SMI CCSG
Centre for Coal Seam Gas

Centre for Coal Seam Gas

Vision: To become the World Leader in CSG Education and Research

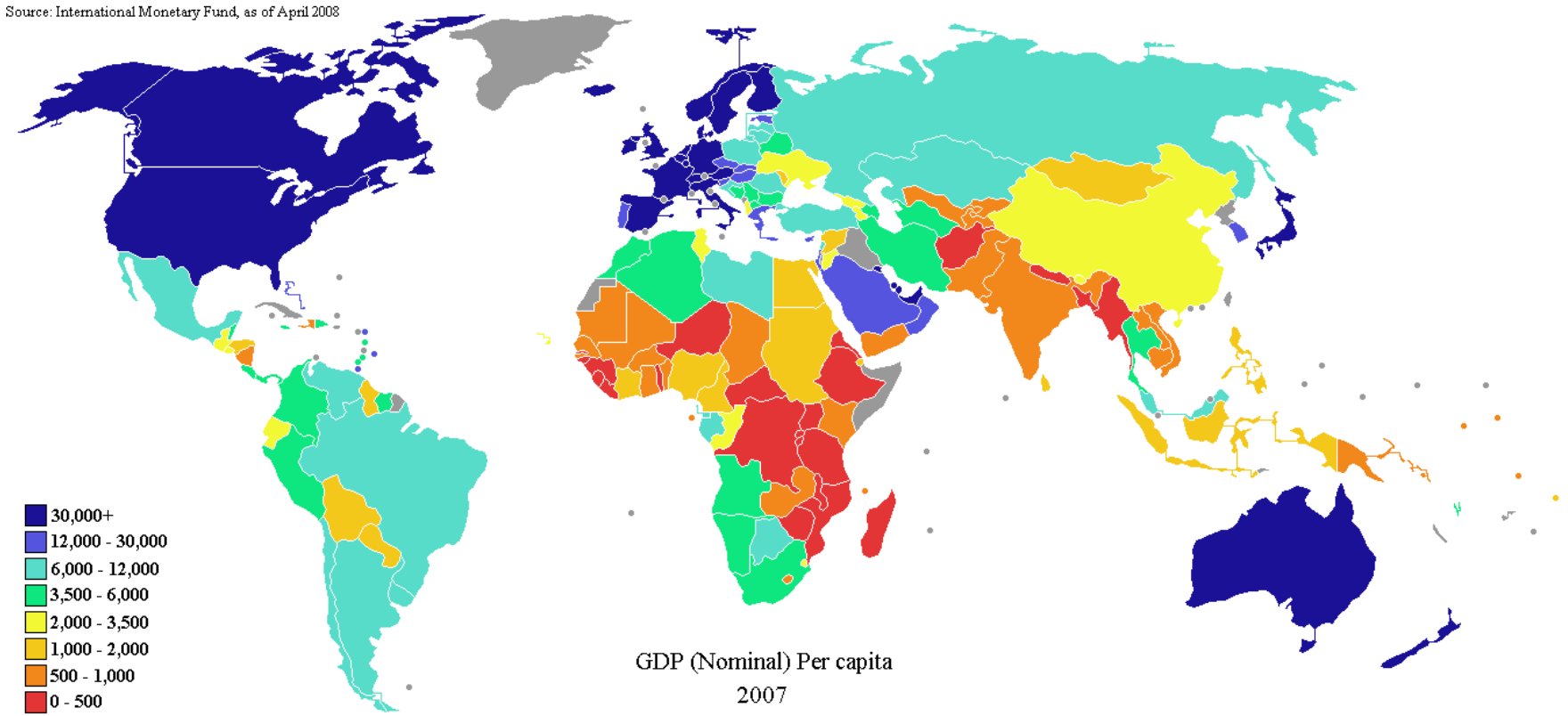
Chris Moran
Director – Sustainable Minerals Institute
Interim Director – Centre for Coal Seam Gas

OUTLINE

- Coal seam gas: The current landscape
- CSG extraction and implications
- UQ CCSG
- Questions

NATURAL GAS – SOME CONTEXT

World GDP



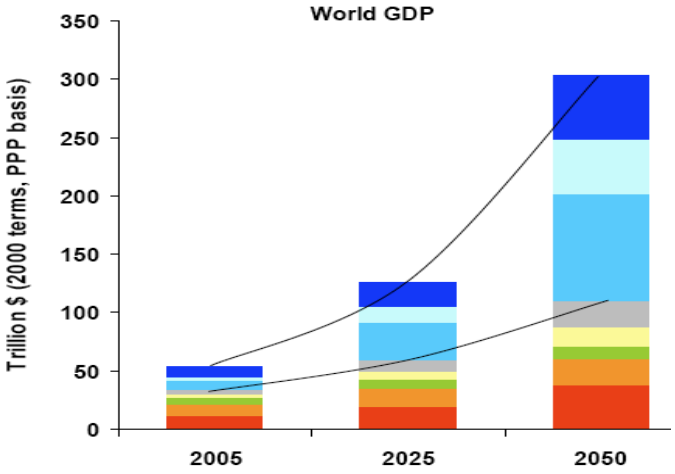
1,300,000,000 people without electricity

