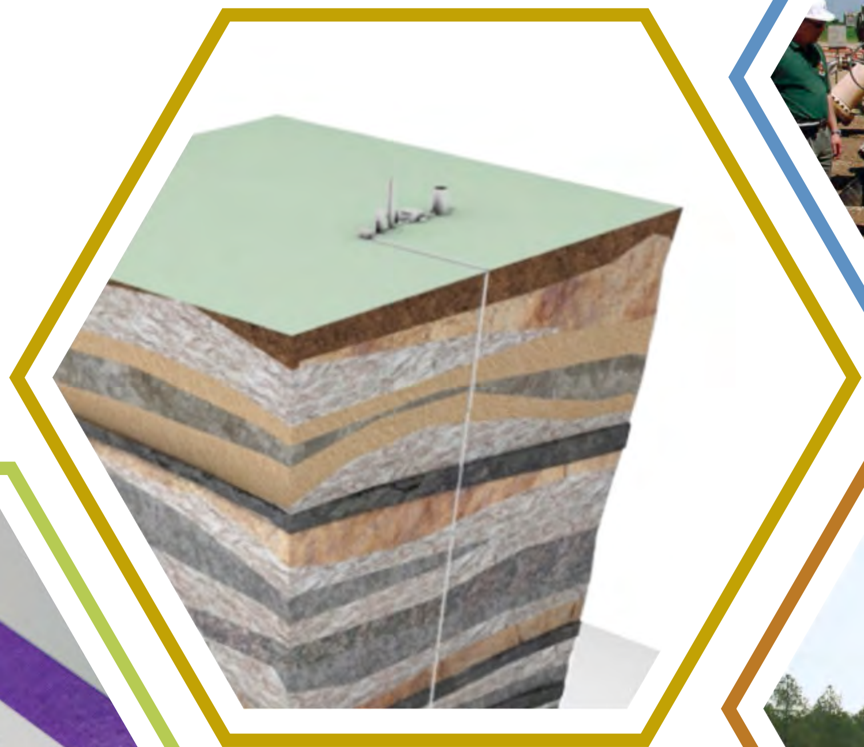
ANNUAL REPORT 2015

Collaborating to build CCS knowledge

CCP

CO$_2$ CAPTURE PROJECT



bp Chevron BR PETROBRAS SUNCOR

PARTICIPANT ORGANIZATIONS

ABOUT THE CCP

The CO_2 Capture Project (CCP) was formed in 2000 to advance technologies for CO_2 capture and geological storage to help make CCS a viable option for CO_2 mitigation.

CCP is now in its fourth phase of activity, which began in late 2014. The program is planned to last for five years and is driven by four of the world's leading energy companies – BP, Chevron, Petrobras and Suncor – supported by numerous experts.

Today, this group is focused on delivering further progress in CO_2 capture and geological storage technology through research, development and demonstration.

This 2015 Annual Report provides an update from the Teams that make up the CCP – Capture, Storage, Policy & Incentives and Communications.

CCP AIMS:

- To drive down the cost of existing CO_2 capture technologies for future use by the oil, gas and power generation industries, through further technology R&D as well as demonstrations of next-generation technology
- Advancing knowledge of well integrity, natural site characteristics amenable to containment and subsurface processes governing CO_2 trapping
- Adapting subsurface monitoring technologies to track CO_2 underground and developing approaches to respond to out of zone migration of CO_2

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Annual Report 2015

CHAIRMAN'S INTRODUCTION

Jonathan Forsyth
BP, CCP Chairman

A warm welcome to the 2015 CCP Annual Report – the first in our fourth phase of the CO_2 Capture Project (CCP) and also my first as Chairman. This Annual Report takes a look at the first full year of our work in the current phase, which we call CCP4, and highlights some of the key areas of work that will be developed and expanded over the coming years.

ACHIEVEMENTS

Looking back over the achievements of the recently completed CCP3, it is clear that CCP has come a long way – building up a significant body of knowledge and insights, with the emphasis very much on the practical applications that will be needed if CCS is to be widely adopted as a climate change mitigation technology. Evaluations and analysis, research, development and demonstrations have created results that have real value at all levels – from the desktop through to the lab and the field.

THE ROLE OF CCP AND CCS

The debate around anthropogenic climate change and what should be done to address it has ebbed and flowed over the life of CCP. The International Energy Agency's most ambitious climate policy scenario (the 450 scenario*) forecasts that the world will continue to depend on fossil fuels for around half its energy needs for many years into the future. Yet the outcome of last year's COP21 talks in Paris shows us that the world sees more than ever the need to take action to seek to limit temperature rise.

In this context, CCS really could become a critical technology in helping to deliver the Paris

*World Energy Outlook 2015

"The debate around anthropogenic climate change and what should be done about it has ebbed and flowed over the life of CCP."

COP21, Paris
Courtesy of Getty Images

Agreement's long-term temperature objective – and this gives renewed impetus for our work. However, it feels like CCS has been in this position before – of being 'just around the corner'. The reality is that there is still a long way to go to bring the technology to widespread commercial use – in terms of both the pace and sheer scale needed and, of course, of cost. It is a huge and complex task. Policy and regulation must lead the way by providing certainty and direction – but industry can continue to play its part in technology development. However, this is a task that is bigger than any one company – and is where the natural strength of CCP lies.

