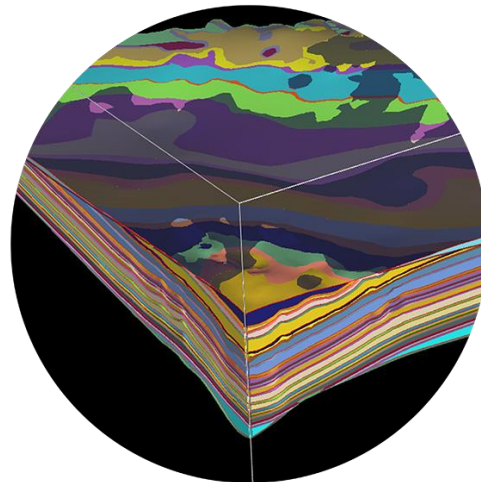


World-class  
research

Independent  
analysis

Research vital  
as natural gas  
flagged to play a  
key role in the  
long transition to  
a lower carbon  
future



# UQ Centre for Natural Gas

## Annual Research Review 2019



**Prof Vicki Chen**  
Executive Dean

UQ Faculty of Engineering,  
Architecture & Information  
Technology



**Prof Andrew Garnett**  
Director

UQ Centre for Natural Gas



## Back drop

An ever noisier energy – climate debate ...  
more clammering and decibels than  
searching for comprehension and bone fide  
searching for ranges of doable solutions



Source: ABC News (online) 9 October 2019

## Research vital as natural gas to play a key role in the long transition to a low carbon future

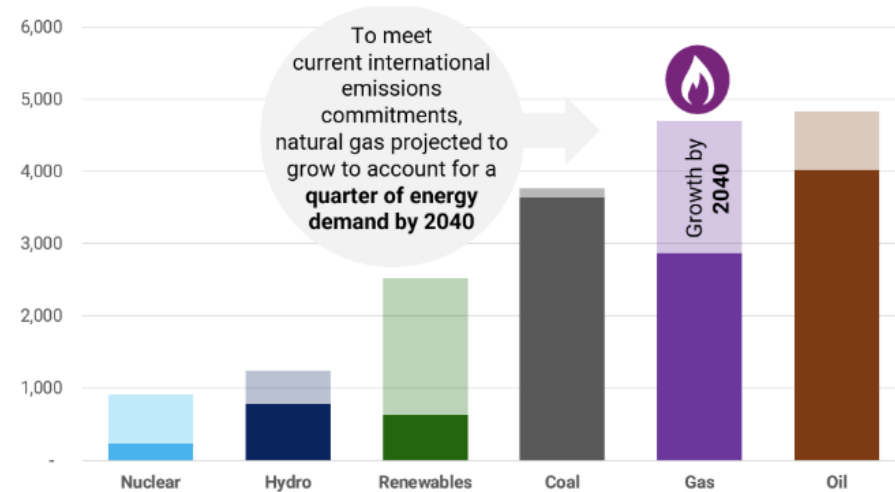
The UQ Centre for Natural Gas is a centre of research excellence. It conducts real-world research focussed on optimising Australia's natural gas industry terms of environmental performance, social performance, and optimisation of cost of operation and supply.

- **Name change – *Centre for Natural Gas***

## Our roles -

### Outreach, engagement and (of course) research

- Framing energy transitions discussions in terms of '**AND**'
- 2 x State and Federal **Parliamentary briefings**
- 4 x **Energy Transition** panel discussions with leading industry and government figures
- >100 external engagements - over 1,000 people
- ...



## Outreach and engagement continued

- 3 major international conferences (IAIA, URTeC, AGC)
- Engagement on IEA, World Energy Outlook 2019 - Deputy CEO Paul Simons
- International speakers (German transition lessons) –Prof Andreas Löschel – Commission Chair
- Regulator engagements DNRME, DES, Productivity Commission, Qld Royalty Review ...
- Research ->

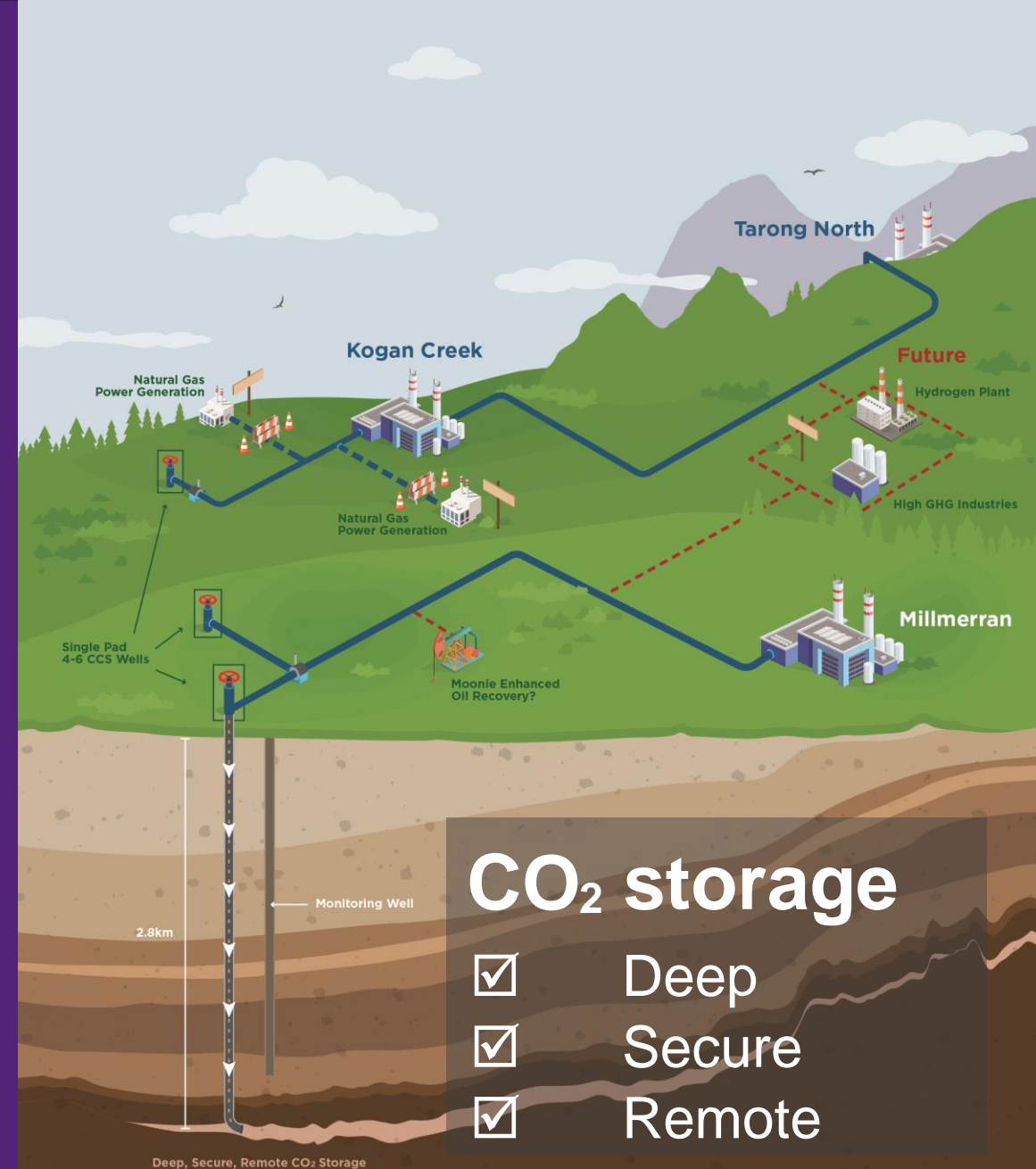




# CCS - 50 PUBLICALLY AVAILABLE REPORTS

- Retrofit up to 3 modern super-critical coal fired power stations in SE Queensland (retirements ~2055) with carbon capture to create very low emissions *baseload* power
- Transport the CO<sub>2</sub> to just 2 or 3 well pad sites via 2 pipeline routes
- Store CO<sub>2</sub> safely at over 2.3km depth in the deepest part of the Surat Basin significantly removed from all other users or resource activities

Material, feasible & lowest risk philosophy





# REAL WORLD IMPACT

## QUALITY REGIONAL JOBS\*

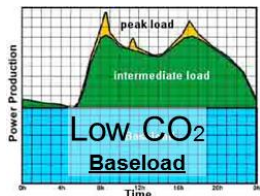
Est. 250 new on retrofit  
>500 safeguarded beyond 2050



\*excl. multipliers (? 2,000+)

## LOW CARBON BASELOAD POWER

~2 GW / 3xSC coal plants  
May continue beyond 2060



## HYDROGEN ECONOMY (& OTHER) ENABLER

H<sub>2</sub> from coal or gas needs CCS.



Other GHG intensive industries attracted

## MATERIAL CO<sub>2</sub> REDUCTIONS

12.7 million tpa, > 30yrs  
> 380 Million tonnes



~ 7% of Aust. power generation emissions

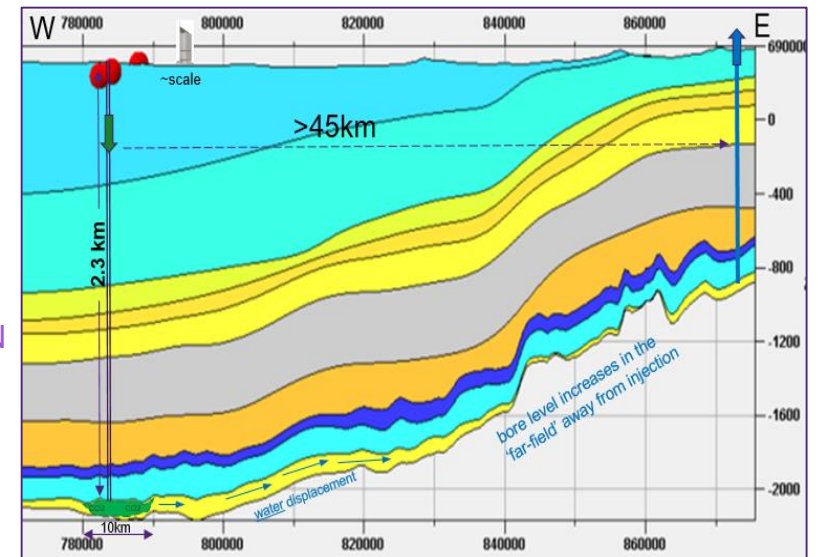
## 'FAR-FIELD' WATER BORE LEVELS RISE

Pressure change *not* water composition change

Localised very deep injection into Precipice  
Water displaced by CO<sub>2</sub> (<10km footprint)  
There is no abstraction within 10's of km

BRINGS A FLOW ON BENEFIT

**GROUNDWATER**  
>2.3km injection  
Stranded water too deep for use



Benefits

Trade-offs

**...coming up next**  
**Research Portfolio: Geoscience**



**THANK YOU**

**Prof Andrew Garnett**  
**Director**

[naturalgas@uq.edu.au](mailto:naturalgas@uq.edu.au)



**Professor Suzanne Hurter**  
Energi Simulation Chair in  
Onshore Gas Modelling

UQ Centre for Natural Gas



**Dr. Zhangxing (John) Chen**  
*Reservoir Simulation*



**Dr. Rick Chalaturnyk**  
*Reservoir Geomechanics of  
Unconventional Resources*



**Dr. Giovanni Grasselli**  
*Fundamental Petroleum Rock Physics  
and Rock Mechanics*



**Frank and Sarah Meyer**  
*Collaboration Centre*



**Dr. Yu-Shu Wu**  
*Reservoir Modelling*



**Dr. Eduardo Gilidin  
Dr. Mike King**  
*Robust Reduced Complexity Modelling  
(R2CM)*



**Dr. Luis Ayala  
Dr. Russell Johns  
Dr. Zuleima Karpyn**  
*Fluid Behavior and Rock Interactions*



**Dr. Benham Jafarpour  
Dr. Kristian Jessen**  
*Dynamic Characterization & Advanced  
Forecasting*



**Dr. Sebastian Geiger  
Dr. Eric Mackay**  
*Carbonate Reservoir Simulation &  
Reactive Flow Simulation*



**Dr. Arne Skauge**  
*EOR*



**Dr. Leonardo Guimaraes**  
*Optimization, Uncertainties and Multi-  
physics*



**Dr. Denis José Schiozer**  
*Integration Of Reservoir Simulation And  
Facilities*





All presentations and posters available on  
<https://energisimulation.com/2019/10/02/summit-2019/>

For me, it was helpful in a way that I got more general information on other aspects of the project that I am working on. I became familiar with the complexities of the reservoir geomechanics which definitely will be helpful for me if I end up working in the gas and oil industry. It was a good opportunity for networking with students working on mutual areas of interest and faculties who are expert in these subjects, and of course, practising how to present my work. (PA)



2 PhD  
students  
from UQ  
attended

It was a wonderful experience ! I expanded my knowledge in areas of petroleum engineering beyond my research field and heard from experts about what are the current challenges in oil industry. I'm grateful for this great opportunity to talk with professors from the best petroleum engineering universities and meet like-minded people. This experience will definitely help me to be able to solve problems and create change in the energy sector (VS).