900,000,000 million without sufficient food or warmth

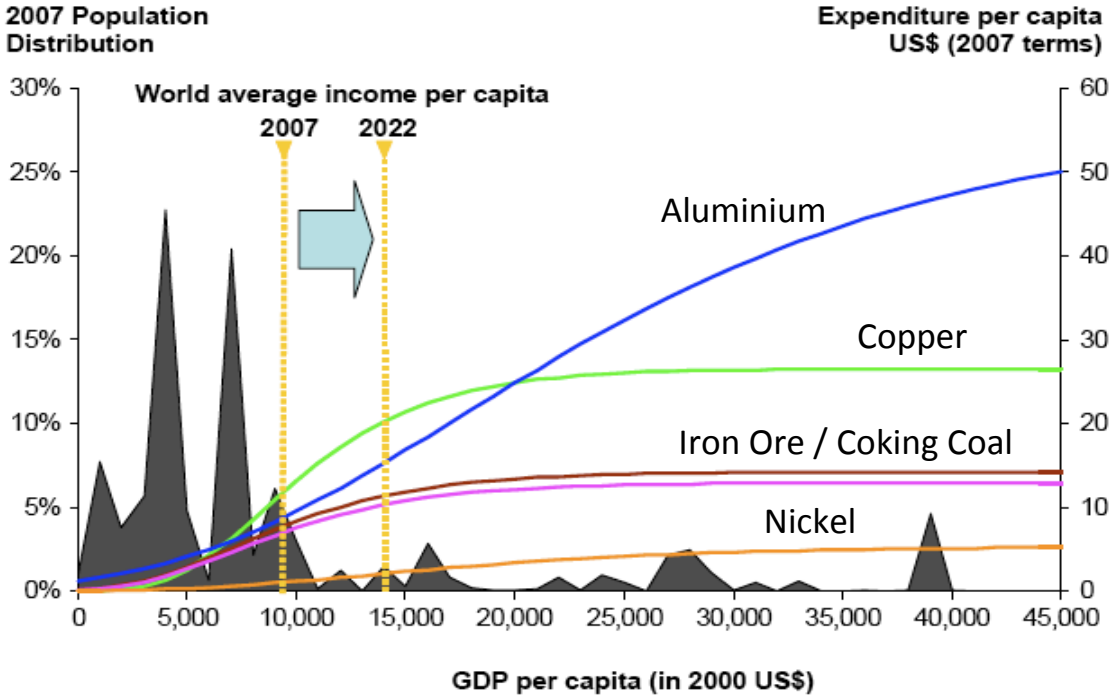
22,328,100 Australians

Demand for Minerals

Developing world's share of economy is expected to double

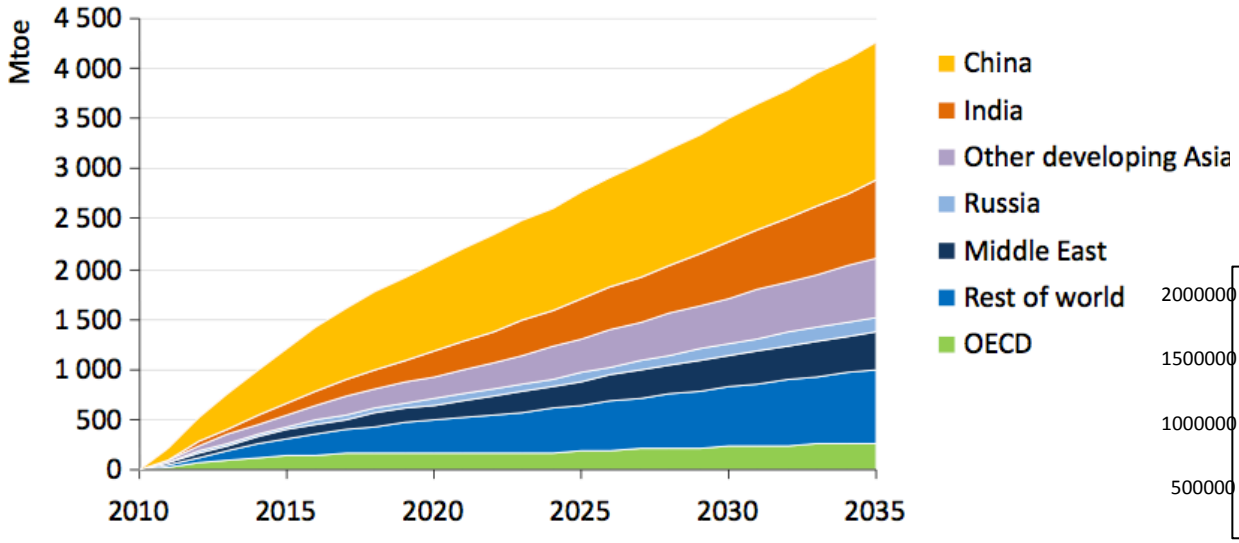


Metals for development



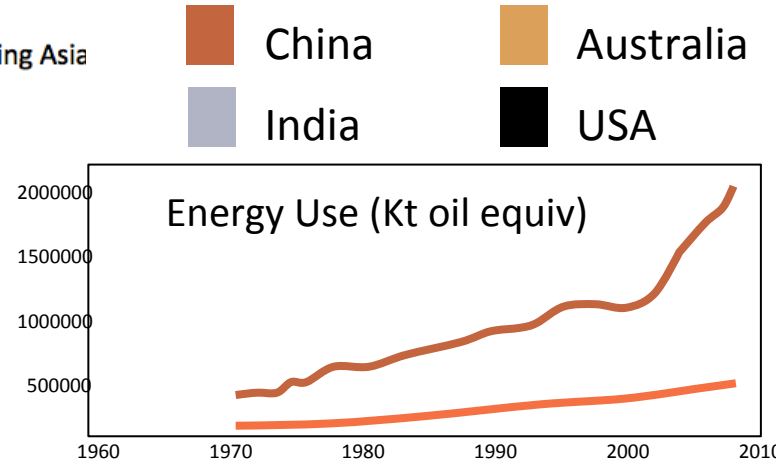
Energy demand outlook

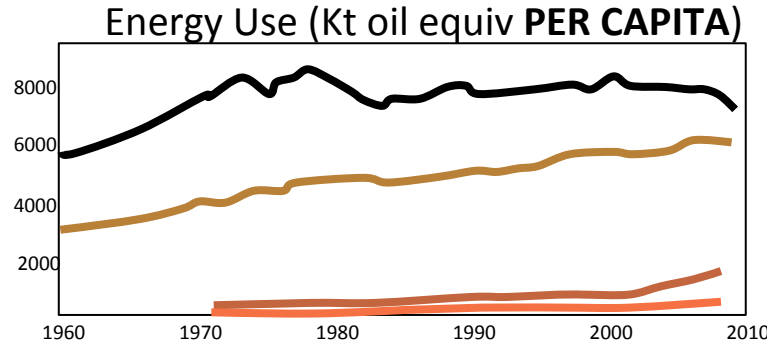
Growth in primary energy demand in the New Policies Scenario



Global energy demand increases by one-third from 2010 to 2035, with China & India accounting for 50% of the growth

OECD (IEA 2011)