STEPS FOR CCP4

As we go through CCP4, we need to keep reminding ourselves of these challenges, strengthen what we are good at and continue our collaboration-based approach to finding solutions. CCP's work to date has shown that CCS is safe, technically viable and has the potential to be cost effective. Moving forward we need to help make CCS more cost-competitive and more accessible. We need to be smart about how CCP can support all areas of what is a very long CCS 'chain' – from early visioning and scoping through to commercial planning, capture, transportation and storage. Keeping abreast of the growing range of breakthrough technologies, sharing insights from demonstration projects and understanding the differing requirements of the many organisations throughout the CCS value chain will all be crucial to this aim.

COLLABORATION

This is a task that is much easier solved with the multiple brains, eyes and resources upon which an organisation like CCP can call. At a time of intense pressure on the industry brought about by the low oil price and the scale of the CCS challenge, the collaborative nature of CCP offers a way ahead, providing expertise, resources and support.

Finally, I am particularly proud to have been elected as CCP Chairman and would like to thank the previous incumbent, Nigel Jenvey, for his focus and determination in helping bring CCP3 to a successful conclusion while also laying the ground for CCP4. I would also like to pass on my personal thanks to the CCP technical teams, drawn from the membership, who are involved in this work. Their dedication and expertise are vital to the success of our joint endeavours.

"The reality is that there is still a long way to go to bring the technology to widespread commercial use."

TRANSITION
CCP3 TO CCP4

CCP3 was brought to a conclusion in May 2014, ending a five-year long program that saw a number of ground-breaking initiatives in the areas of capture and storage. The program can be characterised as a number of demonstration projects but also included a variety of research studies and development projects which added significantly to the overall body of knowledge pertaining to CCS.

While much was achieved, the membership of CCP felt that the job was by no means complete and sanctioned a further five-year program – CCP4 – with a focus on supporting the development and demonstration of new CCS technologies for both CO_2 capture and storage.

CCP3 highlights:

THE CAPTURE PROGRAM delivered two industrial-scale demonstrations, supported development of novel capture technologies and furthered technical and cost understanding of existing state-of-the-art technologies.

TECHNICAL FACTSHEETS ARE AVAILABLE TO DOWNLOAD:

- FCC DEMONSTRATION
- OTSG DEMONSTRATION

THE STORAGE, MONITORING AND VERIFICATION (SMV) PROGRAM developed the first comprehensive approach to manage unexpected leakage of stored CO_2, ran a range of studies to better understand subsurface behaviour of CO_2 and supported a number of field monitoring trials.

TECHNICAL FACTSHEETS ARE AVAILABLE TO DOWNLOAD:

- CONTINGENCIES PROJECT
- MODULAR BOREHOLE MONITORING
- CO_2 IMPURITIES STUDY

CCP4 CAPTURE PROGRAM
2015 OVERVIEW

The CCP4 Capture program will evolve over the course of the five-year period, but will be based upon the key learnings drawn from CCP3 and the likely needs of the oil and gas sector with regard to future deployment of CCS technologies in its operations.

Capture activity has in the past focused on three scenarios of most relevance to the oil and gas industry in terms of CO_2 emissions management: oil refineries, heavy oil extraction and natural gas power generation.

To these, the membership has agreed to add a fourth scenario for focus during CCP4 – separation of CO_2 from natural gas extraction.

IN THIS SECTION:

- CCP4 SCENARIOS
- PROJECT: SMR PRE-COMBUSTION TECHNOLOGIES
- PROJECT: NOVEL CAPTURE TECHNOLOGIES
- PROJECT: NATURAL GAS LANDSCAPE STUDY

CCP4 outlook:

“The ongoing efforts are focused on identifying one or more suitable CO_2 capture pilot/demonstration project(s). Considering the budget available in CCP4, it will be critical to identify partners and co-funding opportunities to execute these high-cost projects. The current work will form a basis for selection of these projects in 2016/2017.”

Raja Jadhav,
Chevron, Team Lead

CCP4 SCENARIOS

In developing the initial CCP4 Capture program framework, new Technical Team Lead Raja Jadhav and his team of member experts have drawn upon the main outtakes from the work in each scenario during CCP3 while adding a fourth scenario – capture from natural gas extraction.

