eReport

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ANLEC R&D Report Summaries

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

Techno-economics Modelling

Can you assemble your own Australian low emissions electricity grid?

A recently concluded project reports on modelling total systems cost for decarbonising the Australian East Coast Grid. Outcomes from this innovative modelling has been made available in an interactive easy-to-use website located at: https://modelling.energy/. It allows you to interactively compose your chosen power generation assets for 2020 and 2050 and assess the cost of these systems. The results should highlight:

- All low emissions technologies including carbon capture and CO_2 storage (CCS) are essential for the lowest cost system.
- The cost of energy storage is significant, essential and must be included to recognise the total system cost for a low emissions electricity grid system.
- In the absence of technologies like CCS consumers will pay more than is necessary for decarbonisation. It is estimated to be as high as $20Billion/year to achieve net-zero emissions by 2050.

A second report published examines current Australian mechanisms available to decarbonise the electricity sector. This includes the effectiveness and limitations of various programs, tools and a raft of policy levers that can be used to deliver decarbonisation.

More information: The role of electricity systems modelling in optimising planning decisions

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Surat Basin

Downhole Raman Isotopic technology still need more development

Isotope ratio analysis is a signal attribution technique for CO_2 sequestration monitoring. This project used a proprietary downhole Raman spectroscopy instrument to detect and attribute isotopic signatures in the Surat Basin Precipice Sandstone reservoir. Firstly, the project determined the necessary methods and accuracy requirements for isotopic attribution. This includes a review of existing isotopic measurement technologies to establish the most suitable technique for field adaptation. The second part of the project involved establishing a stage-gate plan of potential industrial-scale deployment technology at the lowest cost.

- Raman spectroscopy was identified as an ideal signal attribution technique due to its ability to characterise pure CO_2 signal in gas, liquid or supercritical form. On the contrary, IRMS and CRDS technique would require samples to be in gas-phase for measurement.
- A modified downhole Raman isotopic system was prototyped and tested against the proof-of-concept calibration set. The results suggest that the Raman system can resolve the isotopic signatures of naturally occurring gas mixtures. However, the precision of the Raman measurement is not sufficient to distinguish among the samples in the calibration set. Possible improvements to the optical system may be able to improve accuracy.

More information: In-situ isotopic attribution using Raman Scattering

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How does small-scale geological features impact reservoir properties and CO_2 flow?

The Surat CCS storage demonstration project requires accurate predictions of the extent of plume movement within the Precipice Sandstone storage complex. This project develops a multiscale workflow, which consistently addresses the impact of small-scale geological heterogeneity on the static and dynamic rock properties and CO_2 flow prediction. The work integrates utilisation of various data sets from laboratory, outcrop, log and geological data. This project update describes activities on core plug imaging of CO_2:brine floods and testing of single facies propagation along continuous core sample. Specific updates are outlined below:

- Completion of whole core scanning.
- Continuous flow measurements are undertaken on slabbed whole core material.
- Plug scale imaging of CO_2 floods is imaged in 3D.
- Development of rock typing strategies for the full length of whole core material. The final rock typing schema used in the study is based on a textural approach for characterisation. Petrophysical and special core properties (porosity, permeability, pore volume, etc) for each rock type are defined. Dynamic property analysis for the rock types is also described which is used in the forward dynamic modelling process.

More information: Multiscale static and dynamic modelling of Precipice Facies – Milestone 7

Upscaling CO_2 flow simulation in the Precipice Sandstone reservoir

As part of ANLEC R&D Digital-core project on Multiscale static and dynamic modelling of Precipice Sandstone, this component sought to generate a realistic simulation of CO_2 movement in the Precipice Sandstone reservoir. Researchers develop solvers to simulate CO_2 flow at different scales, validated against results from core, experimental data and lithofacies models. The current report reveals the validation of unsteady state (USS), multiphase flow solver, with experimental data through comparing measured and observed CO_2. The report also demonstrates the impact of incorporating realistic bedding structure and geometries on relative permeability. The results are:

- Simulation results agree with experimental measurements. The comparison demonstrates that the USS accurately captures the CO_2 flow behaviour at the material interfaces.
- A new USS upscaling method for the determination of equivalent relative permeability has been developed.
- The USS solver delivers saturation patterns, highlighting the impact of laminations (bedding). CO_2 migrates upstream layers with high capillary entry pressure, which has an impact on the determined relative permeability curves.
- The new USS upscaling method addresses known issues associated with the generic, conventional steady-state (SS) upscaling approach.

More information: Multiscale static and dynamic modelling of Precipice Facies – Milestone 8

ANLEC R&D is a member of the following IEA implementing agreements. For access to their reports, please contact admin@anlecrd.com.au.

IEA Clean Coal Centre Reports

1. Sloss, L. (2021). Reducing Mercury Emissions from the Coal Combustion Sector in Indonesia
2. Adams, D. (2021). A Pathway to Reducing Emissions from Coal Power in India (IEACCC-CIAB)
3. Lockwood, T. (2021). A Technology Roadmap for High Efficiency, Low Emissions Coal Power Plant, CCC/309
4. Reid, I. (2021) Advances in non-Energy Products from Coal
5. Mills, S. (2021) Potential markets for high efficiency, low emissions coal-fired power plants
6. Wiatros-Motyka, M. (2021) Increasing efficiency of pulverised coal fired power plant CCC/310

IEAGHG R&D Program Reports

1. 2021-01 Biorefineries with CCS

Global CCS Institute Reports

1. Policy Factsheet (2021). Global Status of CCS
2. Tamme, E. (2021). Carbon removal with CCS technologies
3. Gassnova (2021). Developing Longship Key Lessons Learned
4. Bright, M. (2021).Surveying the U.S. Federal CCS Policy Landscape in 2021
5. Rassool, D., & Havercroft, I. (2021). Financing CCS in Developing Countries
6. GCCSI (2021). Blue Hydrogen
7. Kearns, D., et al. (2021). Technology Readiness and Costs of CCS