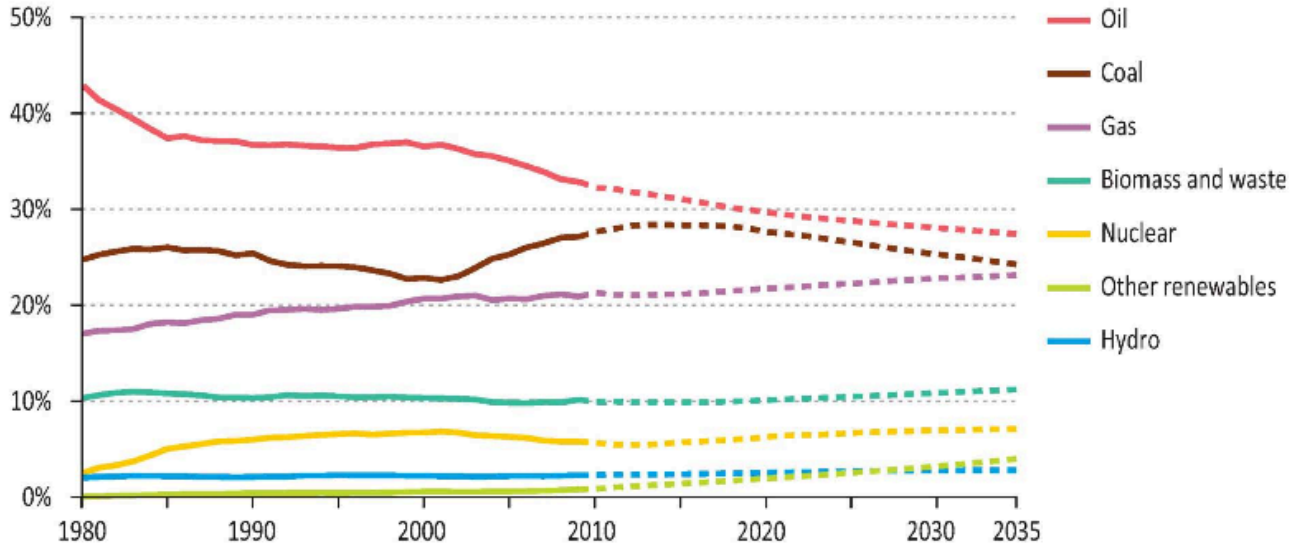


Sources of energy

Natural gas & renewables become increasingly important

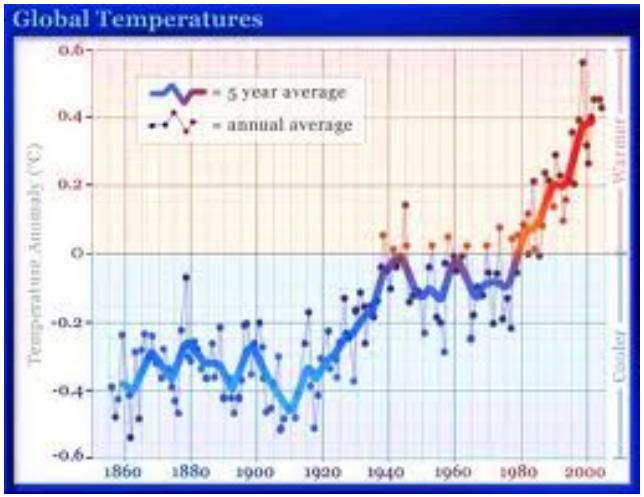
WORLD ENERGY OUTLOOK 2011

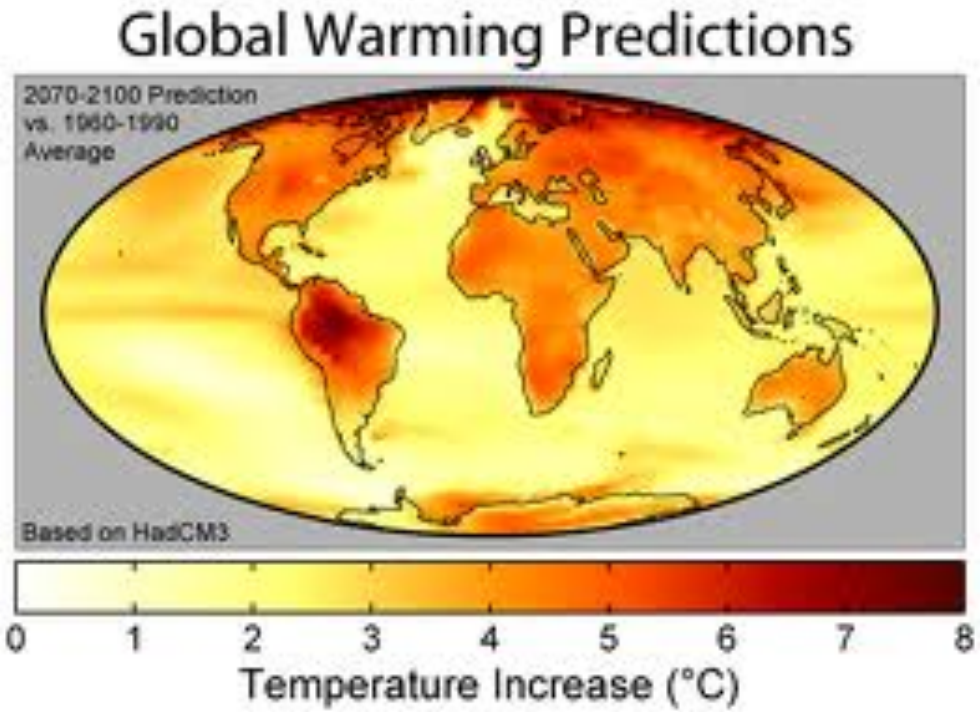
Figure 2.7: Shares of energy sources in world primary energy demand in the New Policies Scenario



Global primary energy demand grows by 40% between 2009 & 2035, oil remains the leading fuel though natural gas demand rises the most in absolute terms

An additional driver of gas expansion: The CO_2 imperative





Questions raised over current published and government-accepted estimates of eCO_2 emissions associated with CSG.

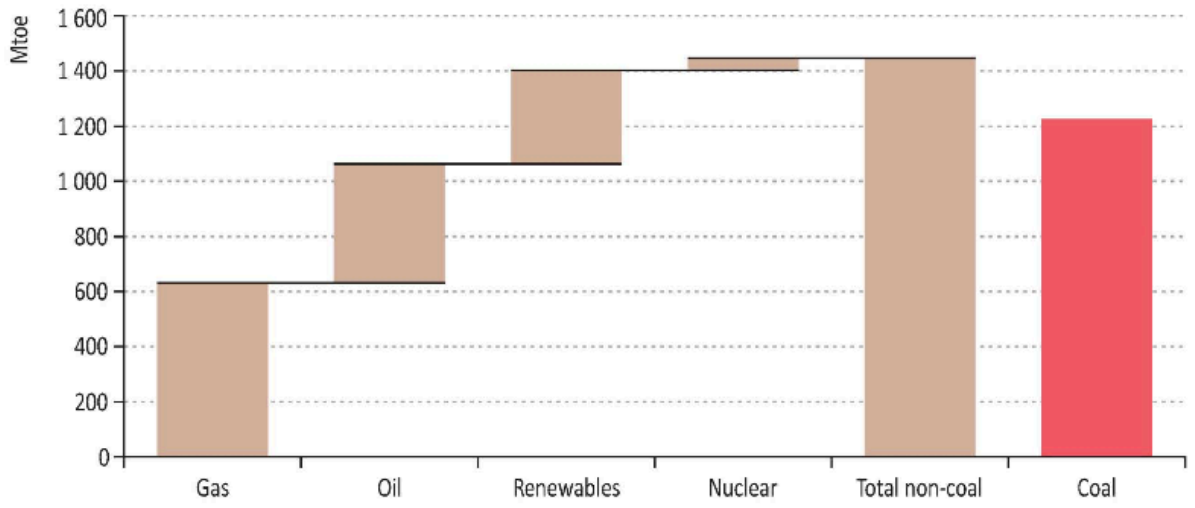
Venting releases CO_2. Better data are needed from Australian CSG facilities

