

## **ANLEC R&D Report Summaries** (July 2015 – November 2015)

The following reports are available from the ANLEC R&D website:

The first three reports are produced from *Project #128: Maximising the value of Digitalcore Analysis for carbon sequestration site assessment*. This is ANLEC R&D's largest research project on upscaling methods to enable faster and cheaper model-based analysis of flow, storage and CO<sub>2</sub>:brine displacements in different rock types. Improved predictions of rock and fluid properties across storage reservoirs will improve our capability to assess the potential of CO<sub>2</sub> storage sites. An interactive catalogue is under construction to enable stakeholders' direct online access to all data produced in this project.

### [Special Core Analysis from Surat Basin West Wandoan-1 Well](#)

#### ***Full suite of special core analysis derived from Surat Basin reservoir samples***

This work reports on high quality Routine Core Analysis (RCA) and Special Core Analysis (SCAL) on a comprehensive suite of CO<sub>2</sub> storage reservoir and seal rock types from the Surat Basin from the CTSCO Wandoan project.

Unique insight from the SCAL suggests, for both steady-state and unsteady-state experiments, endpoint scCO<sub>2</sub> relative permeabilities were found to be quite low, but are consistent with literature data.

The report also contains RCA performed by Weatherford Laboratories in Blendale, Queensland on 25 plugs of Evergreen Formation and 42 plugs of Precipice Sandstone.

### [Digital core analysis results from Surat Basin West Wandoan-1 Well](#)

#### ***Valuable information on Surat Basin mineralogy obtained from high resolution micro CT analysis***

This work focussed on the use of high resolution 3D  $\mu$ CT images to digitally determine petrophysical properties including porosity, permeability, and mineral phase distributions for a series of reservoir and seal core samples from the CTSCO Wandoan project.

The QEMSCAN mineral analysis provided essential information to identify and quantify the minerals that are contributing to reservoir micro-porosity and also to understand the distribution of minerals that are reactive to CO<sub>2</sub>.

Generally, the Precipice sandstone is highly porous and permeable and is therefore a good CO<sub>2</sub> injection target, but some zones occur that have low porosity and permeability. The zones with low porosity and permeability should assist the security of the injection by acting as baffles to CO<sub>2</sub> migration.

### [Geochemical reactivity studies of Surat Basin core material using scCO<sub>2</sub>](#)

#### ***Key improvements made in our understanding of the geochemical reactivity and mineral trapping capacity of Surat Basin***

The work program focussed on acquiring time series imaging of samples from reservoir and seal formations from the West Wandoan-1 wells in the Surat Basin, Queensland.

The results show that heightened dissolution or Fe leaching from reactive silicates in the presence of acid forming gases (e.g. SO<sub>2</sub>) facilitates further ionic trapping and may also increase CO<sub>2</sub> mineral trapping at the reservoir-seal interface over longer time periods.

## [High efficiency post combustion capture of carbon dioxide using solid sorbents](#)

### **Tailored CO<sub>2</sub> sorbents can lower costs of CaO looping post-combustion CO<sub>2</sub> capture**

The aims of this project were to evaluate the economic viability of post-combustion CO<sub>2</sub> capture (PCC) based upon CaO-looping processes and to develop and produce tailored CaO-based CO<sub>2</sub> sorbents on a large scale.

Key findings of this research are:

- CaO looping can increase the net efficiency of a supercritical-coal-fired power plant.
- Improved CO<sub>2</sub> sorbents can lower the variable operating costs of a PCC plant, but has a relatively small effect on the annualised cost of CO<sub>2</sub> captured. However, if these sorbents lower the size requirements for equipment such as the calciner and carbonator, the impact may be greater.
- A techno-economic model for the retrofitting of a PCC plant onto an existing coal plant shows that capital costs are by far the largest contributor to a viable business case.

## [Photogrammetry and Preliminary Mapping Results](#)

### **Preliminary mapping results improve understanding of fluvial environment for precipice sandstone formation**

This study forms part of a larger investigation into the reservoir character of the Precipice Sandstone as a geosequestration target within the Surat Basin. This interim report details the application of photogrammetry and classical sedimentary analysis to determine allostratigraphic units that conform to reservoir flow units.

Classical sedimentary analysis corroborates the general variability in the precipice sandstone. Examination of outcrops on the western margin confirm the south-easterly palaeoflows suggested in previous interpretations, but those on the eastern margin of the basin show a north to north-easterly trend. This is particular to the upper part of the formation. The importance of this difference in interpretation will be tested in future reservoir flow models.