## International Network Building Event for PhD students







PhD student Vanessa Salomao to perform experiments at GeoREF in 2020  
Experiment design in progress



Zhengguang Zhao: Automated microseismic event detection with machine learning and deep learning and focal mechanisms to interpret hydraulic fracture networks (A/Prof Lutz Gross, Prof Suzanne Hurter).

Pouria Amani: Enhancing coal seam gas via foam assisted lift (supervisors Prof Victor Rudolph, Dr Mahshid Firouzi, Prof Suzanne Hurter.

**Ao Chang\***: Using stochastic random mixing method for full seismic wave inversion (supervisors: A/Prof Lutz Gross, Dr Sebastian Hoerning)

**Xiaoxiao Mao\***: Controls on reservoir properties of the Toolebuc Formation, Central Eromanga Basin, Queensland (supervisors Prof Sue Golding, Prof Victor Rudolph, Prof Suzanne Hurter, Prof Joan Esterle)

**Christopher Nichols\***: Assessment of the greenhouse gas inventory of Queensland water bores (supervisors Prof Suzanne Hurter, Dr Sebastian Hoerning, A/Prof Phil Hayes)

**Vanessa Santiago\***: Contribution of individual coals to coal seam gas production (supervisors Prof Suzanne Hurter, Prof Andrew Garnett, Dr Ayrton Ribeiro)

Hossein Dashti: Bentonite plugs for low-cost CCS well abandonment (supervisors Prof Suzanne Hurter, Prof Victor Rudolph, Dr Mahshid Firouzi)

Li Wan: Integrating stratigraphic forward modelling and synthetic seismic: new understanding of deepwater sedimentary systems on a passive margin (supervisors Prof Suzanne Hurter, Dr Valeria Bianchi, Lecturer Dr Tristan Salles)

Ifti Altaf: Reservoir geostorage capacity modification due to long-term CO<sub>2</sub>-rock chemical interactions: a rock mechanics perspective (supervisors Prof Suzanne Hurter, Prof Ray Johnson, Prof Jim Underschultz)

Xiaoling Li: Enhanced water recovery from carbon dioxide storage (supervisors Prof Suzanne Hurter, Prof Jim Underschultz, Dr Ayrton Ribeiro)

\* Posters displayed at Research Review

# RESEARCH ADVISORY COMMITTEE MEETING 10<sup>TH</sup> DECEMBER





# CONFERENCE CONTRIBUTIONS (PRESENTATIONS, POSTERS, SESSION CHAIR)

Invited Presentation at the 2018 QEC Forum 26<sup>th</sup> Feb  
*Integrated Reservoir Modelling: Quo Vadis?*

EGU (7-12 Apr) Sebastian Hoerning presentation, session chair

APPEA (27-30 May): 2 posters (Reilly et al, Vieira et al)

URTec (18-19 November):

Sebastian Hoerning: NERA Innovation Hub Reception

Vanessa Salomao: e-Poster + presentation

Zhengguang Zhao: presentation

Mark Reilly, Zsolt Hamerli (2): presentation

Presence at AGC - Special Session on GAB 25-27 November

Mark Reilly, Iain Rodger: presentation

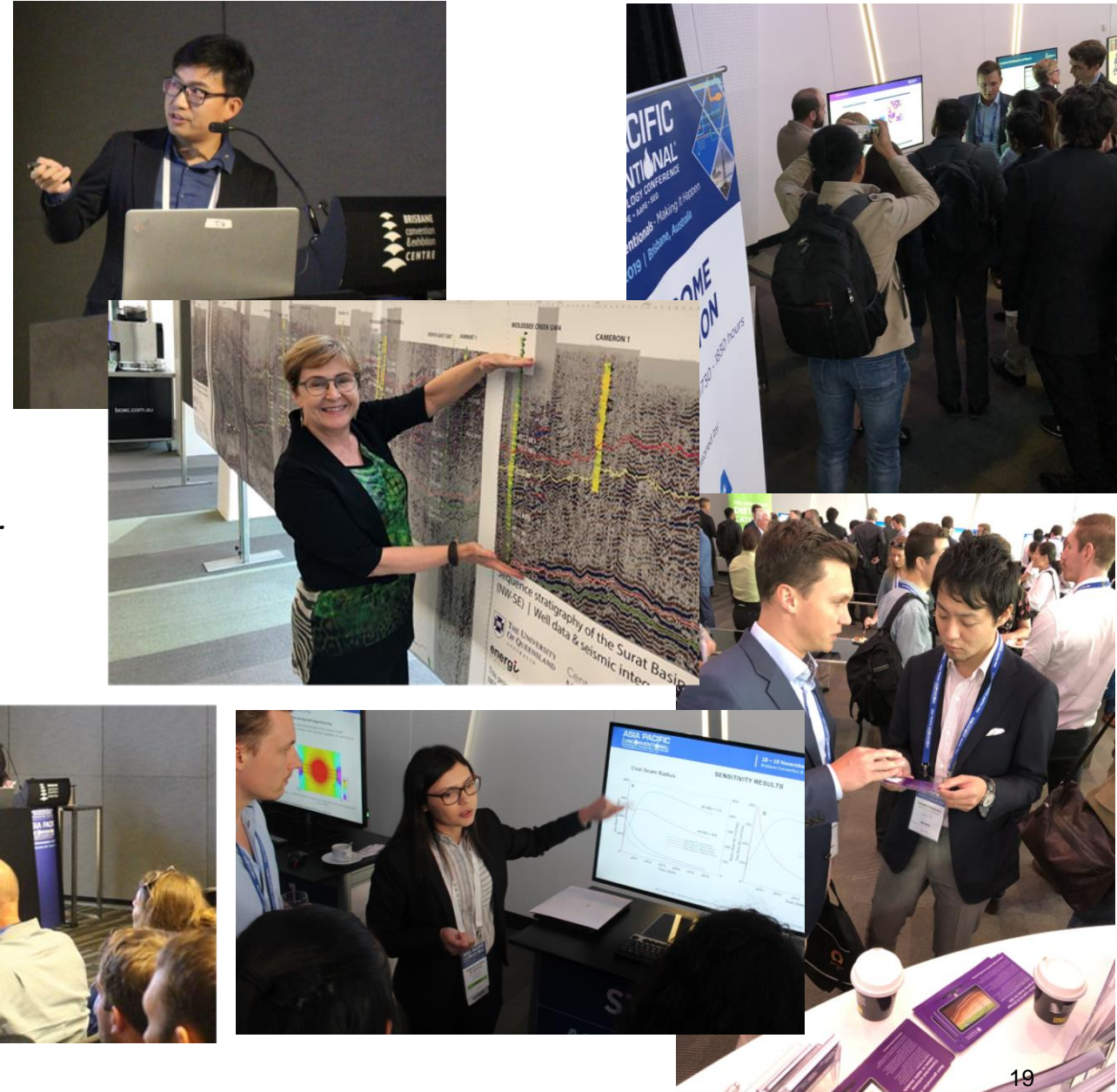
Symposium Committee Member of *Dorothy Hill*

*Woman in Earth Sciences Symposium* (14-15 November)

China Australia Unconventional Natural Gas Forum 21-22 November (CAUNGF)

with 20 Chinese delegates.

Mark Reilly and Sebastian Hoerning presented.



Springbok is classed as an (tight!) aquifer. It directly overlies the Walloon Coal Measures

It is modelled by OGIA for impact assessment purposes.

However, its (flow) properties and heterogeneity are poorly understood.

New Project:

- Better characterise the Walloon-Springbok with core analysis
- Integrate core to log
- Use seismic for obtaining heterogeneity at field scale
- Use data rich areas to establish relationships that can be propagated to data poor areas
- Evaluate impact on large scale models

**To start that conversation: please come to Session B:  
Walloon Springbok interface: when is an aquifer not an aquifer?**



**...coming up next**

**Research Portfolio: Petroleum Engineering**



**THANK YOU**

**Professor Suzanne Hurter  
Energi Simulation Chair in  
Onshore Gas Modelling**

**s.hurter@uq.edu.au**



**Dr Christopher Leonardi**  
Advance Queensland Fellow

UQ School of Mechanical &  
Mining Engineering

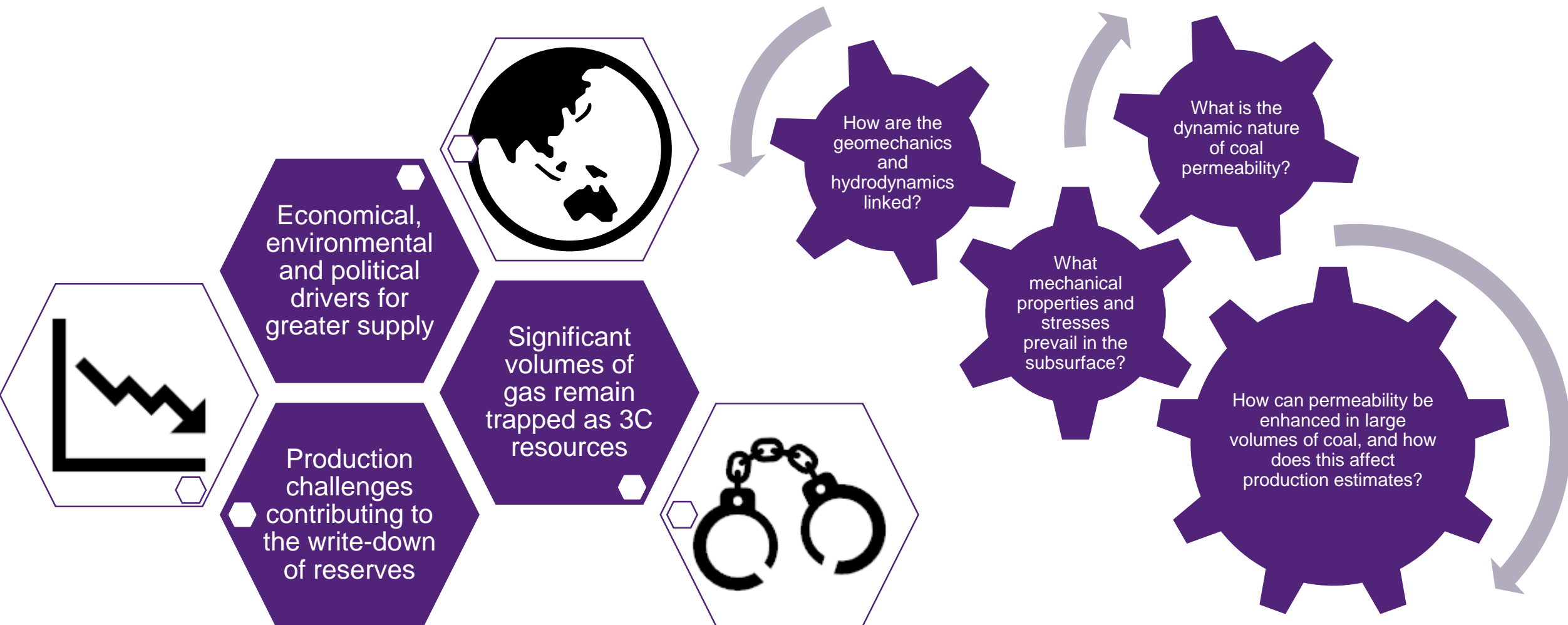
# Theme 3: Converting contingent resources to reserves

Development of new technologies for upgrading the return on what is currently uneconomic or marginally economic

*Prof Raymond Johnson Jr, Prof Victor Rudolph, A/Prof Karen Steel  
Dr Tom Rufford, Dr Christopher Leonardi, Dr Zhongwei Chen*



# Resources to reserves: sustaining and increasing supply



# Current projects

“Modelling and design criteria to improve CSG production by graded particle injection” (CNG-NERA, Johnson, Leonardi & You)

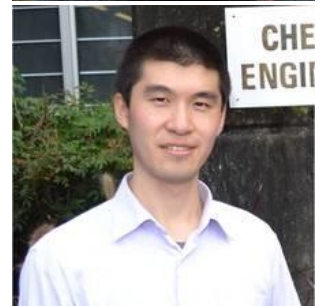
“Sustainable enhancement of coal seam gas production in Queensland” (AQ IRF, Leonardi)

“Development of rock properties using existing field data and real-time drilling data” (CNG, Johnson & Chen)

“Evaluating contributing factors to pressure dependent permeability effects” (CNG, Johnson)

“Advanced environmental technologies for increasing coal seam permeability” (CNG-ARC, Steel, Esterle, Nguyen & Underschultz)

