14161. Use of experiences in the siting of high pressure gas networks (over 10 MPa) operating at natural gas mines (e.g. in conformity with the Order of the President of PGNiG S.A.). Use of specialised software to model the flows of mixtures through pipeline systems.
Performance of construction works							
Need to cut out single trees conflicting with the planned project	4 – very high 3 – high 2 – moderate 1 – low	-	2	-			Specific determination of the pipeline route in order to minimise the need to cut out single trees (outside wooded areas)
Temporary and permanent deforestation of wooded areas		-	2	-			During the construction of the pipeline, small distances should be kept in the case of installation, transport and earth works zones in wooded areas, which may significantly reduce needs with regard to temporary deforestation
Dust in the pipeline construction area and disturbance of the, top soil structure, potentially leading to the creation of recesses and of other adverse residues on the top soil layer.		-	2	-			Organising a road along the pipeline route for heavy mechanical equipment transport so as to ensure that the consequences of operation do not have a serious impact on the inhabitants of the surrounding areas or on plant communities – mainly bushes and tree clusters
The risk exists of pollution of the soil with petroleum derivative substances leaking from vehicles and machines used during construction.		-	2	-			
Destruction of crops in the areas of construction works		-	1	-			During pipeline construction small distances should be kept of installation, transport and earth works zones in agricultural areas, which may significantly reduce the required exclusion of land from agricultural production Humus in agricultural (productive) areas should be removed from the place where the excavation will be made. Subsequently, it should be protected and separated from the remaining earth, i.e. the surface soil, by separate storage along the excavation. After the construction ends, the humus should be laid once again on the top layer of the soil. In cultivated agricultural areas, it is recommended that the construction works schedule be adapted to the crop vegetation periods.
Operation stage							
Potential leaks within connections and places of installation of cut-off fittings, and thus also a sudden pressure drop with the accompanying intense local temperature decrease	4 – very high 3 – high 2 – moderate 1 – low	1	1	3			Using materials resistant to corrosion. Using barrier systems, so as to ensure the possibility of automatic closure of the damaged section in case of failure. Suitable resistance of fittings and sealing at low temperatures Suitable selection of the pipeline materials with regard to: - suitably high resistance, - suitable impact resistance, - required weldability. Using systems operating in parallel for process parameter monitoring, checking the technical condition of the system and monitoring all kinds of activity performed in the immediate vicinity of the pipeline
Corrosive properties of the mixture transmitted		1	1	2			Using internal coating of pipes with an epoxy layer. Taking into account suitable allowance for corrosion during the dimensioning of the pipeline cross-section. Using an active cathodic protection system in order to ensure a suitable level of protection against corrosion Building of sending-receiving chambers of diagnostic pistons at the pipeline ends, making it possible to perform periodic checks of the technical condition of the pipeline, for instance to detect suitably in advance local material losses inside the pipeline
Damage caused by external forces and third party activity		2	2	3			Distribution of marking tapes and posts for correct marking of the pipeline route on site Suitable marking and additional protection by using protective pipes at intersections with natural obstacles and technical facilities Using systems operating in parallel for process parameter monitoring, checking the technical condition of the system and monitoring all kinds of activity performed in the immediate vicinity of the pipeline Detecting undesirable and hazardous actions of third parties, possibly by means of periodic aerial observations or systematic satellite monitoring, Essential scope of information, with particular regard to potential hazards, should be transmitted to the people living in the direct vicinity of the system. Establishment of collaboration is also recommended with the Voivodeship State Fire Service Headquarters having territorial competence

3 FINAL CONCLUSIONS

- After constructing the CCS system in the 858 MW power unit, the predicted concentrations of air pollutants emitted in the vicinity of the Bełchatów Power Plant would stay at a similar level. This conforms to acceptable levels of concentration in the air, with a safety margin;
- The emission of amine compounds in the requested variant, used in the process of CO_2 capture, will not lead to the occurrence of significant concentrations in the air;
- The impact of the CCS system on surface waters will not be significant;
- Management of operation waste will be a part of the existing waste management system applied in the area of PGE Bełchatów Power Plant;
- All waste generated will be subjected to recovery or neutralisation processes in a manner which is safe for the environment and complies with the legal regulations in force;
- The impact on soil will only be significant during construction when excavations are made for the new facilities. After construction and installation activities, reclamation is planned, including levelling of the investment area;
- Due to the location and properties of the plant, the nuisance it will cause in the period of construction and operation will not be significant for the inhabitants of the surrounding areas. Consequently, the impact of the investment on human health is judged as insignificant;
- Any impact will be limited to the construction site and may occur only to a slight extent outside that area, due to increased road traffic and circulation of machines in the construction site itself. No protected plant or animal species occur in the area of the construction site;
- Normal operation of the system will not cause hazards to humans or to the environment;
- Risks related to the project execution including CO2 capture, transportation and storage have been well defined and are being continuously monitored.