## **ANLEC R&D Technical Presentations**

Arif, M et al. 2015, *Impacts of pressure and temperature on CO<sub>2</sub>-brine-mica contact angles and CO<sub>2</sub>-brine interfacial tension: Implications to carbon geo-sequestration*, manuscript submitted to the Journal of Colloid and Interface Science

Bianchi, V et al. 2015, *Facies analysis and 3D photogrammetry in Surat Basin (QLD, Australia): new insights from Precipice Sandstone (Lower Jurassic)*, proceedings presented at International Association of Sedimentologists conference, 22-25 June 2015, Krakow, Poland

Farquhar, S et al. 2014, *CO<sub>2</sub> water-rock interactions in low-salinity reservoir systems*, PhD manuscript submitted to the School of Earth Sciences, University of Queensland

Gao, J et al. 2014, *Lattice Boltzmann Modelling of Nonlinear Coupled Pore Scale Processes in Porous Media Systems and the Applications in Geological Engineering*, PhD manuscript submitted to the School of Earth Sciences, University of Queensland

Iglauer, S et al. 2015, *CO<sub>2</sub> wettability of caprocks implications for storage capacities and containment security*, manuscript submitted to Nature Geoscience or Geophysical Research Letters

Jenkins, C et al. 2015, *Environmental variability in the Bass Strait – what does it mean for CCS?*, proceedings presented at IEAGHG Network Meeting on Risk Management and Environmental Impacts

Julie Pearce et al. 2015, *Geochemical CO<sub>2</sub>-SO<sub>2</sub>-O<sub>2</sub>-fluid-rock interactions*, proceedings presented at Goldschmidt Geochemistry Conference 2015, 21 August, Prague, Czech Republic

Liu, K et al. 2015, *Effects of permeability, heterogeneity and gravity on supercritical CO<sub>2</sub> displacing gas under reservoir conditions*, manuscript submitted to SPE Enhanced Oil Recovery Conference, Kuala Lumpur, Malaysia, 11-13 August 2015

Manaf, N et al. 2015, *Temporal multiscale decision support framework for flexible operation of carbon capture plants targeting low-carbon management of power plant emissions*, manuscript submitted to Journal of Applied Energy

Manaf, N et al. 2015, *The hybrid MPC-MINLP algorithm for optimal operation of coal-fired power plants with solvent based post-combustion CO<sub>2</sub> capture*, manuscript submitted to the International Journal of Greenhouse Gas Control

Michael, K et al. 2015, *Basin Resources and Carbon Storage*, proceedings presented at Third Sustainable Earth Sciences Conference (EAGE), 13-15 October, Celle, Germany

Michael, K et al. 2015, *Numerical simulations of the effects of CO<sub>2</sub> geological storage on the flow and salinity of formation water in the Gippsland Basin*, proceedings presented at AAPG International Conference & Exhibition, 13-16 September 2015, Melbourne, Australia

Michael, K et al. 2015, *Numerical simulations of the effects of CO<sub>2</sub> geological storage on the flow and salinity of formation water in the Gippsland Basin*, proceedings presented at AAPG International Conference & Exhibition, 13-16 September 2015, Melbourne, Australia

Pearce, J et al. 2015, *CO<sub>2</sub> storage with impurities*, proceedings presented at AAPG International Conference & Exhibition, 13-16 September 2015, Melbourne, Australia

Yang, Q. et al. 2015, *Targeting lower cost and higher efficiency CO<sub>2</sub> capture processes through solvent development and amine synthesis*, proceedings presented at Environmental Science & Technology

## IEACCC Reports

Baruya, P 2015, *Coal contracts and long-term supplies CCC/258*

Carpenter, A 2015, *Water availability and policies for the coal power sector, CCC/256*

Mills, S 2015, *Prospects for coal and clean coal technologies in Italy*, Ref: CCC/254

Nicol, K 2015, *Application and development prospects of double-reheat coal-fired units, CCC/255*

Zhu, Q, 2015, *High temperature syngas coolers, CCC/257*

## IEAGHG Reports

*CCS Cluster Projects*, Mar 2015

*CCS Deployment in the Context of Regional Developments in Meeting Long-Term Climate Change Objectives*, TR3 2015

*Criteria of Fault Geomechanical Stability*, Apr 2015

*Integrated Carbon Capture and Storage Project at SaskPower's Boundary Dam Power Station*, Aug 2015

*Oxy-Combustion Turbine Power Plants*, May 2015

*Review of Offshore Monitoring for CCS Projects*, Feb 2015

*USDOE Carbon Storage Program: 2015 Project Peer Review*, TR2 2015

**IEAGHG reports older than 6 months are freely available to download from the IEAGHG website at [www.ieaghg.org](http://www.ieaghg.org), and all other reports that have been published within the last 6 months can be obtained by contacting Becky Kemp at [becky.kemp@ieaghg.org](mailto:becky.kemp@ieaghg.org).**