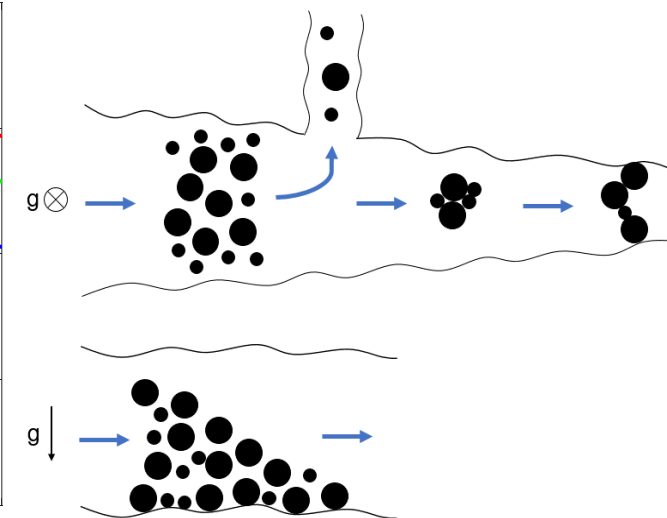
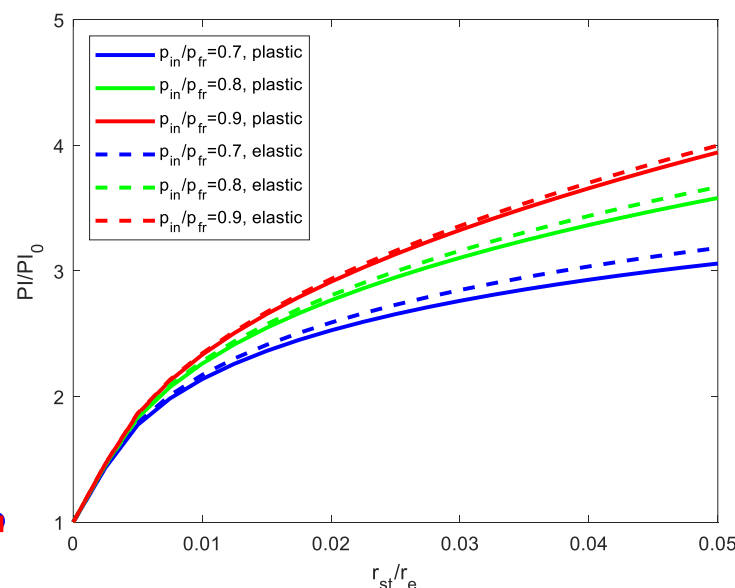
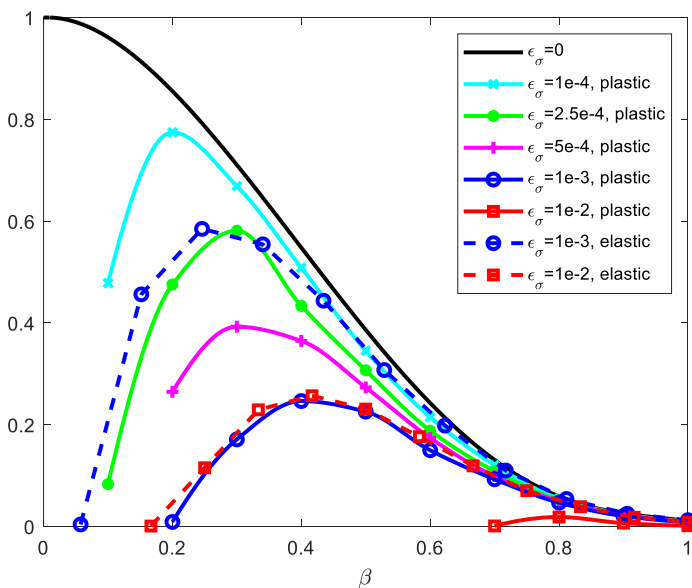
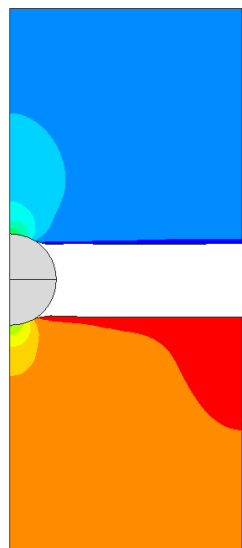
“A new tool to measure the effect of matrix shrinkage on cleat porosity and gain new knowledge on the coal properties influencing shrinkage” (CNG, Steel, Balucan, Rudolph)



# Modelling and design criteria to Improve CSG production by graded particle injection

- Micron-sized particles can be used as an **alternative or complementary treatment** to hydraulic fracturing
- **Research questions** around net fracture permeability, transport in fractures, **field deployment plan**
- Computational modelling of **solid, fluid, and particle mechanics**, in conjunction with **laboratory studies**
- Embedment and permeability has been shown to be **heavily dependent on coal rank** and properties
- Leak-off into vertical cleats is proportional to density, particle size dominates horizontal leak-off

Displacement in Z  
 0.002019  
 4.945e-005  
 -0.001921  
 -0.003891  
 -0.00586  
 -0.00783  
 -0.0098  
 -0.01177  
 -0.01374  
 -0.01571  
 -0.01768  
 -0.01965  
 -0.02162

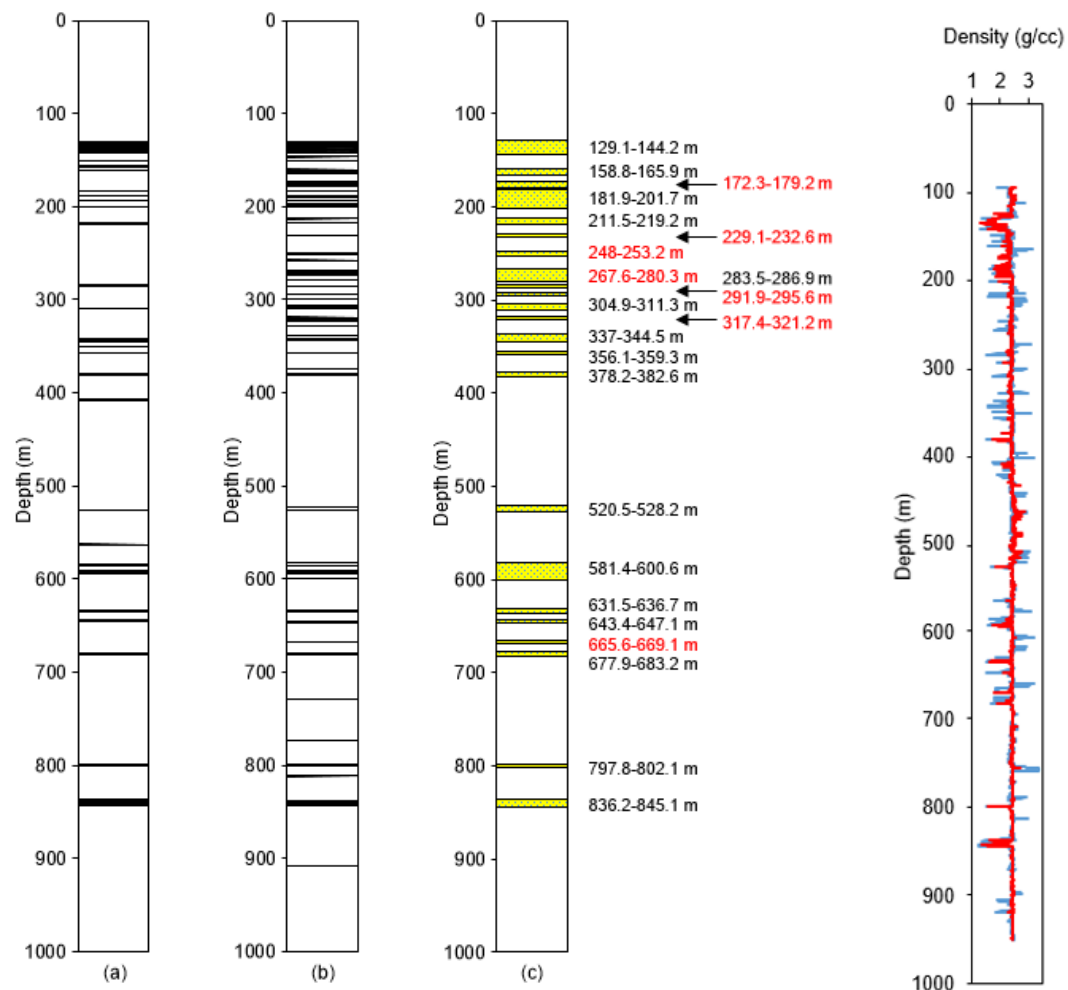






# Development of rock properties using existing field data and real-time drilling data

- Developing synthetic rock properties from drilling data to reduce logging and personnel costs
- Key findings from analysis to date
  - **Coal sections can be identified** using machine learning for slotted casing placement
  - Machine learning can also be used to generate a **pseudo-density log** using drilling data
- Next, machine learning for geosteering
  - Near-bit tools are expensive and may **suffer from lag**, so this approach could maximise **contact area** and save time

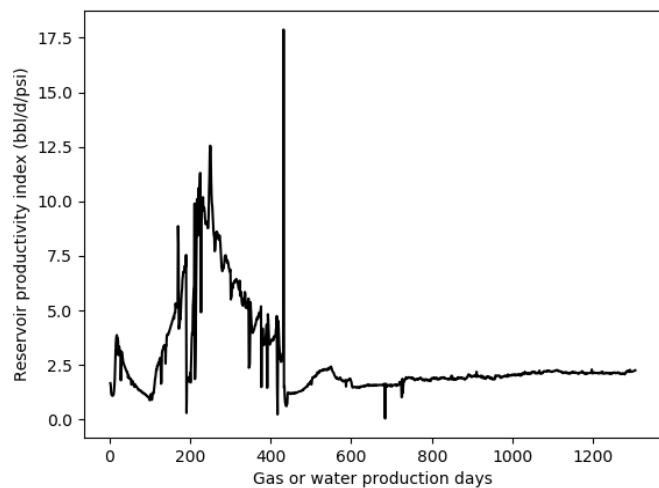
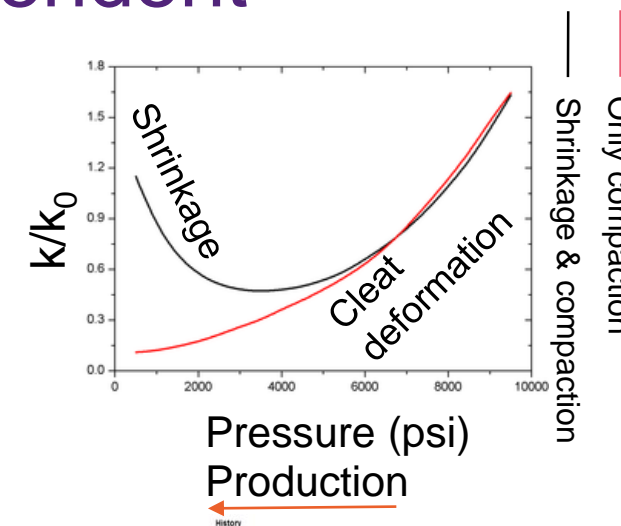


- (a) Coal sections based on the density log.
- (b) Coal sections determined by machine learning.
- (c) Final slotted casing placement based on machine learning.

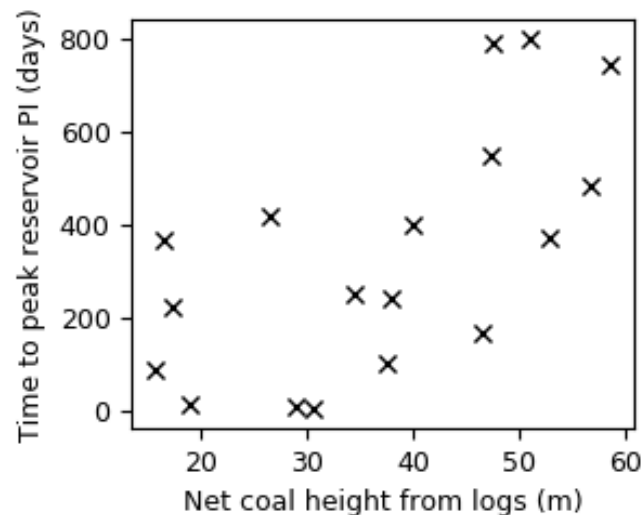
Generated pseudo density log. Blue line: original density log; red line: pseudo density log by machine learning.

