

CO₂ transport and storage project “Northern Lights”



In partnership with Equinor and Shell, TotalEnergies is developing a project in Norway to transport and store CO₂ in underground geological formations located off the Norwegian coast.

Starting date of the project	May 2020
Project localization	Implementation of the project in Norway. The project can be replicated in Europe.
Project objectives	The aim of the project is to transport and permanently store the CO ₂ emitted by two industrial sites in Norway, and by any other European emitter who subscribes to the transport and storage service offered by the project.
Detailed project description	<p><u>Background</u></p> <p>In 2017, Equinor, Norske Shell and Total E&P Norge signed a collaboration agreement, as equal partners, to review the shipping and storage project supported by Gassnova, the CCS arm of the Norwegian government.</p> <p><u>The Northern Lights Project</u></p> <p>On May 15, 2020, TotalEnergies, in collaboration with Equinor and Shell, made a landmark investment decision to develop Northern Lights, Norway's first commercial offshore CO₂ shipping and storage project. This decision was made possible because of the strong support (subsidies) for the project from the Norwegian government.</p> <p>https://totalenergies.com/media/news/news/historic-investment-decision-transport-and-storage-co2</p> <p>This project is part of the Carbon Capture and Storage (CCS) industrial chain supported by the Norwegian government (the “Longship” project). It involves the capture of CO₂ from two industrial sources: the first being the Norcem site in Brevik of cement manufacturer, Heidelberg Group (Norcem), and the second the Fortum Oslo Varme waste processing plant in Oslo.</p> <p>In phase one, the Northern Lights project aims to pioneer and accelerate the decarbonization of European industry, by providing available storage capacity of up to 0.7 MtCO₂/year for emitters, in addition to the capacity already reserved by the Norwegian government (0.8 MtCO₂/year for Norcem and Fortum).</p> <p>The funding from the Norwegian government was approved by the European authorities on July 17, 2020 and ratified by the Norwegian Parliament on December 14, 2020. The establishment of the joint venture that will operate and own the Northern Lights project was approved by various national competition authorities in mid-January 2021.</p> <p>The project is expected to be operational by 2024.</p> <p><u>Context</u></p> <p>In the carbon management cycle, CCS is deployed following the reduction of emissions through various actions, such as energy efficiency initiatives or the improvement of the energy mix of industrial companies: the switch from coal to natural gas (which can reduce GHG emissions by half), and the development of low carbon electricity, etc.</p> <p>CCS is the process of capturing residual CO₂ emissions in flue gas, separating them from the other components (nitrogen, water, etc.) and liquefying the CO₂ to ensure optimal transport to the storage site by pipeline, ship, or other logistical means. The CO₂ is then injected into underground porous rock where it can be stored permanently.</p> <p>This project represents a major step forward in the decarbonization of European industry and will enable the development of large-scale, low-carbon hydrogen production. It also opens up possibilities for integrating CO₂ recycling (CCU). The technology also helps ensure negative emissions when CO₂ is captured directly from the atmosphere (DAC = Direct Air Capture) or when it is derived from biomass or waste (BECCS).</p> <p><u>Technical description of the project (phase 1)</u></p>

- Phase 1 concerns the development of maritime transport and the permanent storage of CO₂. This first phase will provide the capacity to store up to 1.5 MtCO₂/year by 2024, by which time the project is expected to be operational.
- Once the CO₂ from the industrial emitters has been captured, it will be transported by ship in liquid form to the offloading terminal on the west coast of Norway. It will then be pumped from the temporary storage tanks into a subsea pipeline of approximately 100 km long and injected via a well into the underground geological formation where it will be permanently stored at about 2,500 meters below the seabed in the North Sea.

Operation

- The facility is expected to be operational by 2024.
- The CO₂ receiving terminal will be located in the Naturgassparken industrial area in Øygarden, in west Norway.
- The site will be operated remotely from the Sture Terminal in Øygarden and from the Oseberg A offshore platform.