REFINERY

CCP3 learnings
- Steam methane reformer (SMR) hydrogen plants have the lowest cost of CO_2 capture if high-pressure CO_2 is targeted
- Refinery heaters and boilers have very high CO_2 avoided costs and pre-C capture with hydrogen-firing as the most practical and economical capture technology
- For refinery FCCs, oxyfiring and post-combustion capture technology costs are comparable

CCP4 focus
- SMR pre-C capture to be focused upon
- Due to its high costs, refinery heaters and boilers are of low priority
- Lower-cost oxygen technologies

NGCC

CCP3 learnings
- Post-combustion solvent-based technology is still the most cost-effective technology
- Evaluated novel solvents cannot compete with the near-commercial technologies

CCP4 focus
- Look for breakthrough capture technology with CO_2 capture costs less than $50/tonne
- Lower priority for developing 'incremental' cost reduction technologies

NATURAL GAS EXTRACTION

CCP4 focus
- New scenario for CCP4
- Understand environment for capturing CO_2 from natural gas offshore extraction
- Potential for capture technology development projects

HEAVY OIL

CCP3 learnings
- Post-combustion is the lowest-cost capture technology
- Chemical looping combustion is cost-competitive with post-combustion
- Capex has a large impact on the cost due to the Alberta location of the demonstration

CCP4 focus
- Look for breakthrough capture technology with CO_2 capture costs less than $50/tonne

Images courtesy of Shutterstock, BP and Suncor

PROJECT: SMR PRE-COMBUSTION TECHNOLOGIES

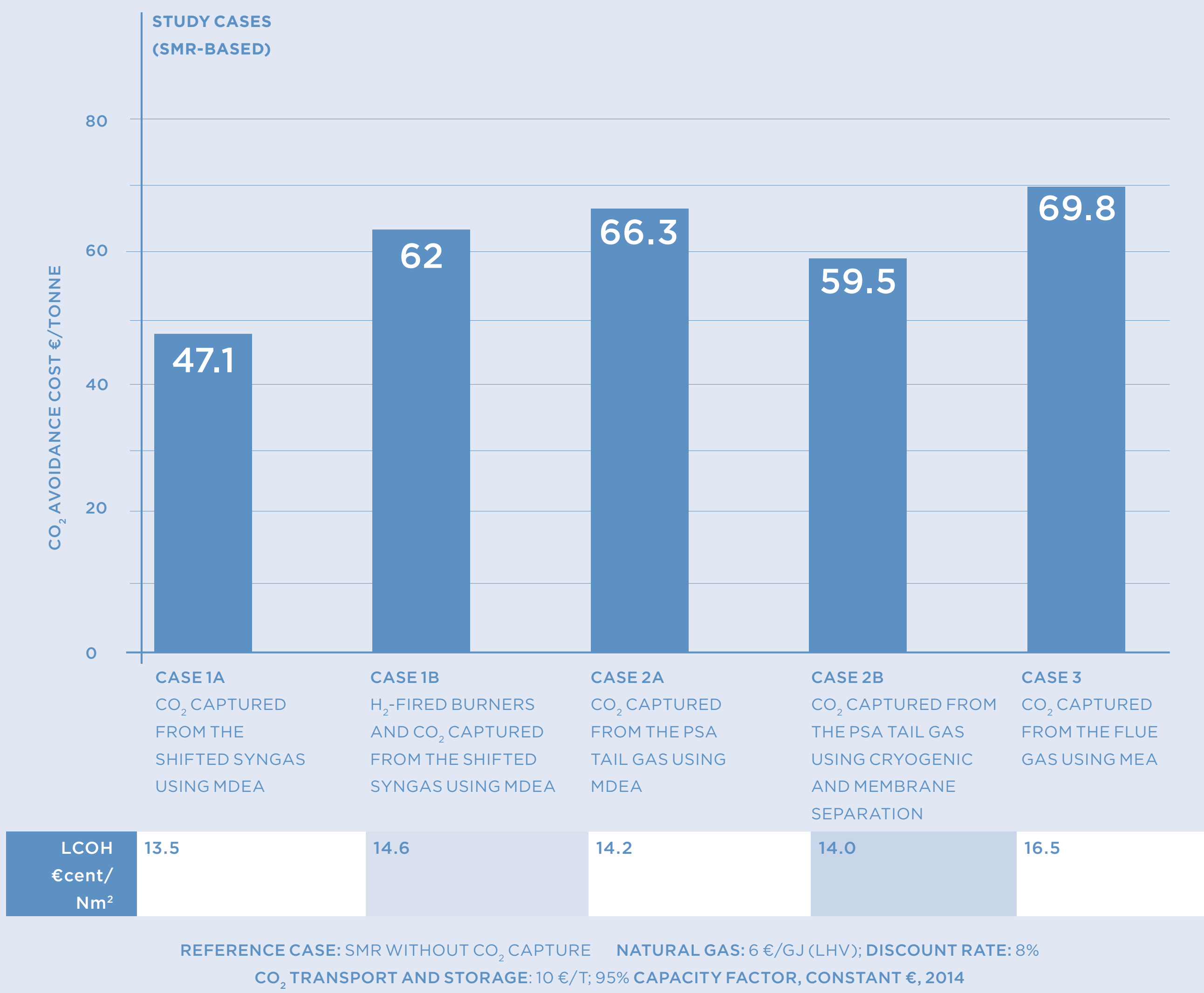
STATUS: COMPLETE

Hydrogen is frequently required in the oil refining process and it is common for it to be produced by reforming natural gas in a Steam Methane Reformer (SMR). The CO_2 produced by hydrogen production can account for up to 20% of the total CO_2 emitted by the refinery. Work in CCP3 revealed that SMR H_2 plants have the lowest cost of CO_2 capture if high-pressure CO_2 is targeted – so a focus on SMR pre-combustion capture was identified as a key 2015 project.