# Evaluating contributing factors to Pressure Dependent Permeability (PDP) effects

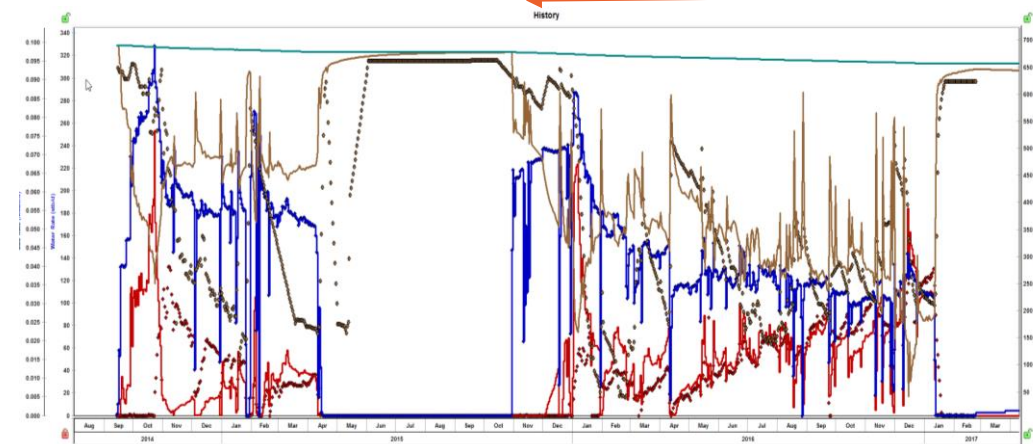
- The objectives of the project are to (i) examine whether **PDP can be identified from existing data** using analytics and (ii) explore **correlations between production indicators** and geological/reservoir parameters
- Areas 1 and 2 (Bowen Basin) and Area 3 (Surat Basin) now completed
- A number of **highlights observed** in Area 3



Productivity index (PI) values increasing and or decreasing with time/stress for most wells (evidence of PDP effect?)



Poor correlation between PI curve parameters and reservoir parameters

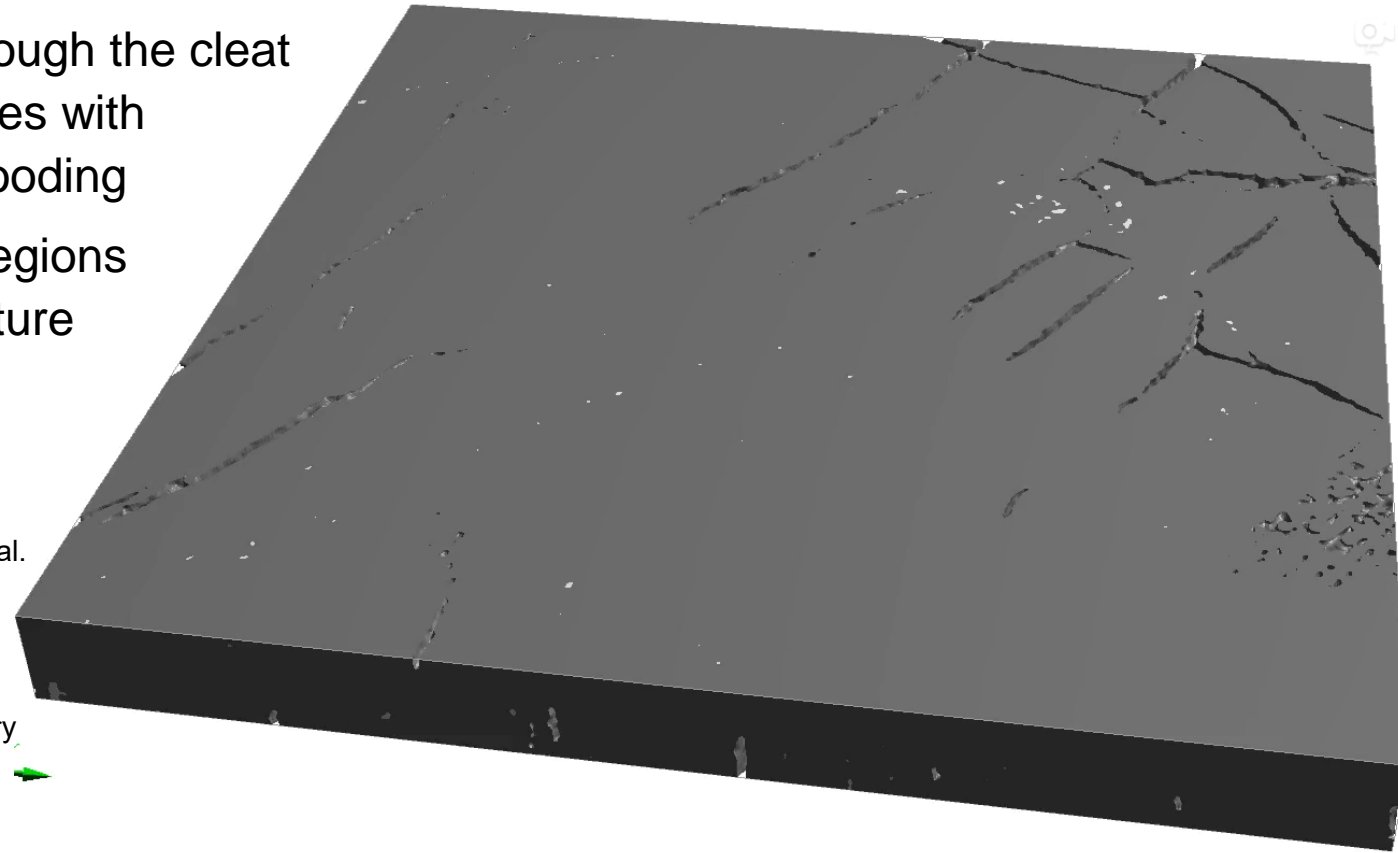


Increasing skin factor required for history match (more evidence of PDP effect?)



# Advanced environmental technologies for permeability enhancement (chemical stimulation of natural fractures)

- Focuses on core flooding with **HCl to dissolve carbonates** and **NaOCl to etch cleat surfaces**
- Characterises cleat structure using **X-ray micro-CT** before and after chemical stimulation to assess efficacy
- Uses **software to model flow (GeoDict)** through the cleat structure. Modelled permeability closely agrees with measured permeability obtained from core flooding
- Can identify **causes for low permeability**, regions where there are restrictions in the cleat structure
- **Publications for 2019:**
  - “Use of FTIR, XPS, NMR to characterize oxidative effects of NaClO on coal molecular structures.” International Journal of Coal Geology.
  - “Coal permeability stimulation by NaClO oxidation.” The APPEA Journal. APPEA Conference. May 27-30, Brisbane, Australia.
  - “The Impact of Cleat Connectivity on Coal Seam Gas Geomodels’ 3D Permeability.” Asia Pacific URTEC Nov 18-19, Brisbane, Australia.
  - “Chemical stimulation for enhancing coal seam permeability: Laboratory study into permeability variation and coal structure examination.” International Journal of Coal Geology, in press.



# Theme 1: Reducing operating expenditure

Reduction in work-over costs and/or frequency with an initial focus on current well stock and improved management of solids

*Dr Mahshid Firouzi, Dr Tom Rufford, Prof Andrew Garnett*

# Current Projects



“Enhancing CSG well production through well bottom-hole pressure control (AQ IRF, Firouzi)

“Enhancing well deliverability and reducing the work-over cost using big data predictive analytics” (CNG - NERA, Firouzi and Garnett)

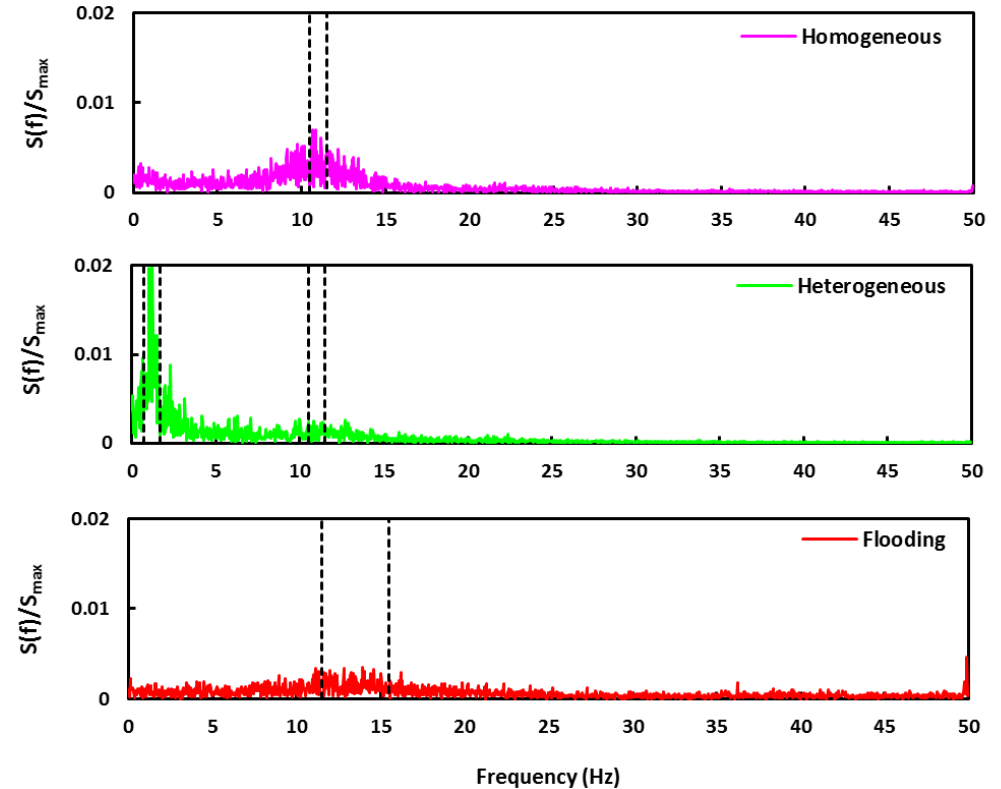
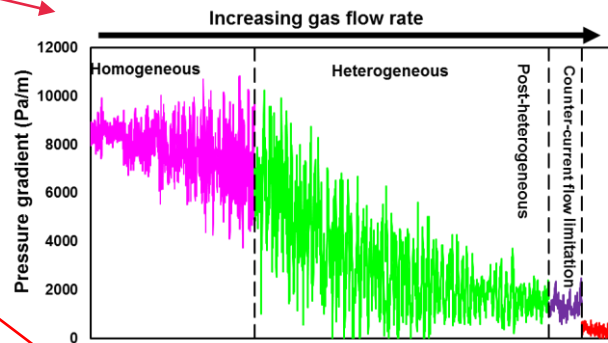
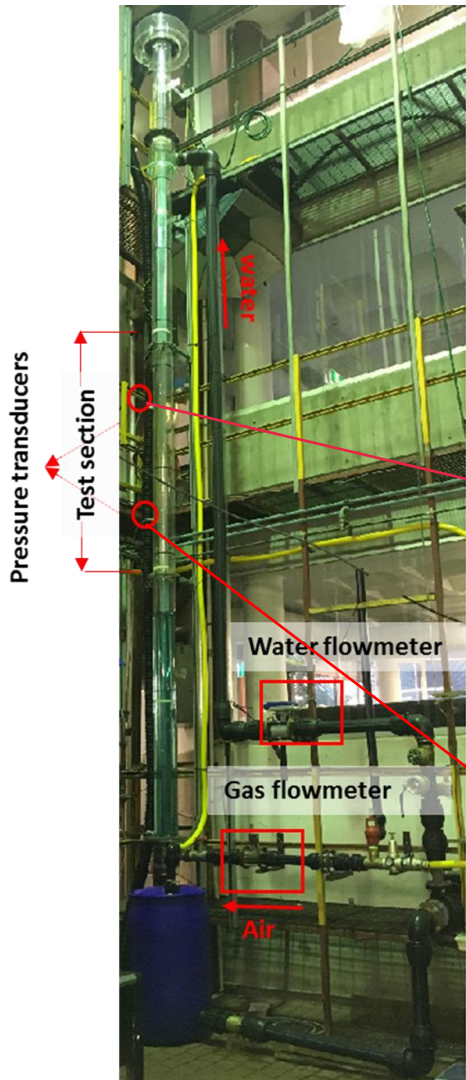
“Screening of solvents and polymers for phase inversion to inhibit clay swelling of mudstone” (CNG-ARC, Rufford, Ge & Chen)





# Enhancing CSG well production through well bottom-hole pressure

- ✓ Proposed a flow map based on the lab results
- ✓ Developed mechanistic models to predict the pressure of individual regimes
- ✓ Developed a reliable & non-subjective flow map using signal processing of pressure data
- ✓ Tested the effect of salinity of formation water on flow regimes and their characteristics (pressure, holdup)