Coal remains the dominant benchmark

Coal won the energy race in the first decade of the 21st century

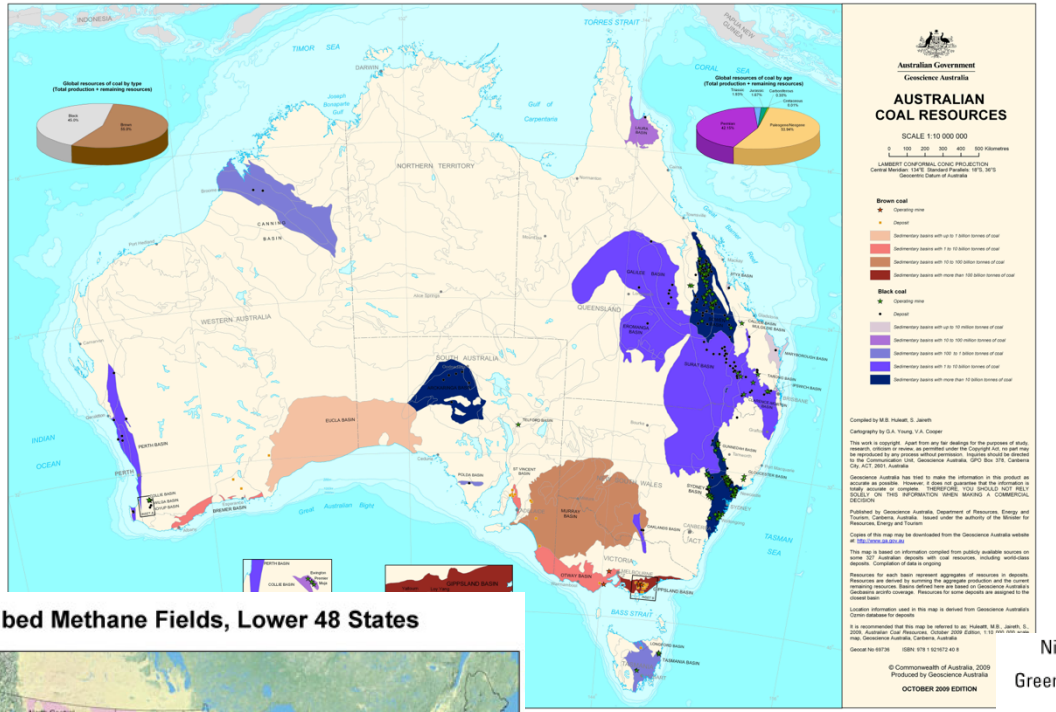
WORLD ENERGY OUTLOOK 2011

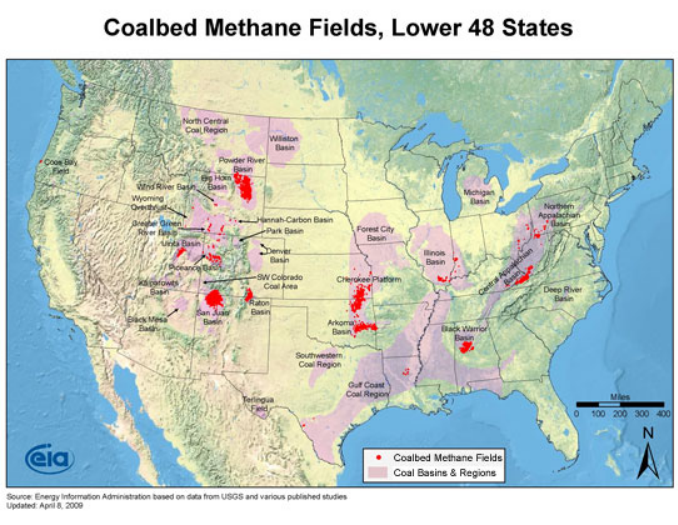
Figure 10.1: Incremental world primary energy demand by fuel, 2000-2010



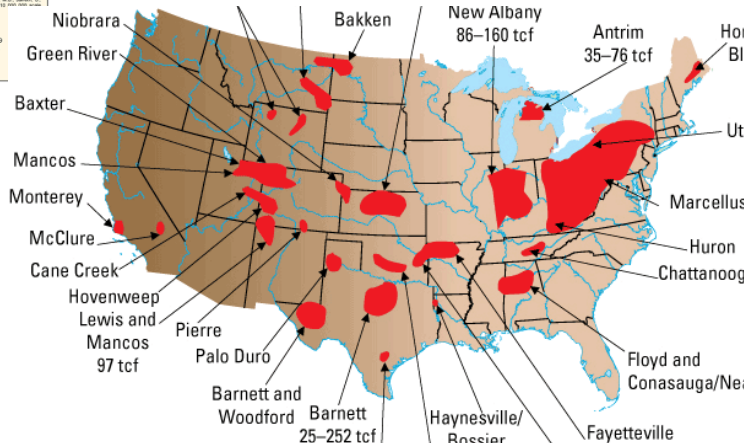
Coal accounted for nearly half of the increase in global energy use over the past decade, with the bulk of the growth coming from the power sector in emerging economies

Australia and USA



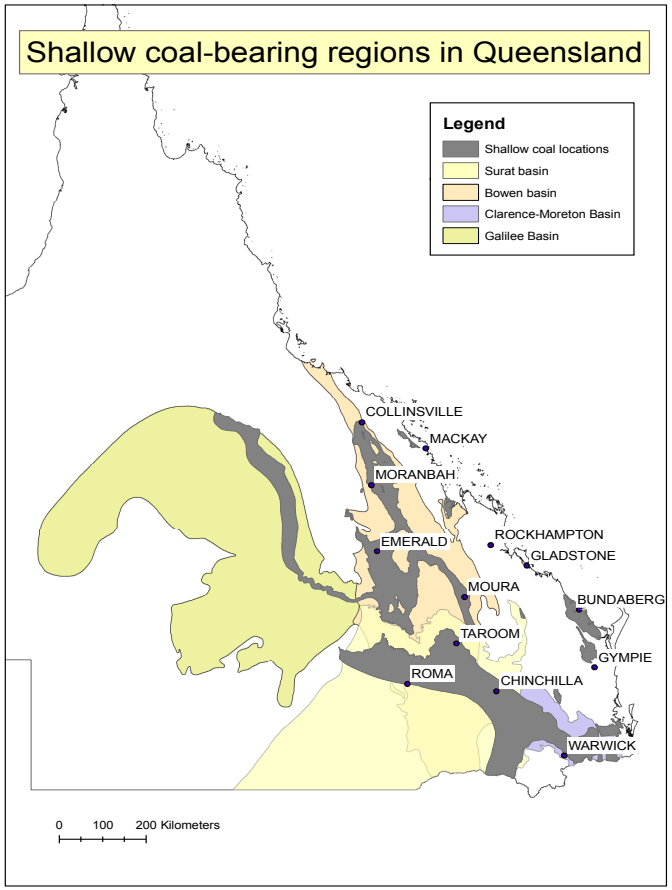


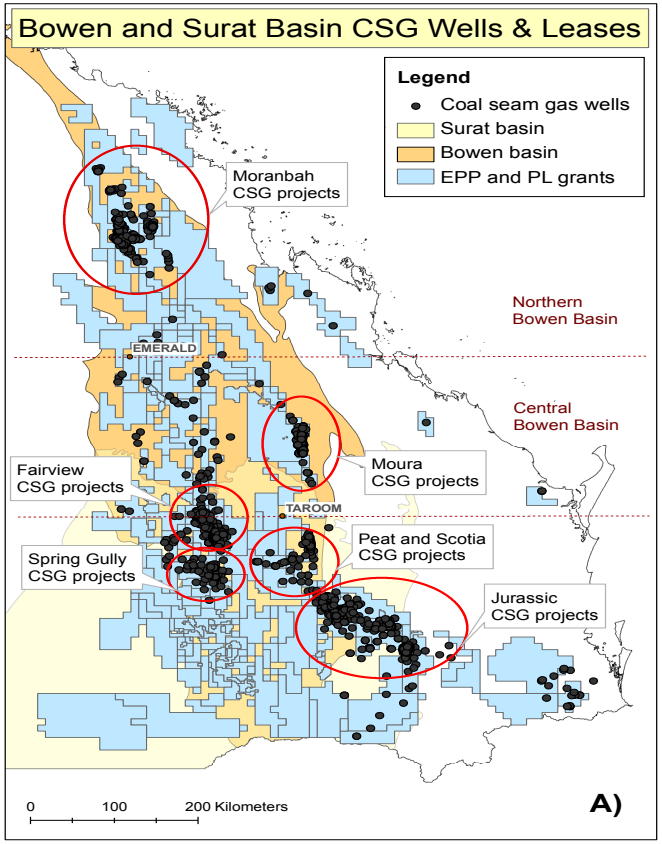
USA seeking self sufficiency and security