CCP partnered with the IEAGHG group on its ongoing SMR pre-combustion assessment study carried out by AmecFosterWheeler in Milan, with the following parameters set:

- Develop reference (uncontrolled) and base (controlled) cases for CO_2 capture
- Location: Northern Europe; Scale: 80 MMSCFD of H_2 product

The study was completed in late 2015 with the finding that conventional MDEA solvent-based technology is the lowest-cost option to capture CO_2 from syngas.



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PROJECT: NOVEL CAPTURE TECHNOLOGIES

STATUS:
COMPLETION EXPECTED BY MID-2016

For the NGCC scenario, CCP identified a number of novel technologies as having considerable potential, and during 2015 partnered with the Laboratorio Energia e Ambiente (Italy) to provide a techno-economic assessment of them.

The five selected technologies have been screened at a high level, before detailed analysis of a selection of them is carried out in the second phase of the project. The project is ongoing and expected to be completed in the first half of 2016.

	DESCRIPTION	BENEFITS
CO_2 SELECTIVE MEMBRANES	Membrane used to recycle a portion of CO_2 to increase its concentration	Enabler for low-concentration flue gas streams
MOLTEN CARBONATE FUEL CELLS (MCFC)	Fuel cell is used to concentrate the CO_2 while producing power	Low avoided cost expected due to large credit from power sales
HIGH-PRESSURE SOLVENT ABSORPTION FROM HIGH-PRESSURE FLUE GAS FROM PRESSURED COMBUSTION / POWER GENERATION	Gas turbine modified to send high-P CO_2 to K_2CO_3 absorber	Makes use of the low regen energy of the process
HIGH-PRESSURE SOLVENT ABSORPTION SUPPORTED BY FLUE GAS COMPRESSION	2,000ft water column is used to absorb the CO_2 at 60 bar	Low CO_2 capture cost claimed; low toxicity solvent
SUPERSONIC FLOW–DRIVEN CO_2 COMPRESSION	Flue gas expanded to produce solid CO_2	Small footprint, low cost for syngas application

PROJECT: NATURAL GAS LANDSCAPE STUDY (OFFSHORE)

STATUS:
COMPLETION EXPECTED BY MID-2016

Separation of CO_2 from natural gas production is a newly introduced scenario in CCP4.

The first project identified was to better understand the state-of-the-art technologies for separating CO_2 from natural gas in an offshore environment and to identify potential technology development projects.

A contract was signed with a consultant in 2015 to produce this landscape study.

SCOPE OF WORK

- Expert informed opinion: advantages/disadvantages of each technology, scenario fit
- High-level performance, energy consumption and cost estimates (Capex and Opex)
- Qualitative comparison of technologies based on desired characteristics

PARAMETERS

- Environment: offshore, new platform and new FPSO cases
- Feed gas pressure: 60–80 bar
- Feed gas temperature: maximum 50°C
- CO_2 in feed gas: range 6–60 mol%
- H_2S in feed gas: assume negligible but consider – also ways to remove
- Natural gas product specification: typical pipeline specification for natural gas

Work commenced in 2015 and a template to carry out the screening was prepared, which will provide qualitative as well as quantitative information on different CO_2 removal technologies subjected to different criteria, such as technical applicability, TRL, Risks, Capex, Opex, etc.

The Lula offshore project
Image courtesy of Petrobras

CCP4 STORAGE, MONITORING & VERIFICATION PROGRAM
2015 OVERVIEW

The CCP4 Storage, Monitoring & Verification (SMV) program aims to build on the successes of CCP3 along a similar framework of themes that will continue to reduce levels of uncertainty and risk, with respect to the long-term security of CO2 deep underground.

During 2015, the CCP SMV Team, led by Scott Imbus, prioritised a number of early projects that could be initiated during the year and can be developed or supplemented by further projects during the life of CCP4.

CCP4 outlook:

"Our work is fundamental to providing key findings on the viability of CCS as a GHG mitigation technology. In CCP4, the SMV Team will focus on field-testing cost-efficient surveillance technology and developing operational 'contingency' responses, both of which will enhance confidence in safe and effective CO_2 storage."

Scott Imbus, Chevron, Team Lead

IN THIS SECTION:

- CCP4 STORAGE THEMES
- PROJECT: WELL SEALING EXPERIMENT
- PROJECT: MONITORING TECHNOLOGY FIELD TRIALS
- PROJECT: EOR AS DE FACTO STORAGE STUDY

CCP4 STORAGE THEMES

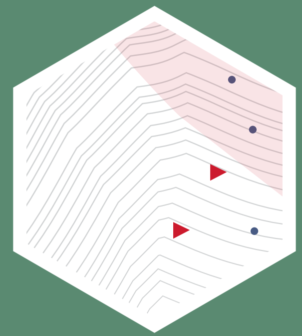
A range of CCP4 initial projects has been identified and initiated under the broad thematic areas established in CCP3 of Security of Storage (Contingencies), Field Trialing and Storage Assurance.