# Enhancing well deliverability & reducing the work-over cost using big data predictive analytics

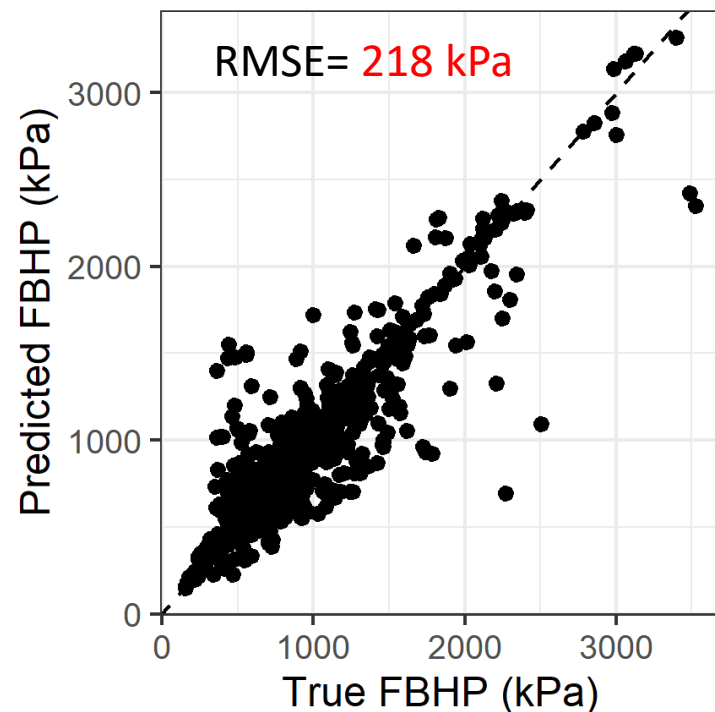
Aim: Combining physics-based data & advanced data analytics to (i) Predict the FBHP & (ii) Predict pump failure

**Prototype model:** allows us to predict FBHP in the event the pressure sensor fails without interrupting the well

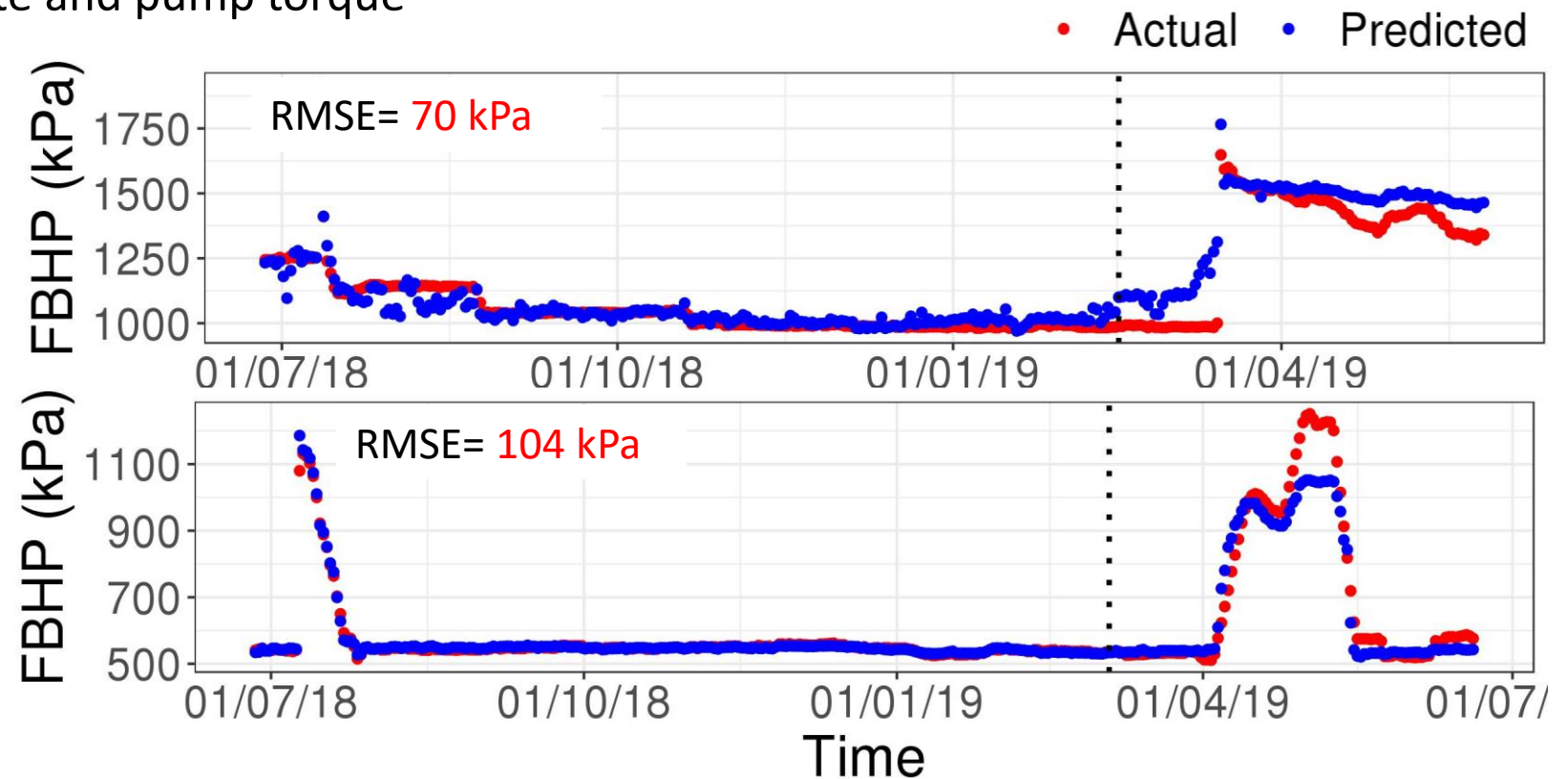
Data: From 341 vertical wells from 13 different fields

Production period: 3-27 months

Variables: water flow rate, gas flow rate and pump torque

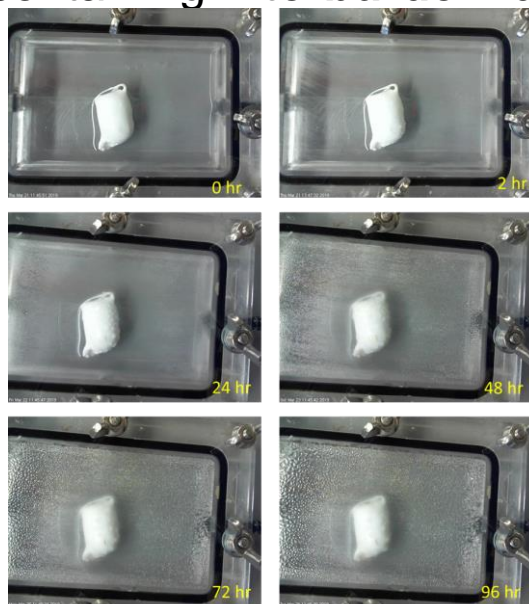


Randomly samples 1000 data points

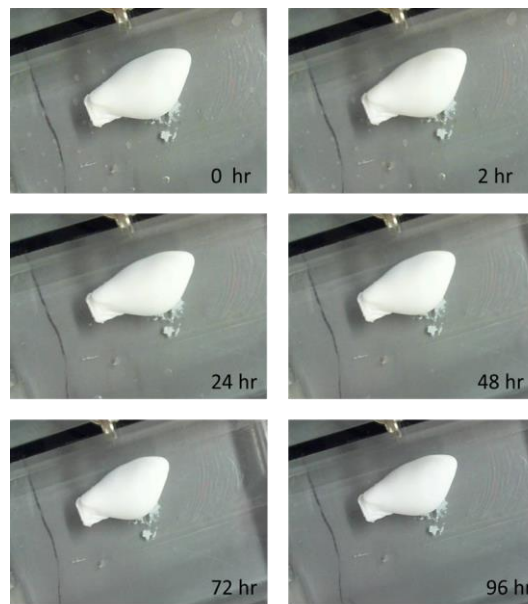


# Screening of Solvents and Polymers for Phase Inversion to Inhibit Clay Swelling of Mudstone

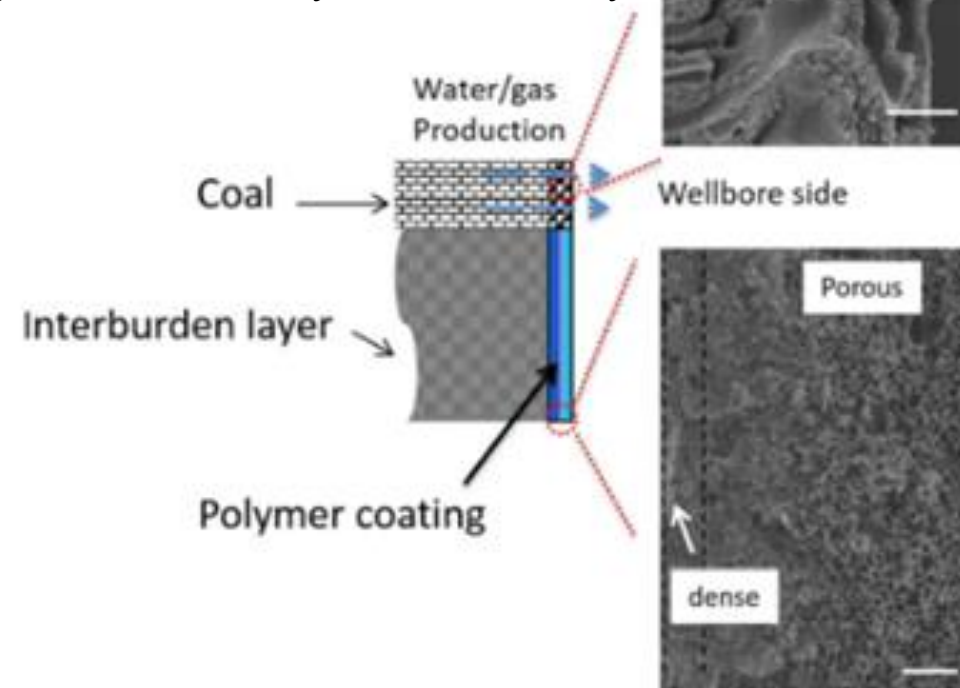
- Aims to identify an **environmentally friendly** and **cost-effective** polymer immersion process to **inhibit clay swelling** and fines generation, which creates problems downstream
- The coating solution **must remain permeable to gas and water** on contacted coal layers
- The phase inversion synthesis approach will form a low-porosity dense skin layer across clay-containing **interburden layers**



*PES:Polarclean*



*PMMA:DMSO*





**...coming up next**  
Research Portfolio: Water



**THANK YOU**

**Dr Christopher Leonardi**  
**Advance Queensland Fellow**

[c.leonardi@uq.edu.au](mailto:c.leonardi@uq.edu.au)