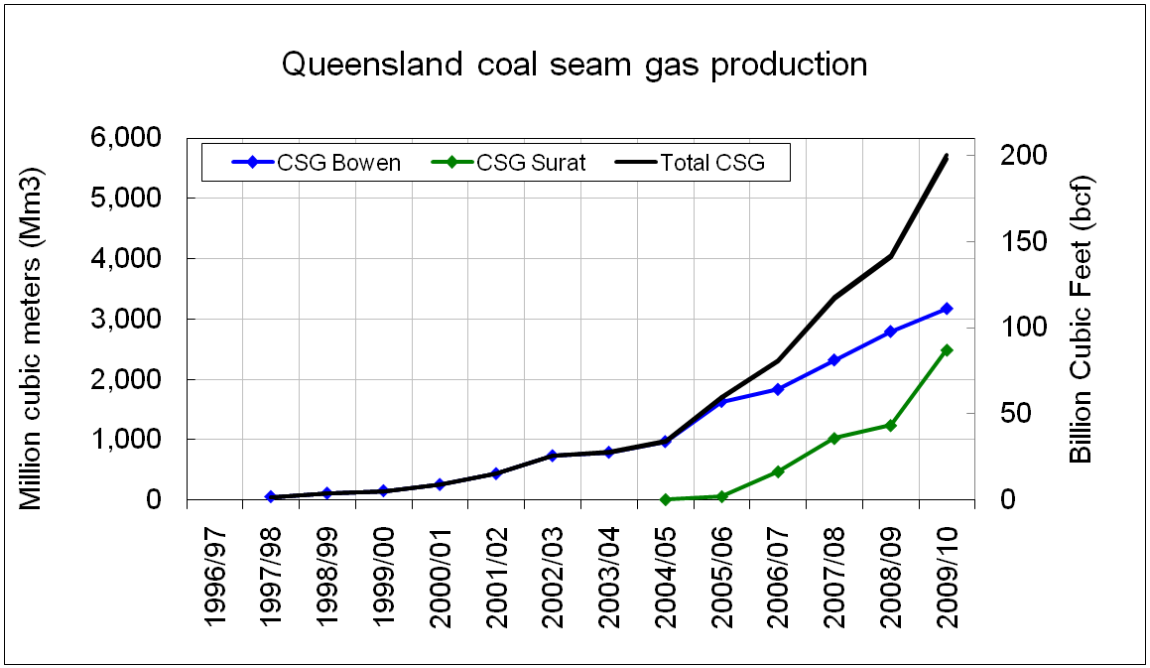
Shake gas

Coal Seam Gas Production in Queensland





CSG Production in Queensland



- Domestic gas supply began 2000
- Cumulative production 2000-2007 = 646 PJ (17,248 Mm^3)
- Annual production 2007-2008 = 133 PJ (3558 Mm^3)
- 1500 wells

Annual Production 2008

- Powder River Basin = 435 bcf
- San Juan Basin = 1210 bcf

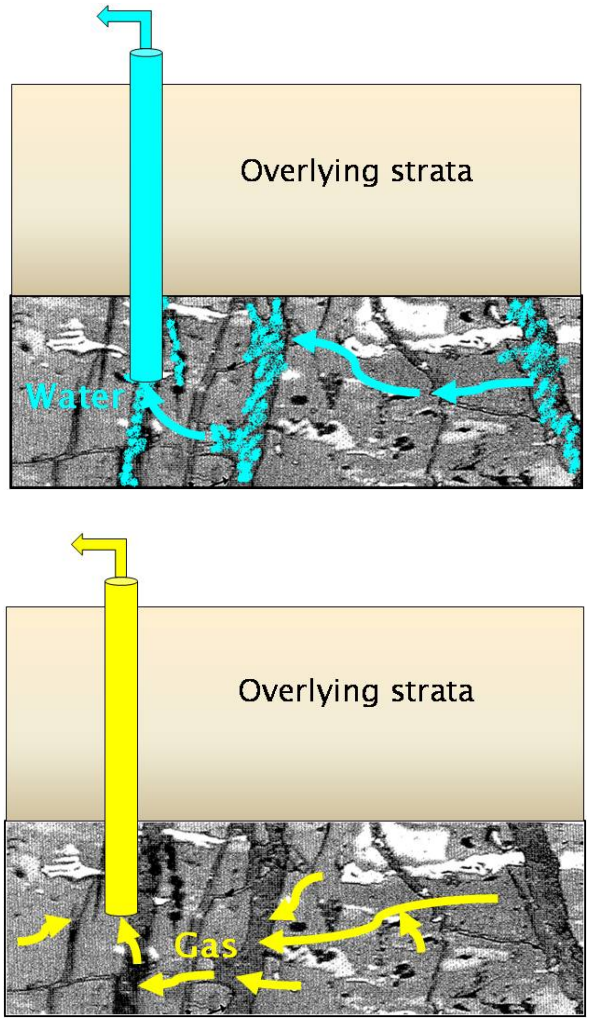
- Next 5-10 years industry growth to supply 6-8 LNG plants
- 49,812 Mm^3 pa; 1,759 bcf
- 20,000-40,000 wells

COAL SEAM GAS EXTRACTION & IMPLICATIONS

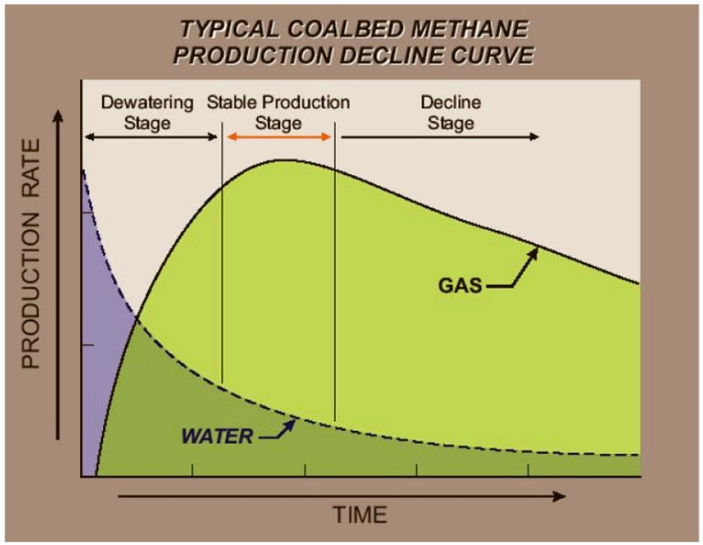
Extracting Gas requires Water Removal

1. To release gas from coal, pressure must be reduced. This is achieved by pumping water out of the cleats.

2. As pumping continues, gases desorb from the coal matrix and flow into the cleats.



Original picture sourced from (Glikson & Mastalerz, 2000)

