

Press Release

Launch of the innovative European “3D” project for the capture and storage of CO₂ on an industrial scale

Dunkirk, May 28, 2019 — A consortium of 11 European stakeholders including ArcelorMittal, Axens, IFP Energies nouvelles (IFPEN) and Total, is launching a project today to demonstrate an innovative process for capturing CO₂ from industrial activities—the DMX™ project. It is part of a more comprehensive study dedicated to the development of the future European Dunkirk North Sea capture and storage cluster.

The “3D” project (for **DMX™ Demonstration in Dunkirk**) is part of Horizon 2020, the European Union’s research and innovation program. The project has a 19.3 million euro budget over 4 years, including 14.8 million euros in European Union subsidies. Coordinated by IFPEN, the “3D” project brings together 10 other partners from research and industry from 6 European countries: ArcelorMittal, Axens, Total, ACP, Brevik Engineering, CMI, DTU, Gassco, RWTH and Uetikon.

The objective is threefold:

- **Demonstrate the effectiveness of the DMX™ process on a pilot industrial scale.**
The pilot, designed by Axens, will be built starting in 2020 at the ArcelorMittal steelworks site in Dunkirk and will be able to capture 0.5 metric tons of CO₂ an hour from steelmaking gases by 2021.
The DMX™ process, a patented process stemming from IFPEN’s Research and to be marketed by Axens, uses a solvent that reduces the energy consumption for capture by nearly 35% compared to the reference process. Additionally, using the heat produced on site will cut capture costs in half, to less than 30 euros per metric ton of CO₂.
- **Prepare the implementation of a first industrial unit** at the ArcelorMittal site in Dunkirk, which could be operational starting in 2025. It should be able to capture more than 125 metric tons of CO₂ an hour, i.e. more than one million metric tons of CO₂ a year.
- **Design the future European Dunkirk North Sea cluster, which should be able to capture, pack, transport and store 10 million metric tons of CO₂ a year and should be operational by the year 2035.** This cluster will be backed up by the packing and transport infrastructures for storing CO₂ in the North Sea developed by other projects such as the Northern Lights project¹ that Total is already involved in.

The “3D” project’s ambition is to validate replicable technical solutions and to achieve industrial deployment of Capture & Storage technology around the world. It should play a major role in enabling industries with high energy consumption and CO₂ emissions, such as the steel industry, to reduce their emissions. This project is an essential lever for meeting the targets of the Paris Agreement on global warming.

¹ Research project for the capture, storage and reuse of CO₂ in Norway

CO₂ capture and the Carbon Capture & Storage (CCS) process

Capture consists in extracting the CO₂ produced by large polluting industrial units, then putting it under pressure before injecting it into a geological storage area. In post-combustion capture, the CO₂ is separated from other gases by absorption in a chemical solvent. Currently, the challenge facing research is to significantly increase the energy performances in this stage, the costliest part of the CSC process, to make this process more competitive.

About Total

Total is a major energy player, which produces and markets fuels, natural gas and low-carbon electricity. Our 100,000 employees are committed to better energy that is safer, more affordable, cleaner and accessible to as many people as possible. Active in more than 130 countries, our ambition is to become the responsible energy major.

Total and Carbon Capture, Utilization and Storage (CCUS)

“Commercial-scale pilots, such as Dunkirk’s, are vital to make carbon capture, utilization and storage technologies more competitive, supporting the growth of low-carbon industry,” **points out Marie-Noelle Semeria, Senior Vice President and Group Chief Technology Officer at Total.** *“Total aspires to become a major player in CCUS technologies, which are vital to achieving carbon neutrality in the second half of the century, and we are happy to be involved alongside our European partners.”*

Total spends 10% of its R&D budget on carbon capture, utilization and storage technologies. We want to help curtail global carbon emissions and set the stage for new business opportunities through our R&D program. We are involved in innovative initiatives ranging from basic research in conjunction with world-renowned universities to commercial-scale working projects.

- In the United States, in 2018, Total joined Stanford University’s Strategic Energy Alliance to speed up innovations in carbon conversion technologies and storage simulation.
- In France, Total has been a partner of the Collège de France since January 2019. Our partnership with the laboratory headed by Professor Marc Fontecave aims to develop a pioneering project to convert carbon dioxide into oil, gas and alcohols.
- Total has joined three demonstration centers, in Switzerland, Canada and Australia, to study the geomechanics, injection monitoring and environmental impact of carbon storage.
- In Canada, Total partners with two innovation centers alongside the start-ups Inventys and CO₂ Solutions. The centers aim to capture carbon dioxide at industrial sites and convert it to products for the chemical industry, materials or fuels.
- In China, Total is participating in the CHEERS, or Chinese-European Emission-Reducing Solutions, project to develop a 3 MWth chemical looping combustion demonstration unit that can capture carbon and produce power and heat.
- In Norway, Total is involved in the Northern Lights project. In 2017, we began research with Equinor and Royal Dutch Shell to develop the transportation and storage segment of the world’s first commercial-scale industrial project to capture, transport and store CO₂. Its capacity will total 1.5 million tons of carbon dioxide a year. It will store the emissions from two manufacturing sites in the Oslo region and be able to take in the emissions of other operators.

- In the United Kingdom, Total is involved alongside OGCI Climate Investments in the Clean Gas Project, which aims to produce power using natural gas and capture and transport the carbon dioxide emitted to a storage site in the North Sea.

* * * * *

IFPEN Contacts

Media Relations: Anne-Laure de Marignan, +33 (0)1 47 52 62 07, presse@ifpen.fr
CO₂ Capture and storage Program Manager: Florence Delprat-Jannaud, +33 (0)1 47 52 74 31, florence.delprat-jannaud@ifpen.fr

ArcelorMittal Contacts

Image 7: +33 (0)1 53 70 74 70, arcelormittal@image7.fr
ArcelorMittal in France: Isabelle Chopin, +33 (0)6 15 21 59 25, isabelle.chopin@arcelormittal.com

Total Contact

Media Relations, +33 (0)1 47 44 46 99, presse@total.com | @TotalPress

Axens Contacts

Media Relations, Corinne Garriga, +33 (0)1 47 14 17 14, corinne.garriga@axens.net
Technological Development Director, Stéphane Fédou, +33 (0)1 47 14 67 42, stephane.fedou@axens.net.

Cautionary note

This press release, from which no legal consequences may be drawn, is for information purposes only. The entities in which TOTAL S.A. directly or indirectly owns investments are separate legal entities. TOTAL S.A. has no liability for their acts or omissions. In this document, the terms "Total" and "Total Group" are sometimes used for convenience where general references are made to TOTAL S.A. and/or its subsidiaries. Likewise, the words "we", "us" and "our" may also be used to refer to subsidiaries in general or to those who work for them.

This document may contain forward-looking information and statements that are based on a number of economic data and assumptions made in a given economic, competitive and regulatory environment. They may prove to be inaccurate in the future and are subject to a number of risk factors. Neither TOTAL S.A. nor any of its subsidiaries assumes any obligation to update publicly any forward-looking information or statement, objectives or trends contained in this document whether as a result of new information, future events or otherwise.