**Associate Professor Phil Hayes**  
Chair of Water Resources and  
Gas Development

UQ Centre for Natural Gas

Thank you to

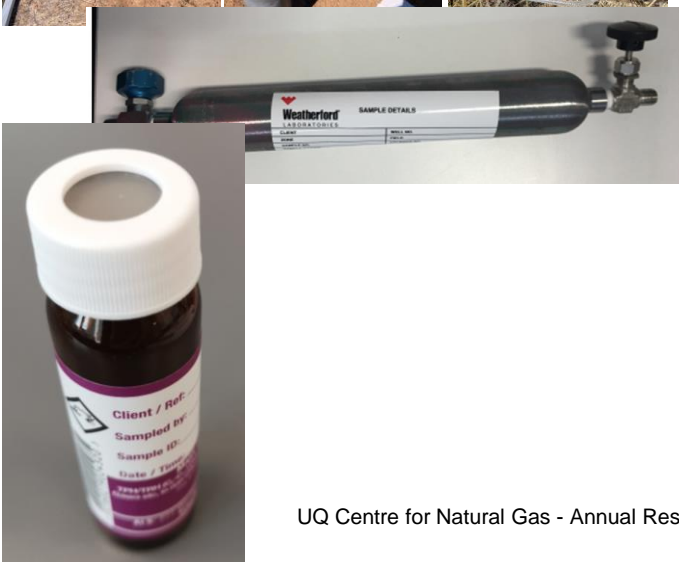
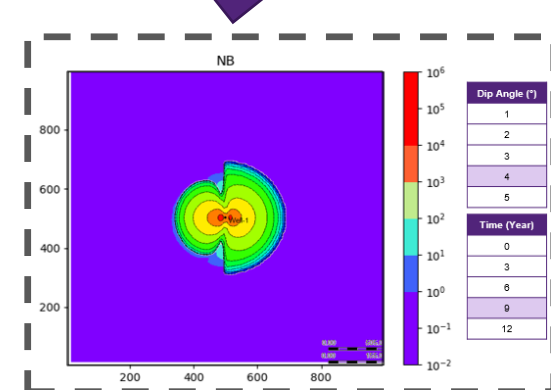
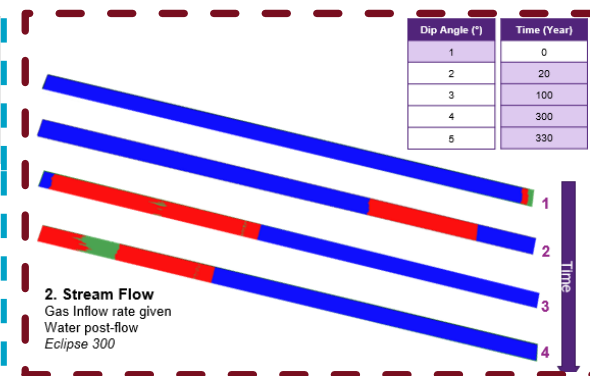
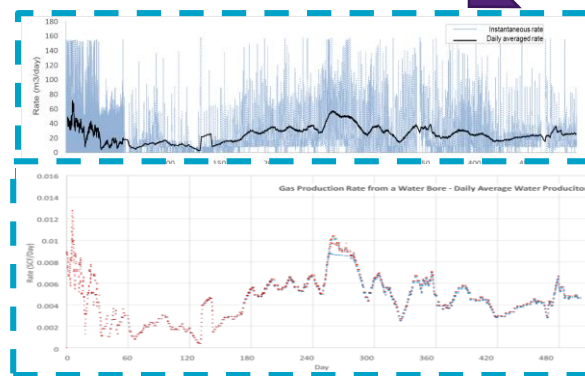
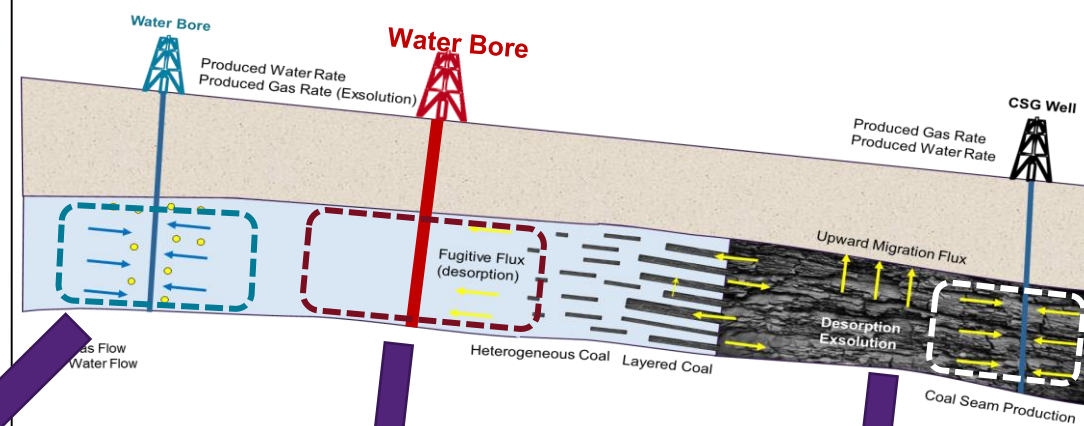
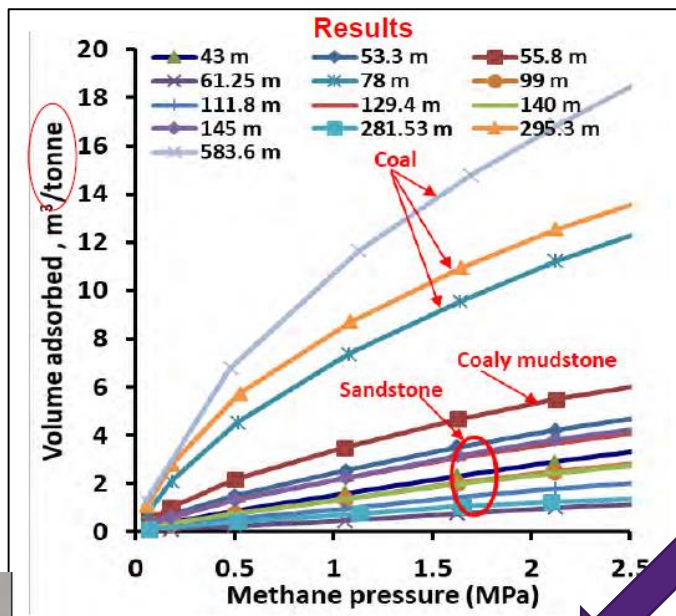
- Project CI's, Post Docs, Students and CNG support
- And thanks to UQ-CNG participating companies for support + data.
- Plus thanks to State Govt Agencies for Collaboration and data.

# Current projects

- |  |   |  |
|--|---|--|
| <p>1. Surface Movement / Ground Motion<br/>UQ-CNG + Shell</p>  |    | <p>Poster by Chris Leonardi / Iain Rodger /<br/>Travis Mitchell and Sarah Brennand</p> |
| <p>2. Subsurface Methane / Shallow Gas<br/>NERA + UQ-CNG</p>   |    | <p>Posters by Julie Pearce + Syed Raza</p>   |
| <p>3. Beneficial Algae for CSG Brine<br/>UQ-CNG</p>  |   |  |
| <p>4. GAB Hydrogeology Journal Special Edition<br/>NERA</p>  |    | <p>Workshop at 3.20 pm</p>   |
| <p>5. Southern Surat – enhancing understanding of<br/>Precipice and Hutton aquifers ANLEC</p>            |    | <p>See Harald Hoffman or myself</p>  |
| <p>6. Mitigation of Silica<br/>ARC Linkage (completing soon)</p>   |  | <p>See me</p>  |
| <p>7. Groundwater Modelling Decision Support Initiative<br/>BHP / Rio Tinto via NCGRT @ Flinders Uni</p> |  | <p>See me</p>  |



# Subsurface Methane / Shallow Gas (UQ-CNG + NERA)





# Beneficial Algae in CSG Water

Schenk Laboratory  
UQ School of Agriculture and  
Food Sciences

Potential to grow halo-tolerant Algae using CSG waters / brines. Two trials conducted:

- *Spirulina platensis* with ~ 25,000 mg/L  
→ **C-Phycocyanin Extract**
- *Dunaliella salina* with ~ 70,000 mg/L  
→ **Beta-Carotene (Pro-Vitamin A)**



## Knowledge sharing

- Technical Research Project reports to industry participants
- Reviews for Environment and Science and OGIA
- Various workshops with industry, regulators, Chinese researchers and indigenous groups
- Presentations including: Geoscience Australia, Groundwater Modelling Uncertainty Workshop at ANU, Qld Great Artesian Basin Consultative Committee
- Australasian Groundwater Conference 2019: Organising committee, Session Chair and speaker
- Australasian Groundwater Conference 2021: Chair of Technical Committee
- Media interviews

## Students

Two PhD students:

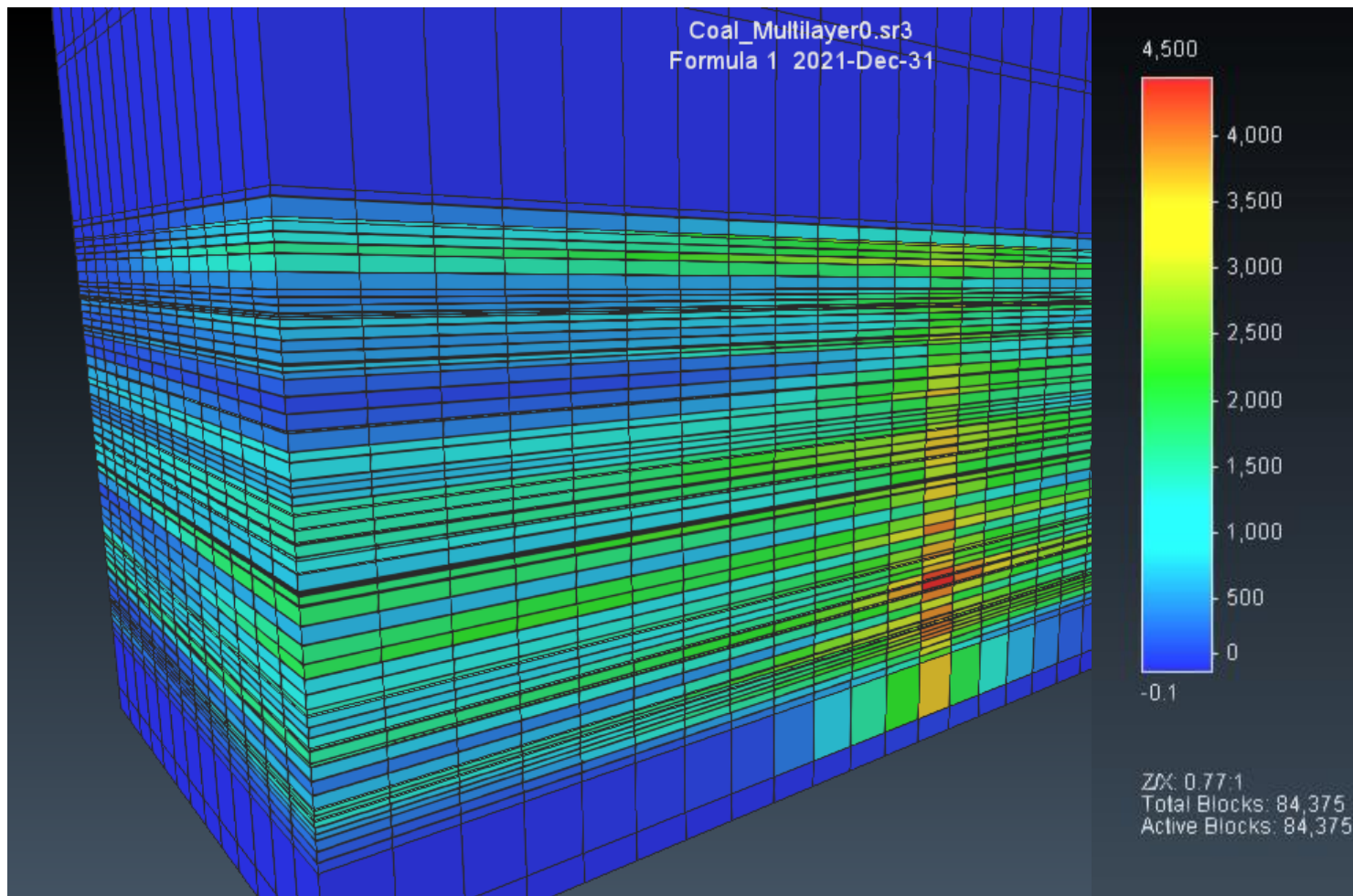
- Sarah Brennand using In-SAR to enhance understanding of natural ground motions
- Chris Nichols investigating methane and emissions from Surat Basin groundwater

Three further applications in progress on:

- Southern Surat Hydrogeology / Hydrochemistry
- Two projects on Groundwater Modelling Decision Support Initiative

Contributions to undergraduate Hydrogeology teaching, on groundwater modelling.

# For 2020 Processes from the well to ~ 2 km scale





**...coming up next**

**Research Portfolio: Social Performance**

**THANK YOU**

**Associate Professor Phil Hayes  
Chair of Water Resources and  
Gas Development**

**phil.hayes@uq.edu.au**

**Go check out the  
awesome posters  
for more details**

With thanks to:

- Project CI's, Post Docs, Students and CNG support
- And thanks to UQ-CNG participating companies for support + data.
- Plus thanks to State Govt Agencies for Collaboration and data.



**Dr Kathy Witt**  
Research fellow

UQ Centre for Natural Gas

# 2019 Research



1. 'Community Indicators' – Cumulative socio-economic impacts
  - Annual Report on Queensland's Gasfields Communities
2. Stakeholder Trust survey (Gillespie et al.)
3. The IEA's Golden Rules of Gas and the Queensland experience
4. Town Capabilities Assessment (ongoing)
5. Assist GFCQ with data collection and interpretation for 'Shared Landscapes' report
6. Systems modelling for social risk in mine operations
7. Advance Queensland Fellowship application (2020-2022) 'Enabling Transition'

# 1. Indicators continuation and reporting

**Background:** *To assess cumulative socio-economic impacts and benefits of CSG development*

Phase 1: (2012-2015) measured impacts by developing and using the [UQ 'Boomtown' Toolkit](#) method.

Phase 2: Tracked changes in indicators over time... (2016-2018)

Phase 3: Continuation of monitoring and reporting with 'deeper dives' on emerging issues (2018-2020)

**2019 Update:** Annual Report on Queensland's Gasfields Communities released in May.

Roadshow – Twba, Dalby, Chinchilla, Miles, Roma in June (over 100 attendees).

Presentations at RCCC, TSBE Resources Expo, URTeC.

Key messages: town differentiation - effects of drought?, housing turning, unemployment down.