SECURITY OF STORAGE

- Initiated in CCP3, this contingencies work aims to increase regulatory and public confidence around CO_2 storage integrity by identifying anomalies that may lead to containment failure and formulating effective intervention options.

FIELD TRIALING

- Involves the deployment and assessment of emerging and integrated CO_2 monitoring technologies at third party sites, with CCP usually collaborating with research organisations and operators.

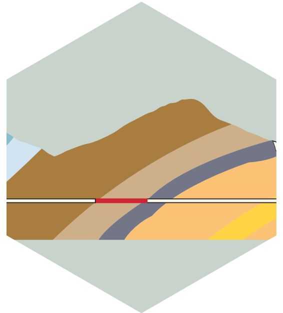


STORAGE ASSURANCE

- Well integrity – to understand the conditions, mechanisms and potential degradation of barrier performance in wells exposed to CO_2 and their mitigation
- Subsurface processes – to improve understanding of the physico-chemical processes that impact CO_2 injectivity, flow and containment underground
- Monitoring – to identify and develop emerging and established technologies to monitor CO_2 stored underground.

Image courtesy of The University of Texas Bureau of Economic Geology

PROJECT: WELL SEALING EXPERIMENT



STATUS: COMPLETION EXPECTED BY EARLY 2017

The initial CCP3 phase of the Security of Storage initiative saw scoping, modelling and simulation of potential scenarios where CO_2 might migrate unexpectedly from a subsurface storage area through wells or a seal breech with modelling of intervention schemes, as well as identification of a potential site for testing these concepts beyond the bench scale.

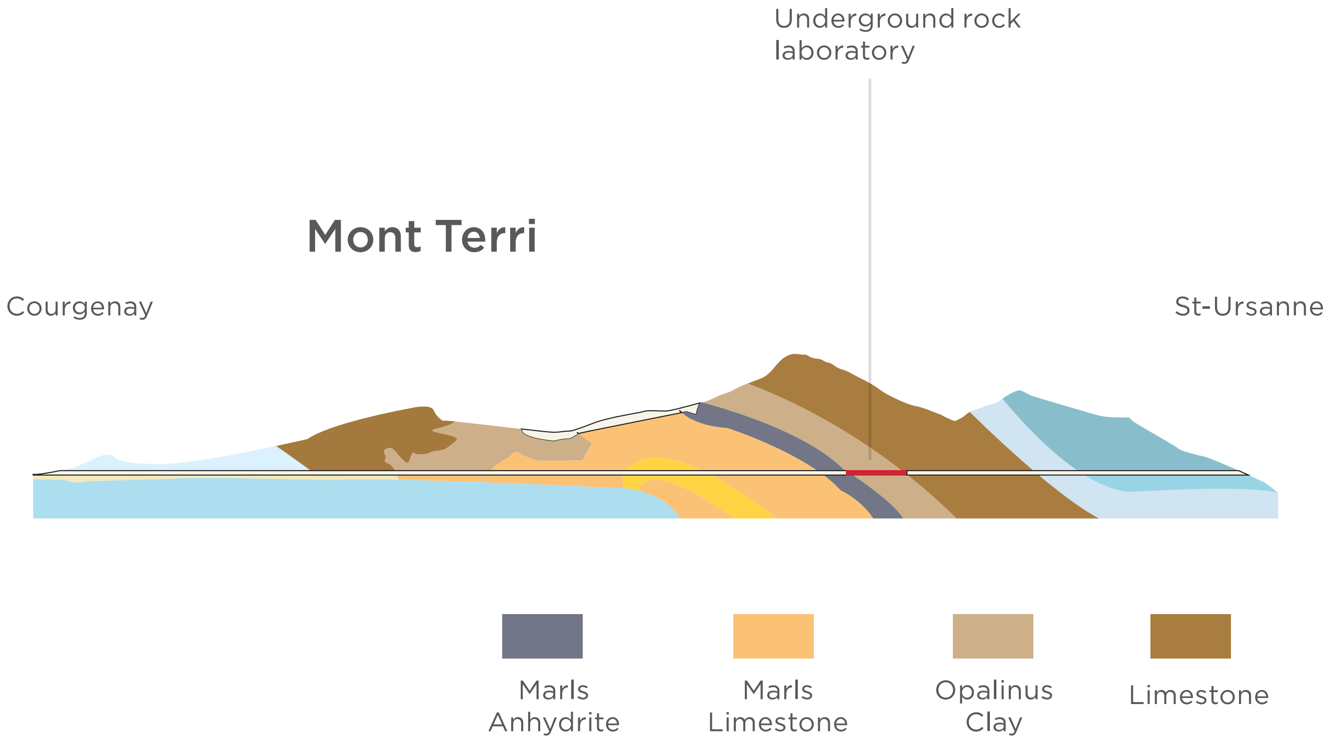
During 2015, the SMV Team work has progressed these projects further, working with a number of partners to realize a testing program. These tests are currently defined as:

- Well-sealing experiment – use of novel sealants to treat small but persistent gas leaks from wells which are not mitigatable using conventional techniques
- Fracture-sealing experiments – use of agents (novel sealants or fluids incompatible with clay stability) to mitigate through seal conduits such as fractures or minor faults.