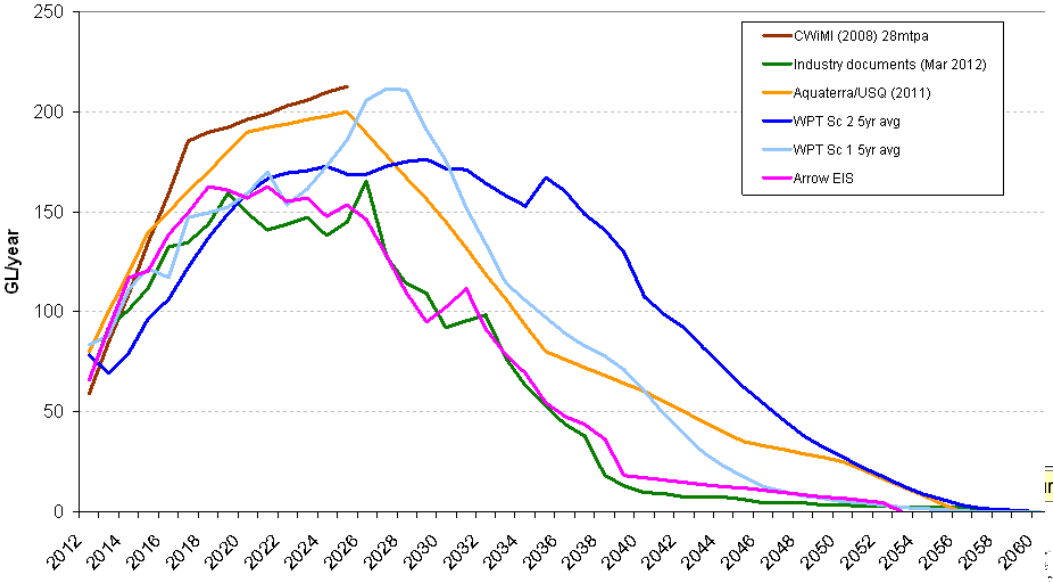


Picture sourced from (DME, 2008); original picture courtesy of CH4 Pty Ltd Arrow Energy Limited

Multiple Issues

- No fossil fuels
  - renewables leap frogging
  - Measurement of CSG CO_2e emissions
- Agricultural land and open cut coal mining
- Farming lifestyles / culture
  - Assumed rights
  - Noise
  - Traffic
  - Strangers
  - Employment
- Fragmentation
  - biodiversity
  - farming practices
- Water

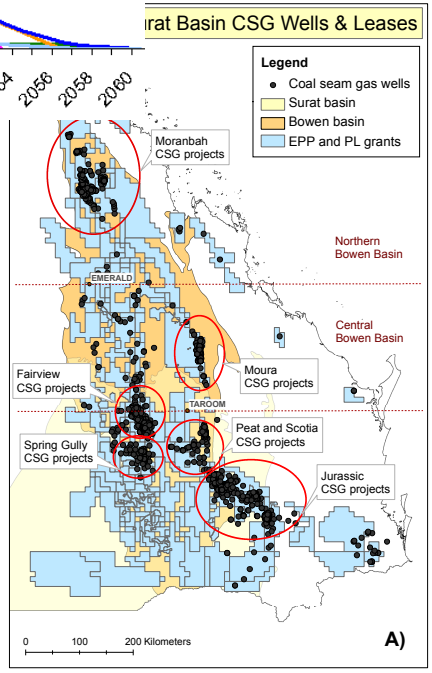
Water Production



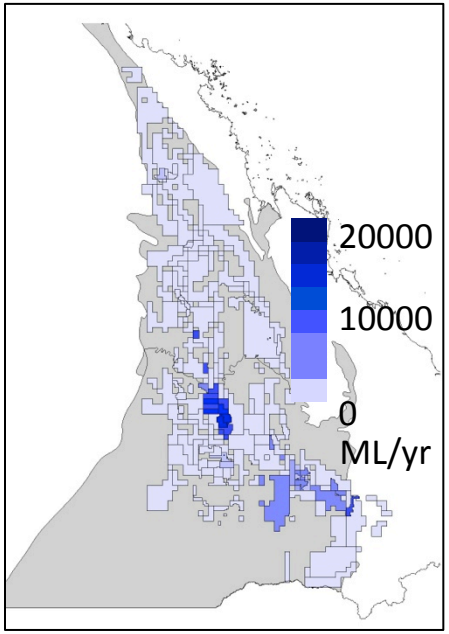
Consensus emerging that ~150Gl/yr dewatered from the coal seams of the basins

Water extracted from Surat Basin aquifers for stock and domestic use ~74 GL/yr

Condamine groundwater irrigation ~40Gl/yr



LOCATION



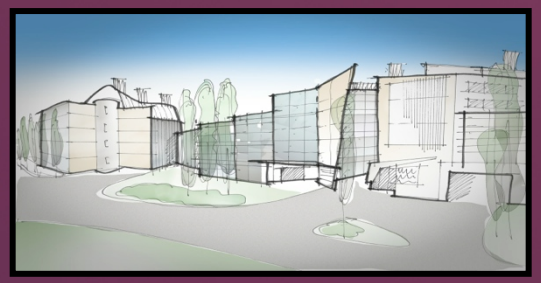
WATER issues

- Aquifer interactions
  - Natural and induced (fraccing and wells) interactions
- Hydraulic fracturing (fraccing)
  - Aquifer interactions and chemical use, transport and reactivity
- Surface water storage
  - Ecology and discharges
- Brine management
- (Re)-injection
- Ecosystems and surface water releases

Social unrest

What is the role of lack of information and deliberate misinformation?

THE UNIVERSITY OF QUEENSLAND'S CENTRE FOR COAL SEAM GAS (CCSG)



The University Of Queensland
AUSTRALIA

SMI CCSG
Centre for Coal Seam Gas

CCSG Mission

To coordinate and deliver the capabilities of UQ and collaborators to provide the research and educational leadership to meet the needs and challenges of an expanding CSG/LNG industry

CCSG Vision

To become the world leader in creating new knowledge and capability for the CSG sector to operate beneficially for the community, government and industry

Activity Areas

Four Activity Areas are identified for the centre:

1. Education
2. Research
3. Industry and government short term responses
4. Utilization

Participation Agreement

- Comittment to the entity in 5 year blocks
- Each Block is equal to $500,000 and is worth 1 vote
- Members can purchase as many blocks as they wish
- Additional Members are actively being sought
- UQ owns intellectual property; members have the right to use in operations
- Publication of research results will be encouraged
- Research on upstream CSG activities
- Core and non-core projects separated
- Collaboration encouraged, research duplication discouraged

Current Members

- Arrow Energy (1 block)
- Santos (1 block)
- BG-QGC (4 blocks)

- UQ strategic funding of 2 blocks
  (supports 5 professorial positions and centre support)

Potential CCSG Members

- CCSG is seeking further members:
  - Main players in Australian CSG/LNG industry
  - Junior CSG companies
  - International companies
  - Environmental groups
  - Community groups
  - CSG Service providers
  - State Government Departments
  - Federal Government Departments

Concerns raised about the Centre

research integrity?

at UQ's new *Centre for Coal Seam Gas*

UQ and the CSG industry have financed the formation of a research centre that focuses on coal seam gas operations. UQ has so far failed to guarantee the independence of the research and to safeguard it from bias and industry influence.

There are many unknowns and uncertainties with CSG and we believe that research into them is crucial. We can't afford to have this research compromised by industry influence. We have approached the interim director of the Centre for Coal Seam Gas and the Vice-Chancellor to ask that they improve the centre by:

1. Finding out how clean CSG really is by undertaking a comprehensive life cycle greenhouse gas emissions assessment and funding research into groundwater impacts to protect Queensland's food and water security.
2. Ensuring independence of research through community engagement, transparency in research agendas and outcomes and independent review and oversight
3. Disclose the conditionality of industry and government funding.

