



CCS DEMONSTRATION AT SHELL

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Reserves: Our use of the term “reserves” in this presentation means SEC proved oil and gas reserves.

Resources: Our use of the term “resources” in this presentation includes quantities of oil and gas not yet classified as SEC proved oil and gas reserves. Resources are consistent with the Society of Petroleum Engineers 2P and 2C definitions.

Organic: Our use of the term Organic includes SEC proved oil and gas reserves excluding changes resulting from acquisitions, divestments and year-average pricing impact.

Shales: Our use of the term ‘shales’ refers to tight, shale and coal bed methane oil and gas acreage.

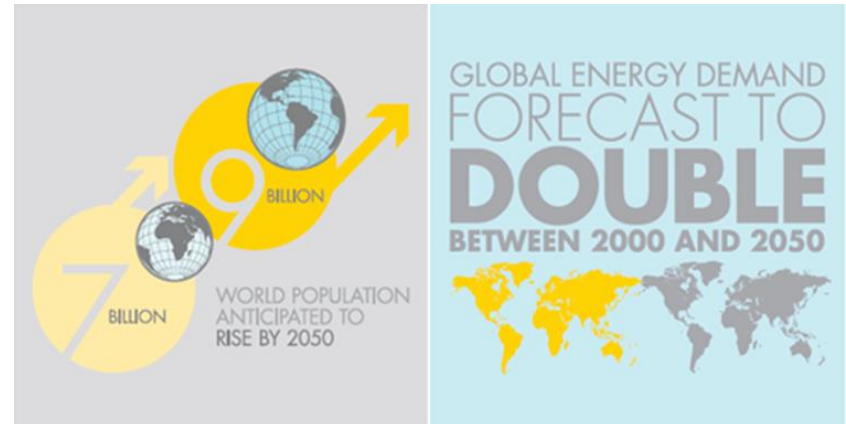
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SHELL AND CLIMATE CHANGE

- Long recognised importance of climate challenge and role of energy in enabling quality of life.
- Challenge is “more energy and less CO₂”.
- Energy transition underway:
 - Renewables will become a significant part of the global energy system;
 - To address shortcomings in availability, intermittency, storage and energy density, renewables need combination with cleaner hydrocarbons.
- Society will struggle to achieve its climate goals without government carbon pricing systems and, longer term, without CCS.
- Shell will play its role to bring more energy and less CO₂, especially where we have the skills such as natural gas, biofuels and CCS.



**. . . . near zero
emissions of CO₂ by
the end of the century.**

SHELL'S RESPONSE TO THE CO₂ CHALLENGE



SHELL IS OUTSPOKEN IN ADVOCACY OF CLEANER BURNING NATURAL GAS



SHELL IS WORKING HARD TO IMPROVE ENERGY EFFICIENCY



SHELL IS DEVELOPING ADVANCED BIOFUELS



SHELL IS DEVELOPING CARBON CAPTURE AND STORAGE PROJECTS

CCS - KEY TO A LOW CARBON FUTURE

13%

CCS has the potential to deliver 13% of the required mitigation by 2050 (International Energy Agency)

138%

Without CCS, the cost of limiting global CO₂ emissions to 450ppm could increase by 138% IPCC Fifth Assessment Report