Storage and location

- The “Aurora” EL001 operating permit was issued in January 2019.
- The storage facility is located at a depth of 2,500 meters below the seabed, south of the Troll gas field.
- In March 2020, the Eos appraisal well was drilled, confirming the characteristics of the storage site. It will be used for CO₂ injection and storage.

Main project's drivers for reducing the greenhouse gas emissions

Reduction levers	Details on the aspects of the project
<input type="checkbox"/> Energy and resource efficiency (including behavior)	
<input type="checkbox"/> Energy decarbonization	
<input type="checkbox"/> Energy efficiency improvements	
<input type="checkbox"/> Improving efficiency in non-energy resources	
<input checked="" type="checkbox"/> Emissions absorption: creation of carbon sinks, negative emissions (BECCS, CCU/S, etc.)	Transport and storage of CO ₂ from the two Norwegian industrial sites and any industrial sites in Europe that subscribe to the Northern Lights transport and storage service in the future.
<input type="checkbox"/> Financing low-carbon producers or disinvestment from carbon assets	
<input type="checkbox"/> Reduction of other greenhouse gases emission	

Emission scope(s) on which the project has a significant impact and quantification of GHG emission reductions per emission scope

	Aspects of the project contributing to the reduction of emissions by emission category	Quantification of associated GHG emissions by emission category <i>Please follow the quantification methodology used in the Afep guidelines.</i>
Reduction of the company's carbon dependency		
Scope 1 <i>Direct emissions generated by the company's activity.</i>	Operations of the CCS projet	50 ktCO ₂ /year
Scope 2 <i>Indirect emissions linked to the company's electricity and heat consumption</i>		
Scope 3 <i>Emissions induced (upstream or downstream) by the company's activities, products and/or services in its value chain.</i>		
Increase of carbon sinks		
Emissions Absorption <i>Carbon sinks creation (BECCS, CCU/S, etc.)</i>	Permanent storage of CO ₂ in deep underground reservoirs located offshore	1.5 MtCO ₂ /year Including 27% of biogenic CO ₂ (Fortum waste incinerator): negative emissions
GHG emissions avoided by the company at third parties		
Avoided emissions <i>Emissions avoided by the activities, products and/or services in charge of the project or by the financing of emission reduction projects.</i>		

Clarification on the calculation or other remarks:

	<p><u>Carbon impact of the project</u></p> <p>In phase one, the project will develop the capacity to store up to 1.5 MtCO₂/year:</p> <ul style="list-style-type: none"> - 0.8 MtCO₂/year will be reserved by the Norwegian authorities. - 0.7 MtCO₂/year can be sold to third-party clients. <p>In phase two, the project has the potential to reach 5 MtCO₂/year of storage capacity.</p> <p>However, the project also leads to the generation of CO₂ emissions when the gas is transported and temporarily stored (before permanent storage in offshore reservoirs): 0.03 tCO₂ per tCO₂ stored of total direct emissions (on-site construction for onshore + offshore + rig + emissions throughout the operation period) plus indirect emissions (CO₂ content of construction materials for ships, and onshore and offshore sites). This represents emissions of 50 kt tCO₂/year for 1.5 MtCO₂eq/year stored.</p> <p><u>Impact on the two capture sites</u></p> <p>The two capture sites (Fortum and Norcem) will each reduce their direct emissions by 0.4 MtCO₂/year.</p>
<p>Modality of verification of the quantification</p>	<p>Calculation standard used (ADEME base, GHG protocol, etc.): European ETS and CCUS directives</p> <p>Verification of the calculation (internal or external): verifications are subject to national and European regulations (CCS Directive among others).</p>
<p>Other environmental and social benefits of the project</p>	<p>TotalEnergies is committed to working towards the Sustainable Development Goals (SDGs) to ensure a brighter and more sustainable future for all. For this reason, the Company is constructing a sustainable development approach based on four pillars: integrating climate change into its business strategy, protecting the environment, respecting and mobilizing employees and suppliers, and contributing to the economic development of the regions where it operates.</p> <p>To this end, the Northern Lights project, because of its co-benefits, will help to achieve three of the SDGs and to meet specific targets:</p> <ul style="list-style-type: none"> • SDG 7 - Ensure access to affordable, reliable, sustainable and modern energy for all <ul style="list-style-type: none"> ○ The project ensures the generation of reliable, sustainable, and modern energy by transporting and storing the emissions from power plants. • SDG 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation <ul style="list-style-type: none"> ○ The project's CO₂ transport and storage service provides a solution for the CO₂ captured by industrial companies and will therefore enable the development of a sustainable, low-carbon industry in Europe. • SDG 13 - Take urgent action to combat climate change and its impacts <ul style="list-style-type: none"> ○ The aim of the project is to develop geological storage capacity, which is essential for fighting climate change.
<p>Project maturity level</p>	<p><input type="checkbox"/> Prototype laboratory test (TRL 7)</p> <p><input type="checkbox"/> Real life testing (TRL 7-8)</p> <p><input type="checkbox"/> Pre-commercial prototype (TRL 9)</p> <p><input type="checkbox"/> Small-scale implementation</p> <p><input checked="" type="checkbox"/> Medium to large scale implementation</p> <p>Remarks: Click here to enter the level of maturity of the project</p>
<p>Capacity and conditions of the project reproducibility, with associated climate impact mitigation potential</p>	<p>The Northern Lights solution can be replicated for all emitters (waste-to-energy, hydrogen, cement and steel producers and other CO₂ emitters) as well as for all communities who would like to be involved in the decarbonization effort.</p> <p>To date, 15 projects are being examined in Europe. No such project is currently being envisaged in France.</p> <p><u>Climate-related issues:</u></p> <p>The Intergovernmental Panel on Climate Change (IPCC) has described CCS technology as essential in order to achieve a worldwide "net-zero" carbon balance by the second half of the 21st century.</p> <p>Today, approximately 40 Mt of CO₂/year are stored underground. In its 2020 "Sustainable Development" scenario, the International Energy Agency (IEA) estimates that these volumes must be increased to 900 Mt of CO₂/year by 2030 and 5.4 Gt of CO₂/year by 2050 in order to meet the Paris Agreement objectives. The European bodies agree with this growth requirement, and the Commission recommends developing CCUS capacities by 80 and 300 Mt of CO₂/year.</p> <p>In France, the National Low-Carbon Strategy (SNBC) has set a target of achieving Net Zero by 2050. Its reference scenario, "With Additional Measures" (<i>Avec Mesures Supplémentaires - AMS</i>) forecasts 15 Mt of CO₂/year of CCS (5 Mt of CO₂/year in the industry and 10 Mt of CO₂/year in bioenergy). The ADEME has selected three industrial centers of interest for CCS deployment (Dunkirk, Le Havre-Rouen, and Lacq), with a combined potential capacity of 24 Mt of CO₂/year.</p> <p><u>Conditions for the project's success:</u></p> <p>In the project's later stages of development, it will be possible to increase capacity at the site according to market demand from major CO₂ emitters across Europe.</p> <p>The main conditions for the success of the project and of the CCS industry as a whole, are as follows:</p>