What is coal seam gas?
CSG is a methane gas trapped in coal seams by water and geological formations. It's a booming industry, with 40,000 gas wells proposed for Queensland over the next decade.

In Queensland, the CSG industry relies heavily on 'fraccing' the coal seam to extract the gas. This process involves pumping water, sand and chemicals down a well to increase the pressure in the coal seam and makes it crack, releasing the gas from its formation and enabling it to flow and be subsequently extracted.

With the support of staff and students, we can ensure that research at the new centre is for the benefit of the public, not just the gas industry. If you want to see Staff and Student concerns addressed within the CCSG, you can:

- find out more and write a letter to the Vice Chancellor and / or the Senior Deputy Vice Chancellor: **uqclimateforchange.org.au/uqccsg**
- like the Facebook page to be informed of CCSG updates: **www.facebook.com/CentreforCoalSeamGas**

PETROLEUM AND GAS ACT 2004 (Qld)

Exploration Permit #832012

UQ Centre for Coal Seam Gas (CCSG)

Description: Drilling for Coal Seam Gas all over QLD; Drilling for favourable research at UQ.

$20 million in industry funding from Santos, Queensland Gas Company and Arrow Energy has gone in to the new "Centre for Coal Seam Gas" at UQ.

CAUTION:
Coal seam gas drilling has the following risks:

Fracturing underground aquifers

Undermining research and teaching integrity

Water contamination

Methane leakage and climate damage

UNKNOWN:

- How much money the energy corporations have given UQ for the new Centre.
- Whether any conditions are attached to that money.
- Will UQ investigate whether CSG really is the clean energy source the energy corporations claim.
- Will UQ investigate the impacts of CSG on groundwater and the Great Artesian Basin.
- Will UQ investigate the social impacts of CSG extraction.

That's just how the big energy corporations like it.

Chris Moran

Authorising Officer

They own this Permit, they own your research institution.

Ministry of Whimsy

Responsiveness of communications

- Some criticism of the CCSG web site
- Some direct questions from various people and groups, eg UQ Climate for Change (CfC) 10 January 2012
- 13th January 2012 – CCSG responded with the following email:

  'Thank you for your recent email to Professor Chris Moran regarding UQ's Centre for Coal Seam Gas (CCSG).

  We have received a number of requests from UQ staff and students asking for further details about the Centre, as well as information on coal seam gas more broadly. As such, the Centre's Interim Director, Professor Moran, will hold an information session early in the academic year to address some of the issues raised. There will be a presentation on the CCSG and the opportunity for attendees to ask questions. This forum will be open to all UQ staff and students.

  I will forward details of this event to you once they have been finalised. In the meantime, please feel free to contact me should you have any further questions.'

Risk report to State government in 2008

Centre for Water in the Minerals Industry
Sustainable Minerals Institute
University of Queensland
Brisbane 4072
Australia

CWiMI

Purpose: *To facilitate the capture of benefits from opportunities associated with sustainable water management in the minerals industry*

Scoping Study:

Groundwater Impacts of Coal Seam Gas Development

– Assessment and Monitoring

Prepared for

Mr. Mal Helmuth

Executive Director LNG Projects

Infrastructure and Economic Development Group

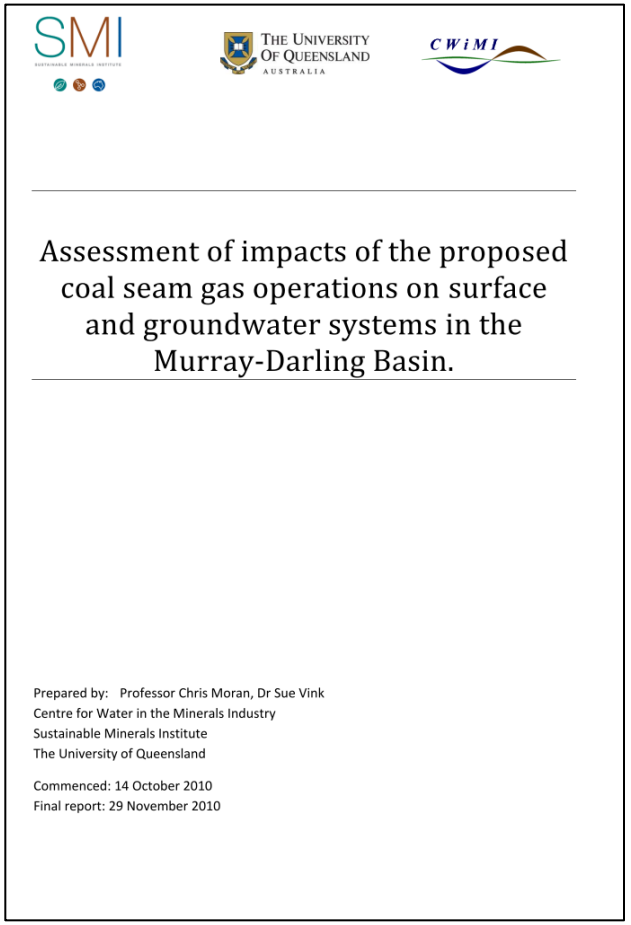
Department of Infrastructure and Planning

Document reference: P08-010-002.doc

Project Team: ... and Chris Moran

CCSG Communications

- 2012
  - AMP Capital CSG Forum ‘Provide Technical Insights on the water and farming land issues around extracting CSG’
  - Presentation to CITI Investments ‘Managing Water from Coal Seam Gas Development’
  - Expert Panel of Coal seam gas Issues Management Workshop for Department of Primary Industries in Victoria ‘Industry Best Practice’
  - QUPEX Presentation ‘Coal Seam Gas: Context, Issues and (some) Solutions’
  - Independent Expert Committee for CSG and large coal mines (Dr S Vink)
- 2011
  - Global Change Institute University of Queensland
  - JKMRC University of Queensland
  - Briefing to Queensland Premier, Treasurer and Minister for Resources Offices
  - Briefing to Federal Minister for Resources, Energy and Tourism
  - Australia-Israel Chamber of Commerce ‘CSG – The Impact on Australia's Economy’
  - Briefing to Texas A&M
  - Briefing to University of Colorado, Boulder and Colorado School of Mines
  - Guest on Insight Program regarding Coal Seam Gas
  - Guest Speaker of Triple J’s Hack Program
  - Presentation to National Water Commission ‘Managing Water from Coal seam Gas Developments’


SMI
The University Of Queensland AUSTRALIA
CWiMI

Assessment of impacts of the proposed coal seam gas operations on surface and groundwater systems in the Murray-Darling Basin.

Prepared by: Professor Chris Moran, Dr Sue Vink
Centre for Water in the Minerals Industry
Sustainable Minerals Institute
The University of Queensland

Commenced: 14 October 2010
Final report: 29 November 2010

Regularly presented as part of general briefings on the Sustainable Minerals Institute

In what manner is “independence” practically defined?

