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Reducing CO₂ Emissions by Making Cheaper CO₂ Capture Technologies Available

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Abstract

The Royal Dutch Shell Group (Shell)¹ was one of the first energy companies to acknowledge the threat of climate change - to call for action by governments; our industry and energy users; and to take action ourselves. Shell's strategy: to expand our alternative energies portfolio, while investing in advanced CO₂ solutions in order to improve our ability to manage emissions from our hydrocarbon business. Measures to manage future emissions will include developing new technologies to capture and store CO₂ underground. The pursuit of Carbon Capture and Storage (CCS) technologies allows Shell to play an important and leading role towards addressing the need for an increasing worldwide demand for energy, while at the same time dealing with the need to reduce global emissions.

No single universal policy or technology will solve the CO₂ challenge. Therefore, various CCS solutions will need to be considered within a portfolio of measures to reduce global CO₂ emissions while assisting a transition towards a low-carbon energy future. Shell seeks to position itself as part of the solution to the climate change issue.

¹ Shell Global Solutions is a network of independent technology companies in the Shell Group. In this material the expression 'Shell Global Solutions' is sometimes used for convenience where reference is made to these companies in general, or where no useful purpose is served by identifying a particular company.

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The United Nations Intergovernmental Panel on Climate Change (IPCC) has identified CO₂ capture and storage (CCS) as the most promising for the rapid reduction of global emissions - by up to 55% by 2100². As the bridge to a more sustainable energy system, it is therefore a key solution for combating climate change - among a portfolio of solutions, including renewable energies, energy efficiency and biofuels

In order to achieve deeper reductions in CO₂ emissions there will need to be new technologies brought to the market to enable a 'Kyoto 2' type-agreement. Authorities such as the International Energy Agency, the European Union Commission for Research and the US Department of Energy predict that new technologies will include hydrogen fuels cells, clean coal technology, and storage of CO₂ below ground - in deep saline formations or redundant reservoirs, or for enhanced oil recovery. Considerable attention is being focused on CO₂ storage with the desire to reduce the cost of capture and storage below 25 \$/t CO₂.

Shell has a special team working on the CO₂ Capture Project (CCP) Joint Industry Project. For the CCP Shell carries out studies, manages projects and the team is involved evaluating opportunities for deployment of the technologies within Shell. Shell also provides the Vice Chairman for this initiative and has several key-players working on this project. CCP is an international collaboration among industry, governments, academics and environmental interest groups focused on developing technology for CO₂ capture and geological storage. The CO₂ Capture Team (CCT) conducts Shell's participation in the CO₂ Capture Project (CCP) and other external programs. CCT also works internally to apply external learnings and technologies within Shell businesses. Additionally, Shell's research and development funds and manages a separate CO₂ storage program. Our goals are to:

- reduce the cost of capture by 60 to 80%, and
- demonstrate that geological storage can be secure.

In addition to the CCP, Shell is involved in many other CO₂ collaborations. A few of these are mentioned below:

CO₂CRC is a leading regional collaboration for capture and storage technology. Participants include international energy companies plus others from Australia and New Zealand.

(1) ² IPCC Special Report on Carbon Dioxide Capture and Storage, 2005

The Australian government helps with funding and organizational support.

WESTCARB is a leading regional collaboration for infrastructure and demonstration. Participants include international energy companies plus others from the US West Coast. The US DoE helps with funding, including capital for an integrated demonstration.

The IEA Greenhouse Gas R&D Programme is a unique collaboration of governments and industry. It produces definitive reports for the participants, and sponsors the premier conference on capture and storage. The reports provide primary input to the IPCC. Participants include 18 governments and 17 multi-national companies. CCT participates on the executive committee.

This paper further describes the CCP program, reviews the results of the completed CCP1 and provides an overview of the main technologies and activities of the current CCP2.

Applications

Shell is involved in a number of projects to capture and store CO₂:

- 1) Halten project:
 - a. Shell in collaboration with other Companies are conducting a feasibility study on power production (860 MW at Tjeldbergodden) and CO₂ management at Halten in mid-Norway.
If the project goes ahead, the impact will be enormous, not only improving long-term electricity balance in Norway, but will also provide a secure power supply to industries producing vital hydrocarbons for Europe.
- 2) Middle East:
 - a. CO₂ captured from LNG plants and transported for re-injection in oil reservoirs for EOR.
 - b. Shell's Middle East Region has signed a Memorandum of Understanding with Mitsubishi to develop CO₂ capture projects.

Value/Size of the prize:

The main business objective is to reduce CO₂ capture costs from the current 50 \$/t CO₂ to below 15\$/t. Cost reductions referred to before of 25 \$/t CO₂ includes CO₂ capture and storage. This will potentially provide several benefits:

- significant savings on millions of tonnes that Shell will need to avoid;
- maintaining or enabling license to operate by avoiding those emissions; and
- opportunities to use CO₂ for enhanced recovery (enhanced oil recovery, enhanced gas recovery, or enhanced coal bed methane)

The main drivers to economically apply CO₂ capture technologies and CO₂ storage are:

- to ensure Shell meets its targets over the coming

years on CO₂ emissions;

- to make CO₂ an opportunity, rather than a cost burden;
- to reduce the cost of existing technologies and develop new lower-cost technologies; and
- to work with leading competitors to share costs and obtain Governments buy-in.

Deployment plan

Shell is working on a variety of developments for the deployment of CO₂ capture technologies. It is expected that in the near future one of these developments will enter the execution phase.

Leverage of core competences / Partnering strategy

Shell decided to pursue technologies to capture CO₂ by participating in industry programs and other collaborations, notably the CCP.

The leverage of the CCP is huge because eight oil companies and three governments support this program. Shell's cash contributions to the CCP total about \$ 2 million over four years and the resources provided to the CCP total about \$50 million. Shell builds on collaborative work with other expertise and implementation.

Shell also differentiates from other CCP participants by applying other in-house expertise:

- gasification for pre-combustion technologies;
- gas treating for post-combustion technologies; and
- catalysts for oxy-firing technologies.

In addition to the funding leverage of Shell's external collaborations, working with the other participants and governments can also lead to opportunity leverage.

Key technical hurdles

- Develop a portfolio of capture technologies that apply to a wide range of Shell's stationary combustion sources;
- Implement technologies to potentially cut (in half) the cost of mitigating CO₂; and
- Provide the captured CO₂ as a cost-effective fluid for EOR.

More information

At the IPTC Conference an update on progress of the Shell activities will be presented.