	<ul style="list-style-type: none"> • The Net Zero ambitions of governments, companies, and communities. • Transposing these ambitions into quantified targets and implementation plans. <p>And by creating value for CO₂ through:</p> <ul style="list-style-type: none"> • Recognition of the added value of low-carbon products (cement, steel, chemicals, etc.). • Decarbonization incentives based on regulations as well as carbon taxation.
Amount of investment made (in €)	<p>An investment decision was made by TotalEnergies and its partners in Norway on May 15, 2020 (NOK 6.9 billion or approximately €800 million for CO₂ transport and storage).</p> <p>The funding from the Norwegian government was approved by the European authorities on July 17, 2020 and ratified by the Norwegian Parliament on December 14, 2020. The establishment of the joint venture that will operate and own the Northern Lights project was approved by various national competition authorities in mid-January 2021.</p>
Economic profitability of the project (ROI)	<p><input type="checkbox"/> ST (0-3 years) <input type="checkbox"/> MT (4-10 years) <input type="checkbox"/> LT (> 10 years)</p> <p>Remarks: Economic viability not disclosed.</p> <p>Northern Lights marks the first step towards developing a value chain based on carbon management and decarbonization services. It paves the way for new forms of international logistics.</p> <p>TotalEnergies has drawn on its expertise in carbon capture, transport, underground storage, and complex chain management to develop this new decarbonization tool. TotalEnergies is thus offering a solution which meets the scale of the decarbonization challenge by taking the first steps towards commercializing this emerging industry.</p>
Engaged partnerships	<p><u>Engaged partnerships</u></p> <p>TotalEnergies is working in partnership with Equinor and Shell on this project.</p> <p>The Norwegian government is supporting the project through subsidies in return for reserving 0.8 MtCO₂/year of storage capacity over the first 10 years of operation.</p> <p><u>Business development</u></p> <p>A non-binding Memorandum of Understanding has already been signed with nine European companies for the development of CO₂ capture and storage value chains. The signatory companies include Air Liquide, Arcelor Mittal, Ervia, Fortum, Preem, HeidelbergCement, and Stockholm Exergi.</p> <p>The establishment of binding commercial agreements will depend, among other things, on a favorable decision by the Norwegian authorities, the decision to develop CO₂ capture facilities by third-party clients and the conclusion of bilateral agreements between Norway and third-party countries, where these clients are based, for CO₂ transport and storage. This cross-sectoral collaboration provides a unique solution to managing large volumes of CO₂ and preventing their release to the atmosphere. These new value chains and the infrastructure for CCS projects can only be developed through cooperation between governments and the private sector.</p>
Open comments from the project owner	<p>Experts agree that CCS is an essential tool in the fight against climate change and very important long-term objectives have been set for this technology. Even after 2050, it will still be necessary to continue reducing CO₂ emissions in the atmosphere, which can be achieved through CCS.</p> <p>This collective awareness and greater societal acceptance because of offshore storage and the resulting public and private commitments made, have given rise to a multitude of projects planned between now and 2030, with CCS activity set to increase fivefold.</p> <p>Furthermore, in May 2020, TotalEnergies announced its aim to achieve Net Zero by 2050, together with society, for all of its global operations, from production to the use of its energy products by its clients.</p> <p>This ambition is centered on two focuses, each of which has clear objectives for 2030:</p> <ol style="list-style-type: none"> 1. Achieving Zero Net emissions by 2050 or sooner in the case of TotalEnergies' global operations. The objectives for 2030 related to this ambition are as follows: <ul style="list-style-type: none"> - A decrease in scope 1+2 emissions of more than 40% compared to 2015. - A decrease in methane emissions of more than 80% compared to 2020. - Zero routine flaring. 2. Achieving Net Zero emissions by 2050 or sooner in the case of indirect emissions related to the use by our clients of sold energy products. The objectives for 2030, compared to 2015, related to this ambition are as follows: <ul style="list-style-type: none"> - A decrease in global scope 3 emissions (i.e. < 400 MtCO₂eq/year). - A decrease of more than 30% in global scope 3 emissions related to petroleum products sold. - A decrease of more than 30% in scope 3 emissions in Europe. - A decrease in the carbon intensity of energy products sold of more than 20% throughout their lifecycle. <p>The Northern Lights Project will thus contribute to reducing TotalEnergies' operated emissions and help it propose a storage service to its clients.</p>

Contact the company carrying the project

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Project URL links

[Northern Lights \(norlights.com\)](http://norlights.com)

Illustrations of the project