WELL SEALING

CCP arranged to join an existing test of the well-sealing project (developed by Chevron) at the Mont Terri underground laboratory (~300m beneath the surface of the Jura Mountains, Switzerland). This gives CCP an opportunity to test multiple sealants in a scale well (~15m), in-situ rock environment.

During the course of the year, well installation and pressure testing was successfully completed at Mont Terri and the surrounding shale



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PROJECT: WELL SEALING EXPERIMENT (CTD)

saturated with compatible synthetic water. A process was agreed upon to introduce defects to the well barrier system and CCP recommended the inclusion of tracer testing pre- and post-sealant injection to confirm the geometry, volumes and connectivity of these defects.

Sealant selection was also initiated through an RFP process. Once the sealants are selected in early 2016, CCP plans to initiate the testing process with sealant performance results available in late 2016/early 2017.

MICRO-ANNULUS SEALING

A separate project that CCP is leveraging with Suncor Energy Inc. (focused on well integrity) features the development of a sealant-based or non-cement remediation technique to seal a micro-annulus. This Suncor Micro-Annulus Remediation Technique (SMART) was inspired by thermal operations where well abandonment is complicated by cooling.

The mechanism entails deforming casing to close the casing/cement sheath micro-annulus while simultaneously holding it in this position until the casing cools, thus preventing contraction and micro-annular defect formation. After development of a tool to carry out this task, workshop tests are expected to be followed by field testing in 2016. There is significant application potential for this application in thermal wells and conventional wells, especially those used for CO_2 Enhanced Oil Recovery.

PROJECT: MONITORING TECHNOLOGY FIELD TRIALS

STATUS: EM – COMPLETION EXPECTED BY END 2016; MBM COMPLETION PLANNED FOR 2018

EM MONITORING CAPABILITY

A CCP3-supported project showed that electromagnetics have the potential to offer a cost-effective means of monitoring CO_2 underground in comparison to surface seismic. A baseline survey was undertaken at the Aquistore reservoir (~3,000m deep), Saskatchewan, Canada and a plan is being considered to repeat the survey following CO_2 injection at the reservoir in 2016 when approximately 30,000 tonnes of CO_2 are expected to have been injected.

This new work should help to answer outstanding questions around the monitoring capability of electromagnetics including the ability to measure lower (less than 10,000 tonnes) as well as higher volumes of injected CO_2.

Modelling is planned which may assist in co-interpretation of 2D VSP & EM data.

MODULAR BOREHOLE MONITORING

Work has been ongoing in 2015 to extend the successful Modular Borehole Monitoring (MBM) program carried out in CCP3 with LNBL.

The aim is to develop and test novel and/or more resilient sensors for this technology unit, (e.g. CASSM [continuous active-source seismic monitoring], continuous fluid analysis and fibreoptic chemical sensors) or develop a slim hole-based MBM that could be used to monitor changes ‘above zone’ of the CO_2 storage reservoir and possibly localize and treat well leaks, particularly in plugged and abandoned wells.

Field trialing of MBM technology carried out in CCP3 at Citronelle Dome, Mississippi, USA.
Image courtesy of LBNL