**Achievements:** The CNG team won the ON Prime finals for research commercialisation potential

- attended the ON Tribe awards and PD workshop in Melbourne in Sept. (fully funded)

**What's next:** review of indicators,



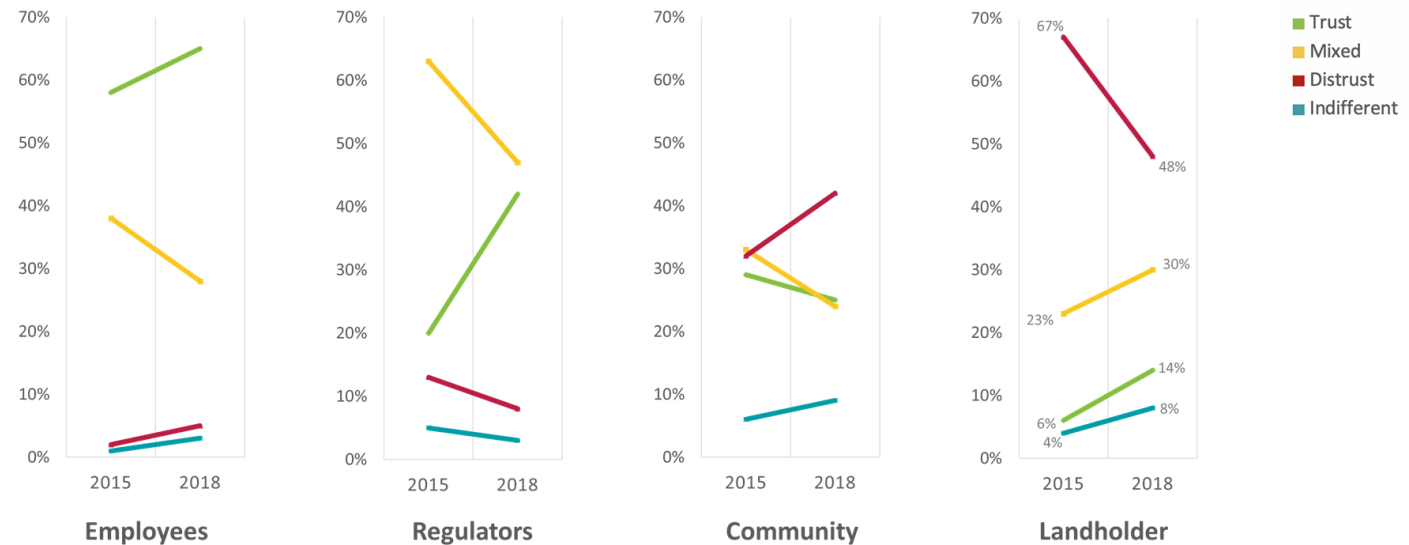
## 2. Stakeholder trust

**Purpose:** *To provide a rigorous, independent understanding of stakeholder trust in the Queensland CSG industry.*

**Background:** First round of interviews in 2013/2014 followed by survey in 2015. Found that: stakeholder trust is dynamic and influenced by 10 key ‘trust drivers’; Stakeholders differ in their level of trust: Employees had high trust, Regulators and Community had polarised opinions, and Landowners had low trust. Re-tested May-October 2018.

### 2019 Update:

- Significant increases in trust for regulators (from mixed trust to trust)
- and landholders (reduced distrust)
- Community trust decreased



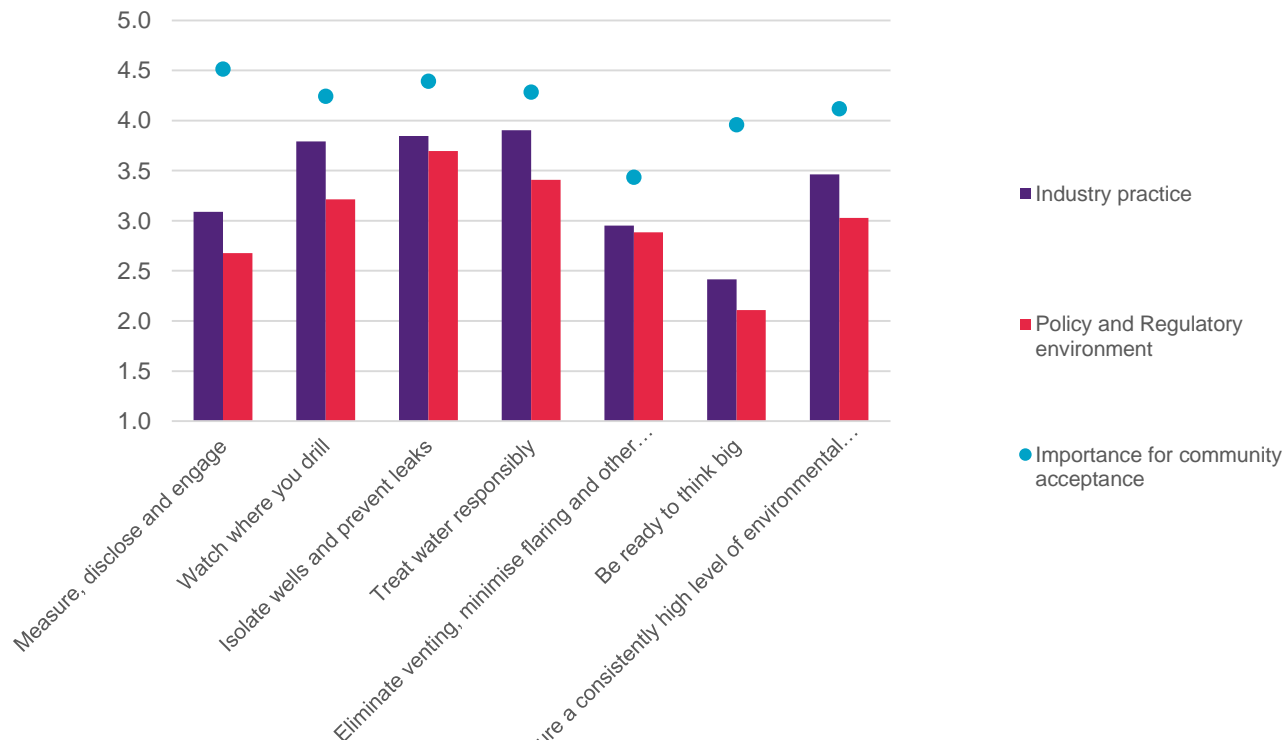
# 3. 'Golden Rules' of Gas and the Qld experience

**Purpose:** *How did the Qld experience stack up to the IEA's 'Golden Rules' of Gas?*

**2019 Update:** Final report sent to IEA for comment. Presented at DNRME in April

**What's next:** Paper publication, scorecard tool now used to evaluate MLA's sustainability framework

Summary



- Industry practice was scored higher than the policy/regulatory environment
- Qld CSG scored very well in relation to well integrity & water
- Qld CSG scored poorly in relation to regional coordination & cumulative impacts
- Measure, disclose & engage the most important rule for community acceptance
- Venting and emissions the least important rule for community acceptance

# 4. Town Capabilities Assessment

**Purpose:** *Does CSG development increase town capability? (A broader view of ‘benefits’)*

**2019 Update:** Preliminary findings presented at RDA; MCA-ECW

**What’s next:** Finalise and write up (and inform Indicators)

Capital	Indicator	Data	Results
Human	Education levels	ABS	✓
	Unemployment/participation	DEET	✓
	Population/ Average age	ABS/QPS	✓
Social	Relative advantage/disadvantage	SEIFA scores	✓
	Volunteering	ABS	✓
	Crime rates	QPS	Low during construction, then ↑
	Linkages with other towns/markets	Interviews	✓
Cultural	Cultural diversity (% pop born OS)	ABS (Census)	✓
	Employment in Arts & Recreation		x
Political	Local ‘voice’ in media	UQ media analysis	✓
	Political influence		?
Financial	Average personal income	ATO	✓
	Total business income	ATO	✓
Built	Infrastructure spending	Council Reports	✓
	Housing approvals	QGSO	✓
	House values	QGSO	x
(Institutional)	Business diversity (counts by industry)	ABS	?
	No. of services	QGSO/Interviews	Mixed
	# community groups	Business directory	✓ ?

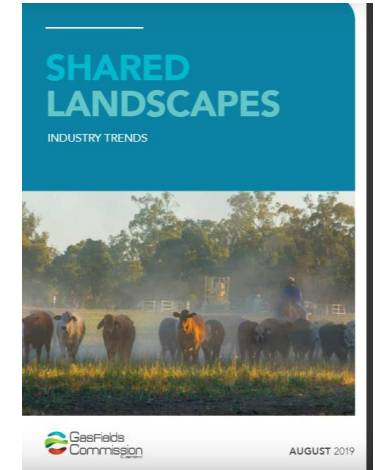
# 5. GFCQ Reporting

**Purpose:** Leverage Indicators reporting to assist GFCQ with broader industry reporting

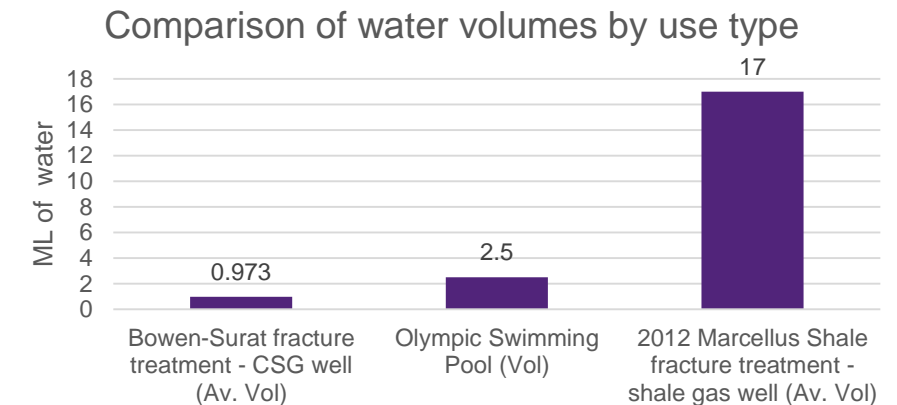
**2019 Update:** Shared Landscapes report released August.

UQ assisted with:

- Data collection and organisation
- Reviewed 21 Well completion Reports to construct ‘a typology of frac’s’
- QA and interpretation of data



Cases	Base Water	Proppant - sand	Chemical additives	No. of additives
21	96.4%	2.9%	0.62%	7





## 6. Taking the systems approach further

**Background:** Asked to collaborate on a pilot project to assess social risk in mining. This was inspired by the ‘systems approach’ applied to the social impacts assessment in the “Boomtown Toolkit”.

**2019 Update:** Proof of concept successful. Project going ahead under the ‘complex orebodies’ program.

Paper accepted for Asia Pacific System Dynamics Conference in Feb 2020

**Next steps:** collaborate on project to develop advanced systems modelling tools to assess social risk (including investment risks if possible) in mining operations.

*“The Sustainable Minerals Institute, in conjunction with its UQ and external partners, is uniquely placed to lead this transdisciplinary program to develop the step changes in social understanding, environmental innovation, and mining and processing efficiency which will be required to allow cost effective access to these Complex Orebodies in a way that that also enables sustainable development”* <https://smi.uq.edu.au/complex-ore-bodies>



Developing a model to quantify social impact of metal extraction for complex resources using Boomtown Toolkit

<https://smi.uq.edu.au/project/understanding-social-complexity-relating-social-impacts-mining>

## 7. Advance Queensland Fellowship application

The Centre has applied for a Advance Queensland Fellowship. If successful, it would secure \$300,000 of Queensland Government support for over three years. This would be matched by industry contributions.

**Project proposal:** *Enabling Transition: understanding co-benefits of new energy projects*

**Summary:** Explores expectations and opportunities for shared value and regional benefits from new energy projects - with a focus on large-scale solar and hydrogen - drawing on lessons learned from the development of Queensland's coal seam gas industry.

**Partners:** Arrow; APLNG; Santos; Comet Ridge; QFF, SQL; CSIRO; UQ

The Fellowship would be synergistic as it:

- Supports “original research that will have positive impacts for Queensland”.
- Assists “keeping the best and brightest research minds in Queensland”.
- Builds “capacity to conduct innovative research and development in partnership with industry”.

...coming up next

Research Portfolio: Energy transitions panel



**THANK YOU**

**Dr Kathy Witt**  
Research fellow

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# What is the role of gas in the transition (and for that matter what is the transition)

PANEL MODERATOR:

Prof Andrew Garnett  
Director,  
UQ Centre for Natural Gas



**Richard Jeffery**  
General Manager  
Commercial Strategy,  
Stanwell Corporation



**Georgy Mayo**  
Queensland Director,  
APPEA



**Prof Tapan Saha**  
Professor, UQ School of  
Information Technology and  
Electrical Engineering



**Ian Langdon**  
Commissioner and Chair,  
Gasfields Commission





# An Energy *Transition* ?

## From

### Current energy mix

- Systems & performance
- Interdependencies
- Technologies
- Emissions,
- Prices,
- Locations
- Jobs,
- Royalties & taxes
- ...

Current  
 trajectory /  
 trends?  
 Current  
 constraints?