£32

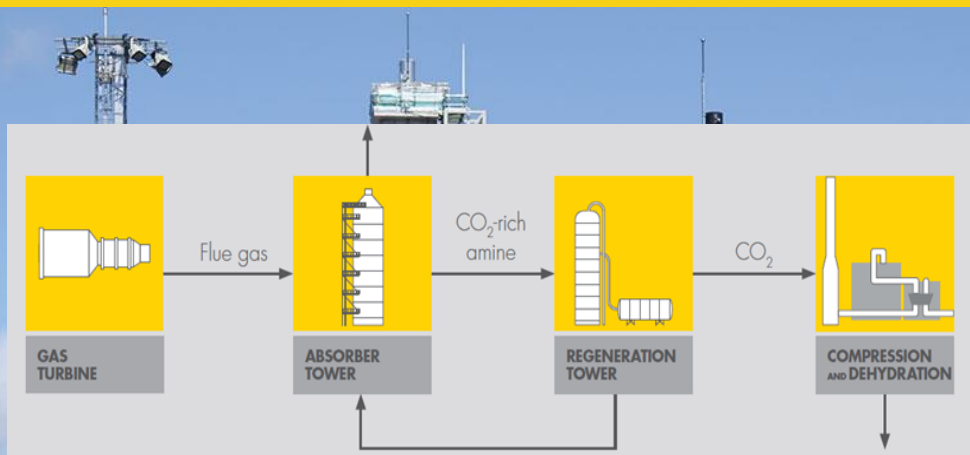
Billion per annum

Without CCS, the additional costs to run a decarbonised UK economy in 2050 will be £32 billion IPCC Fifth Assessment Report

CCS ELEMENTS ARE PROVEN

Capture

- Capture-related technology has been utilised in industry for decades for product decontamination.
- Most mature technology uses amine solvents for CO₂ and H₂S.
- Emerging capture technologies build on industrial processes e.g. gas/solid fluidised beds & membranes.



- Shell's proprietary Cansolv and ADIP-X amine capture technologies are optimised for CO₂ capture
- Other capture technologies not based on amines are in development

CCS ELEMENTS ARE PROVEN

Transport

- Decades of CO₂ - enhanced oil recovery (EOR) experience in the US
- Established pipelines across the US and Europe