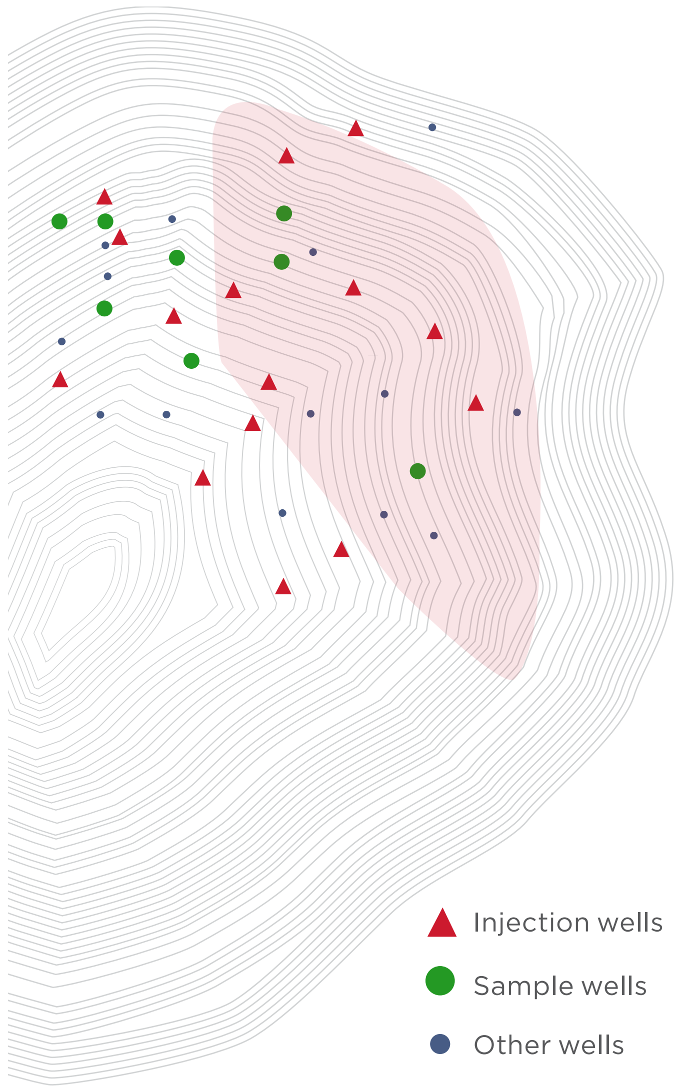
PROJECT: EOR AS DE FACTO STORAGE STUDY

STATUS: COMPLETION EXPECTED BY END 2016

Early work has been undertaken to set up a project to show that Enhanced Oil Recovery (EOR) constitutes de facto CO_2 storage via permanent trapping of some proportion of injected CO_2. The plan is to estimate the amount of oil and CO_2 trapped at different stages of a field's history (using Cranfield – site of a large gravity stable CO_2 EOR project that was heavily instrumented and has an extensive fluid geochemical database).

A water-flood analysis will also be included at the post-production and post-storage stages as many reservoirs are water-flooded before CO_2 EOR. Discussions were held on the best practices for converting a water flood to a CO_2 EOR flood and a CO_2 EOR flood to a CO_2 storage flood. These were contained in the request for proposal that was developed by the SMV Team and is now being implemented by UT-BEG (University of Texas Bureau of Economic Geology). Additional funding received by UT-BEG from the US DoE will leverage additional work including relative permeability measurements, improved history match through possible addition of 4D seismic data and longer-term simulations.

Work is now underway and expected to be completed during 2016.



Area of study (shaded in red) of testing CO_2 EOR as de facto storage at Cranfield site, Mississippi, USA.

CCP4 POLICY & INCENTIVES PROGRAM
2015 OVERVIEW

The CCP4 P&I Program aims to conduct research and provide insights of regulatory development within technical, economic or social areas that may impact the deployment of CCS.

In 2015, the P&I Team, led by Arthur Lee, focused on consolidating CCP3 learnings and summarizing the team's work on policies, incentives and benefits for community acceptance. This information was made available in the latest CCP3 results book.

The P&I Team also shortlisted three potential projects to begin in 2016, and decided on the project to identify significant regulatory implications when transitioning from CO_2 EOR to CO_2 storage.

CCP4 outlook:

"For CCS to become more widely deployed in the future, the appropriate policy and regulatory framework needs to be in place. In entering CCP's new phase, our team will continually assess government regulations and industry practices. Exploring the legal framework for transition from EOR to CCS is an important part of this work."

Arthur Lee, Chevron, Team Lead

IN THIS SECTION:

PROJECT: TRANSITIONING CO_2 EOR TO CO_2 STORAGE

PROJECT: TRANSITIONING CO_2 EOR TO CO_2 STORAGE

STATUS:
WORK COMPLETED;
PUBLICATION EXPECTED Q3 2016

The focus of the project is to understand current regulatory frameworks around the world in the context of CO_2 EOR and how such EOR operations could transition to CO_2 storage. The project's final report would aim to make recommendations to address such regulatory transitions and the report results would be made publicly available.

Collaborating with Environmental Resources Management Ltd, a kick-off meeting was held to discuss initial findings from desk-based review of regional policies and regulations of CO_2 EOR and any additional CCS frameworks. ERM presented a preliminary survey of EOR-to-CCS regulations in the US, identified a lack of specific regulations in the EU and Australia, and some lessons learned from the Weyburn-Midale Project in Canada. Petrobras had also provided general environmental permitting conditions to ERM but Brazil has no specific EOR-to-CCS regulations.

CO_2 injection at Weyburn, Canada
Image courtesy of Carbon Mitigation Initiative, Princeton University

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CCP4 COMMUNICATIONS PROGRAM
2015 OVERVIEW

The CCP4 Communications program aims to continue to inform and build technical understanding of CCP's work to support member and industry-wide development of commercially viable capture and storage solutions. At the most basic level, communications activity is intended to help ensure that the work of the technical teams is shared with the CCS world, reaching its peak when significant project results become available.

During 2015, the CCP Communications Team, led by Mark Crombie, completed a range of activities, including developing CCP4's new identity as the group entered its next phase.

IN THIS SECTION:

PROJECTS: COMMUNICATIONS HIGHLIGHTS

CCP4 outlook:

"*With new projects being adopted in CCP4, the need for communications becomes crucial ensuring that various stakeholders are aware and kept informed of CCP's work. The Communications Team will continue to share findings from CCP with both the industry and the wider public.*"

Mark Crombie,
BP, Team Lead

PROJECTS: COMMUNICATIONS HIGHLIGHTS

CCP4 LAUNCH

To mark the new phase, CCP has undergone a few visual changes with a new logo and strapline. The new identity is now in full use across all of CCP's printed communication material as well as online resources available on the website.