*How: Scenarios ?*

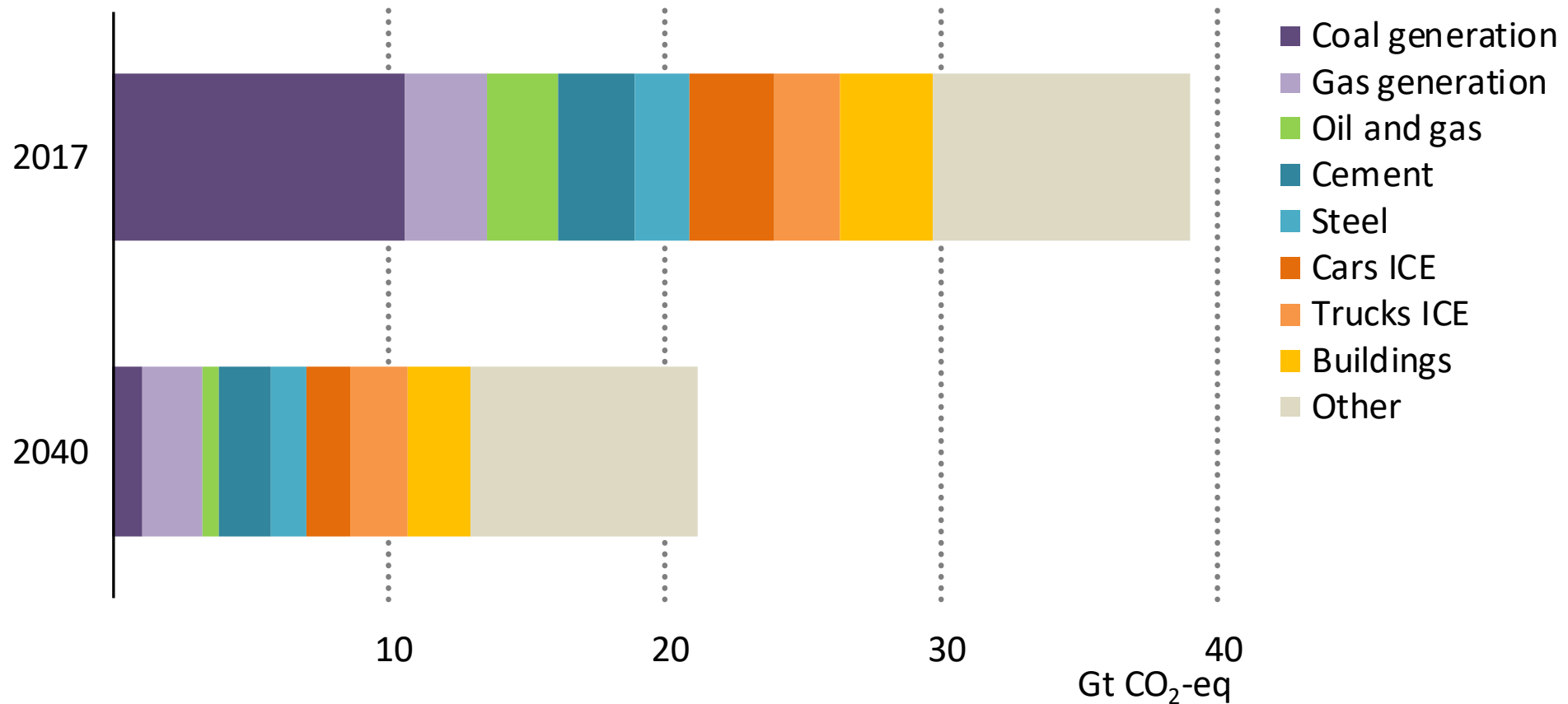
Some period of time?

## To (when?)

### Future energy mix (year ?)

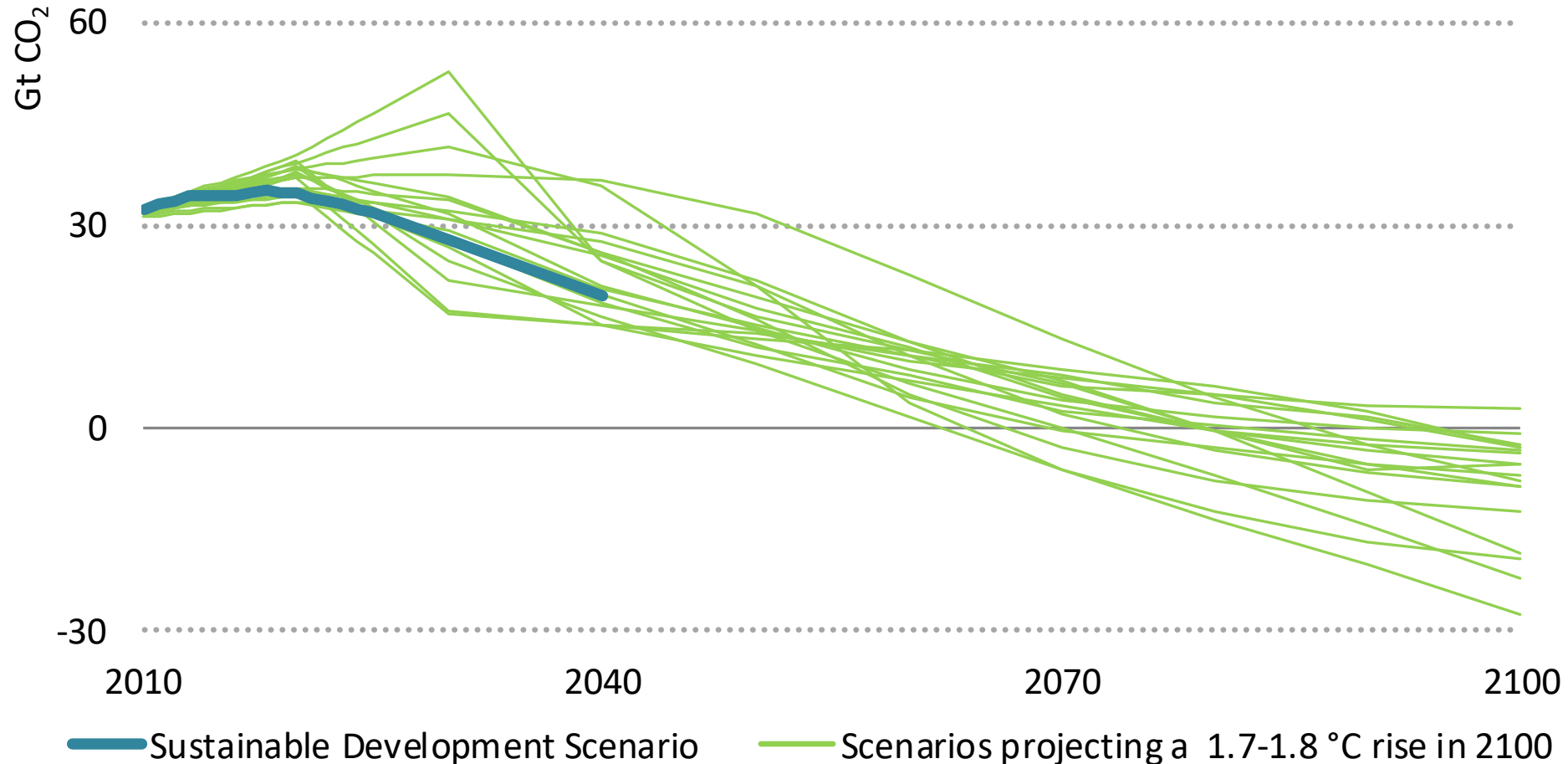
- Systems & performance
- Interdependencies
- Technologies
- Emissions,
- Prices,
- Locations
- Jobs,
- Royalties & taxes
- ...

# GHG emissions from selected sectors, 2017, and in the Sustainable Development Scenario, 2040



*Eight source categories account for three-quarters of today's energy-related GHG emissions; power sector emissions drop by 76% by 2040 in the SDS*

# CO<sub>2</sub> emissions in the Sustainable Development Scenario and other “well below 2°C” scenarios (1.7-1.8 °C)

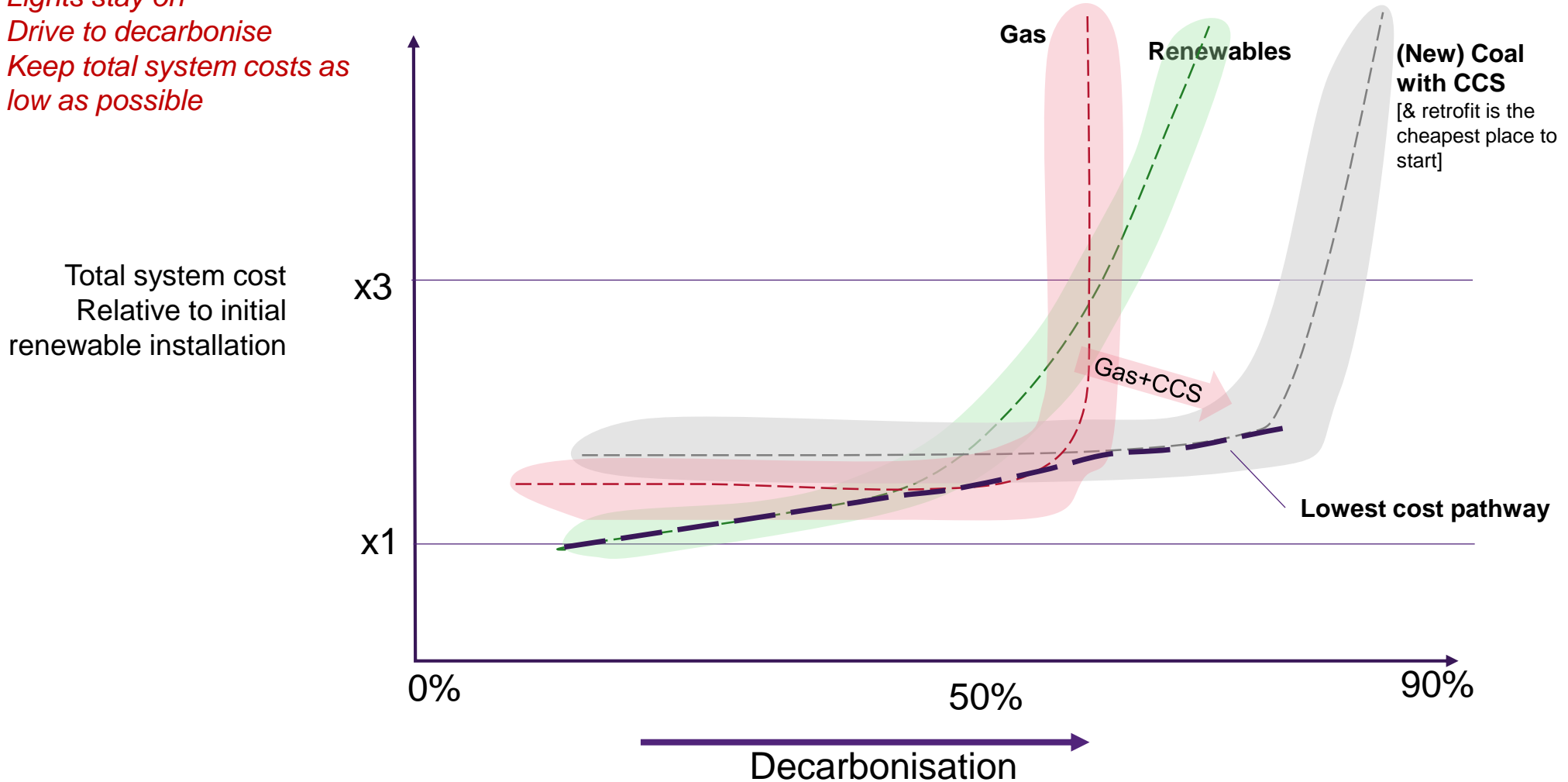


*The CO<sub>2</sub> emissions trajectory to 2040 in the SDS is at the lower end of a range of scenarios projecting a global temperature rise of 1.7-1.8 °C in 2100*

# Illustration of decarbonising: Lowest cost pathway needs a mix

### Rules

- 1) Lights stay on
- 2) Drive to decarbonise
- 3) Keep total system costs as low as possible





# What is the role of gas in the transition (and for that matter what is the transition)

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Professor, UQ School of  
Information Technology and  
Electrical Engineering



**Ian Langdon**  
Commissioner and Chair,  
Gasfields Commission



# After the break

**...coming up next**  
Concurrent sessions

Room 301

Challenges  
in the  
communication  
of technical  
information... and  
other things

Room 313A

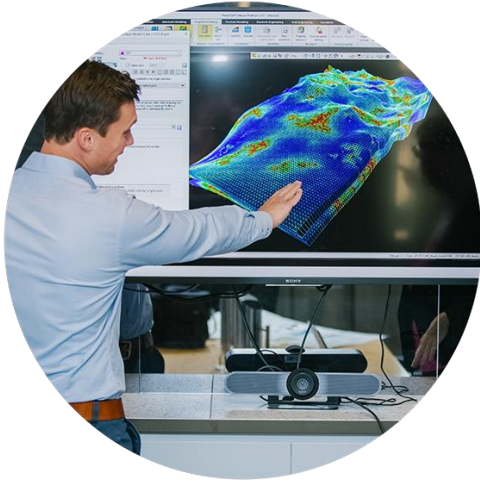
Walloons  
Springbok  
interface: when  
is an aquifer not  
an aquifer?

Room 200

What's new  
in understanding  
the GAB  
the research is in,  
what's next?

**THANK YOU**

Please join us now on level 5  
for canapes



World-class  
research  
  
Independent  
analysis

Research vital  
as natural gas  
flagged to play a  
key role in the  
long transition to  
a lower carbon  
future