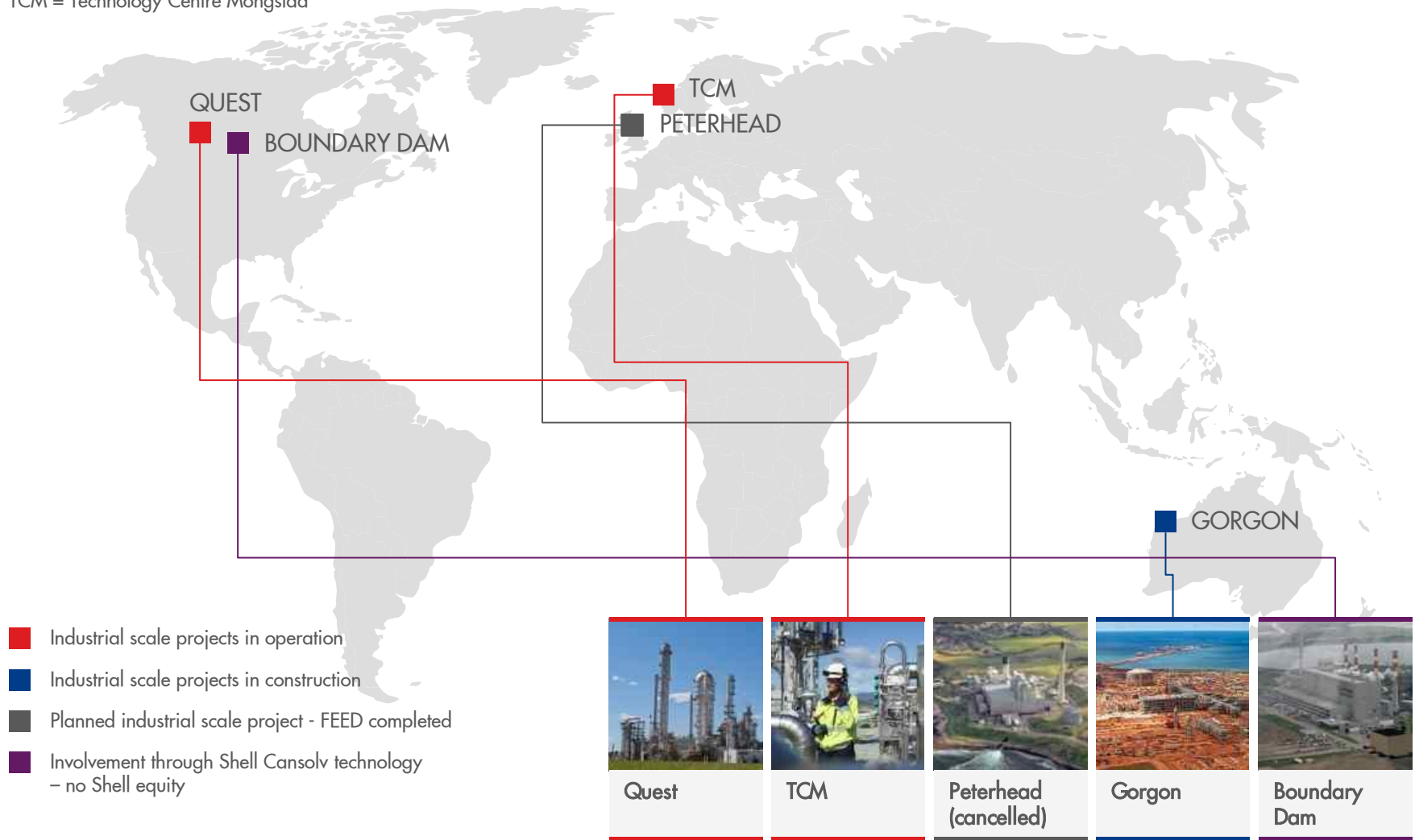
Storage

- CO₂ storage is being demonstrated
- Many accumulations of natural CO₂
- Natural gas storage experience in Northwest Europe



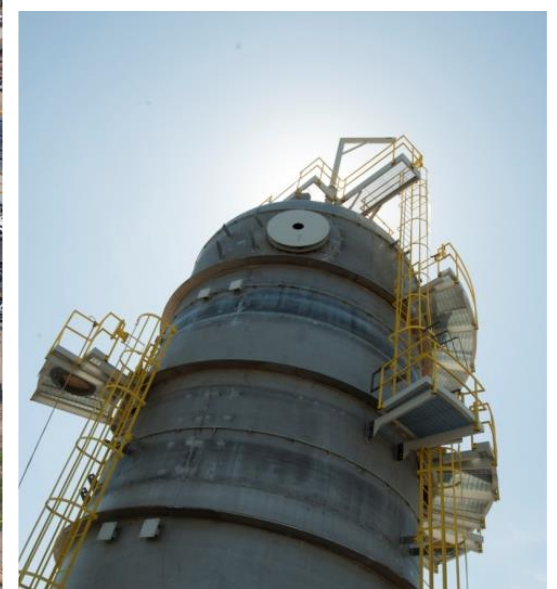
SHELL INVOLVEMENT IN CCS PROJECTS

TCM = Technology Centre Mongstad



SHELL CANSOLV AT SASKPOWER'S CCS PROJECT UP TO 1 MM TONNES/YEAR CO₂ CAPTURE FOR EOR

- First commercial-scale post-combustion carbon capture system at a coal-fired power plant
- Demonstrates the viability of large-scale post-combustion CO₂ capture
- Uses Shell Cansolv CO₂ technology.
Captures up to 90% CO₂, high or low SO₂ content
- Enables EOR with CO₂ from power plant fluegas
- Meets stringent CO₂ regulations
- CO₂ permanently stored



SASKPOWER'S BOUNDARY DAM PROJECT UPDATE

Capacity of the process successfully demonstrated

- 72 hours test completed in November 2015
- 3,240 TPD of CO₂ (90% capture)
- Energy consumption aligned with expectations

This year, the capture process continues to operate at levels meeting CO₂ emission regulations and CO₂ sales obligations