INDUSTRY CONFERENCES

CCP exhibited at the annual CCUS conference held in Pittsburgh, US, in late April. As an official partner, the CCP hosted a booth to share materials and provide updates on the latest work from its projects to a range of stakeholders visiting the stand.

MEDIA

CCP continued to outreach to industry bodies and publications to share information. A most recent article, focusing on the history and role of CCP was published in the online magazine, *Greenhouse Gases Science & Technology*.

CCP3 RESULTS BOOK

A new volume of comprehensive results of work conducted during CCP3 was published in November. Entitled *Carbon Dioxide Capture for Storage in Deep Geologic Formations – Results from the CO_2 Capture Project Volume 4*, the results book is the latest volume which follows those published for the first two phases of CCP activity. The book is available to download in various reader formats at: www.co2captureproject.org

CSLF RECOGNITION

This year, CCP received twofold international recognition for its pioneering work in CCS from the Carbon Sequestration Leadership Forum (CSLF). The CSLF recognition comprised:

- A Global Achievement Award for CCP3, reflecting CCP's role as an exemplary model of scientific research that shares its learnings and insights in developing CCS technologies
- Recognized Project status for CCP4. This follows earlier recognition from the CSLF for CCP's second and third phase of work since its formation in 2000.

Former CCP Chair, Nigel Jenvey, attended the CSLF Ministerial meeting, held in Riyadh, Saudi Arabia, to receive the award.

COLLABORATION

A NETWORK OF SUPPORT AND INFLUENCE

TECHNICAL EXPERTS

The CCP teams comprise technical experts from the member companies and include engineers, scientists and geologists

PARTNERSHIPS

CCP has worked closely with government organizations – including the US Department of Energy, the European Commission and the Norwegian government – and more than 60 academic bodies and global research institutes

FUNDING

CCP is being funded mainly by the member companies and with further support from governments

INDUSTRY INFLUENCE

Access to leading policymakers, NGOs and technology developers on all aspects of CCS. Provides a platform for members to help shape future policy and regulation

RESEARCH & DEVELOPMENT

Member companies have contributed results through research as well as data obtained from existing CO_2 capture, geological injection and storage operations and demonstrations

SHARING PROJECT INSIGHTS

CCP has conducted over 150 projects and shared insights to help increase understanding of the science, economics and practical engineering applications of CCS

CCP

A like-minded group of industry experts, working together to identify the most cost-effective application of CCS technologies

CCP

CCP HISTORY
PREVIOUS PHASES

Since its inception in 2000, CCP has remained constant in advancing technologies and improving operational approaches to help CCS become a viable option for the oil & gas industry.

Here are the main milestones from CCP's three previous phases

CCP1

2000-2004 SCREENING/ PROOF OF CONCEPT

- 200 capture technologies screened and ~80 storage technologies screened
- Identified pre-combustion, post-combustion and oxyfiring technologies to deliver significant capture cost reduction
- Pioneered risk-based approach for geological site selection, operation and closure
- Identified promising storage monitoring tools for further development
- Published book of full technical results

CCP2

2004-2009 INTENSIVE DEVELOPMENT

- Further development of most promising capture technologies from CCP1, with two potentially made ready for field demonstration
- Novel capture technologies identified
- Storage science, with focus on well integrity, built up through systematic R&D: publication of definitive book on storage
- A landmark CO_2-exposed well study elucidated the type and extent of alteration, barrier preservation and geomechanical/ geochemical factors influencing alteration
- Development of the Certification Framework
- Engagement with policymakers, NGOs, media
- CSLF Recognition Award in 2009
- Published book of full technical results

CCP3

2009-2014 DEMONSTRATION

- Field demonstrations of FCC and OTSG oxyfiring capture technologies
- Continued development of novel technologies
- Economic baseline modelling for all scenarios
- Storage R&D and field trialling of several monitoring technologies including breakthroughs in borehole gravity and use of fibre optic cable as an acoustic sensor
- Continued development of the Certification Framework with site testing
- Storage contingencies modelling completed and field experiment feasibility and design study launched
- Participant at key UNFCCC COP, GHGT and NETL conferences
- Published book of full technical results

STRUCTURE
CCP TEAMS 2015

The CCP is made up of four Teams – Capture; Storage, Monitoring & Verification; Policy & Incentives; and Communications.

The Teams consist of experts drawn from each of the member organizations.

Each participating member is represented on a CCP Executive Board that comes together quarterly.

The CCP is also supported by a Technical Advisory Board (TAB) responsible for conducting independent peer reviews on the activities of the CCP Teams and their respective programs. The TAB comprises independent assessors from industry and academia.

CCP4 EXECUTIVE BOARD

Jonathan Forsyth (Chair)
BP
Vincent Kwong (Vice chair)
Chevron
Rodolfo Dino
Petrobras
Stephen Kaufman
Suncor

PROGRAM MANAGER

Mark Crombie
BP

CCP3 ADVISORY BOARD

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