- Q1, 2016 CCS plant availability = 90% (planned outage in Feb)
- Q1, 2016 capture = 217,000 tonnes of CO₂
- 2016 annual objectives = 85% availability & 800,000 tonnes captured



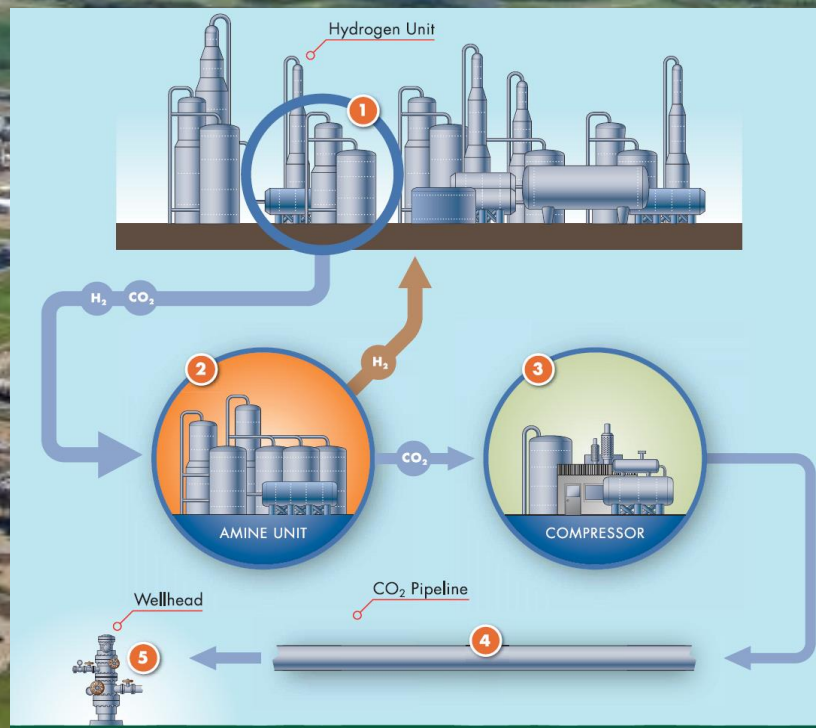
SHELL'S QUEST CCS PROJECT

1MM TONNES/YEAR CO₂ CAPTURE

- Fully integrated CCS project located in Alberta
- The Scotford Upgrader processes bitumen from Shell Albian Sands. It is integrated with Shell Canada's Scotford Refinery – making it one of the most energy efficient facilities of its kind.
- Quest is expected to capture over one million tonnes of CO₂ annually and store it deep underground – equivalent to the emissions of about 250,000 cars.



SHELL'S QUEST PROJECT UPDATE



Project successfully demonstrated

- AOSP fully integrated CCS project sequestering 1.1 million tonne per year of CO_2 , up to 1/3 of Upgrader emissions.

Value Creation

- Project Near NPV = 0.
- Post government funding, availability to leverage volumes for Enhanced Oil Recovery or other value added opportunities.

Quest Performance

- >600k tonnes captured to date. Recoveries >80%.
- Great Subsurface performance.
- Operating costs trending lower than expected.

WHY HERE? – WCSB SUITABILITY FOR CO₂ STORAGE



CO₂ Sequestration
Suitability in the
Western Canadian
Sedimentary Basin

BASIN SUITABILITY

Not suitable Limited Good Very Good

CCS PROJECTS ARE OPERATIONAL BUT MORE ARE NEEDED



15 large scale projects in operation globally, a further 7 under construction

Most projects are associated with O&G industry and using CO₂ for EOR



Capacity to prevent 40 million tons of CO₂ per annum from reaching the atmosphere

Source: Global CCS Institute, 2016



POLICY NEEDS



CCS will require a robust CO₂ price, a level playing field with alternative low carbon technologies, and short term demonstration support to drive down costs.

Q&A