- In today’s research environment there are only two national sources of research support based on merit of science: Australian Research Council Discovery and the NH&MRC

- All other forms of research funding involve private interests – including philanthropy

- State and federal government schemes strongly encourage private involvement in which the private component has a direct say in what research is undertaken, eg, Smart State, ARC Linkage, CRC’s, rural industry research and development corporations (GRDC, CRDC, DRDC, RIRDC, MLA etc). ACIAR and Ausaid dictate the research topics for their investments

The key issue is opportunity for researchers to propose ideas and to be clear of influence in the carriage of research, the reporting of results and exploitation of intellectual property

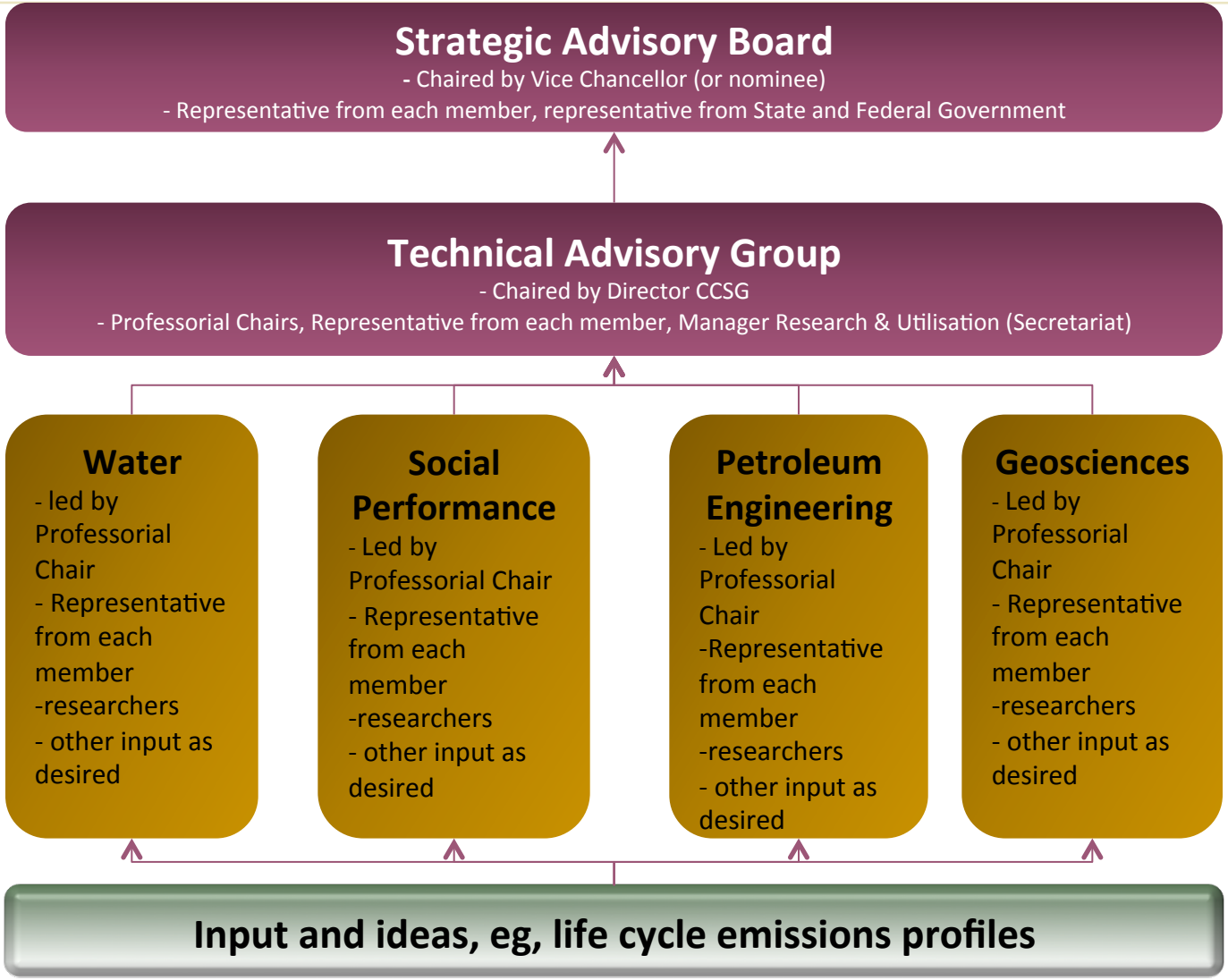
Governance

- Development Board: Chair DVC(Research)
  - Engagement of UQ capability
  - Balance of the project portfolio
- Strategic Advisory Board: Chair VC of nominee (Prof Chris Greig)
  - Each Member nominates a representative, 2 x UQ, Director CCSG, state and federal government observers, QWC
  - Guidance on knowledge gaps and directions
  - Project final prioritisation (voting by blocks if necessary)
  - Overview of project output delivery
- Technical Advisory Group (TAG)
  - Government, member representatives, researchers, collaborators, others(?)
  - Project development and initial prioritisation

Independence, project sources & types

- Any researcher can undertake research into any topic they can resource as long as it does not violate employment conditions of the university
- No researcher can be required or coerced to work on any project
- UQ is not required to develop or work on any project or area
- UQ can choose not to work on any project
- Membership funds – core projects
- UQ has casting vote on all matters
- Non-core projects: Business as usual for any researcher or research centre in any university in Australia, eg, ARC, CRC, contract research

Development of core projects (1)



Development of core projects (2)

- Projects are developed by researchers in dialogue with government and industry (role for broader community input being thought through)
- Pre-competitive
- UQ owns intellectual property
- Public domain publishing
  (assuming UQ doesn't take a decision to commercial IP and company confidential information is not disclosed)
- Project portfolio transparent
- Members have a say in the projects selected and if voting is required vote is in proportion to financial contributions.
  This deals with disagreement on priorities between members it does NOT set a requirement on UQ or any researcher

CCSG engages capacity from across UQ

- Advanced Water Management Centre
- Centre for Mined Land Rehabilitation (SMI)
- Centre for Social Responsibility in Mining (SMI)
- Centre for Water in the Minerals Industry (SMI)
- Institute for Social Science Research
- National Research Centre for Environmental Toxicology
- School of Agriculture and Food Sciences
- School of Chemical Engineering
- School of Civil Engineering
- School of Earth Science
- School of Mechanical & Mining Engineering
- School of Population Health
- School of Social Science

Collaboration, resources & Australian expertise

- Main capability
  - CSIRO – GISERA & other more technically-focused groups
  - University of NSW
  - University of Adelaide
  - Curtin University
  - University of Western Australia
  - CO2 CRC (CCS technologies and practice)
  - National Groundwater Research and training Centre (emerging interest)
- Major resourcing
  - GISERA – CSIRO ($2m) and APLNG ($10m)
  - CCSG - industry ($15m)and UQ ($5m)
  - NCGRT – ARC, National Water Commission, super science
  - Independent Expert Committee for CSG and large coal mines ($150m)
  - State governments (research expenditure ?)

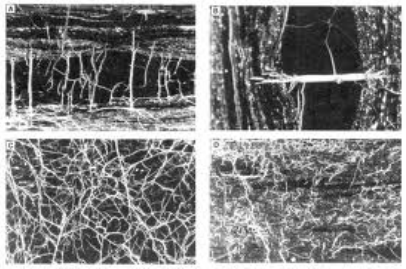
Initial Themes

UQ intends to seek world class expertise for professorial Chairs for each of it's research areas:

- Hydrogeology and treatment of coal seam water

- Geophysics and geochemistry in CSG

- Petroleum Engineering



- Social Performance and community impact

Multiple Issues – first round projects under development

- Fossil fuels
  - renewables leap frogging — No proposed projects
  - CSG CO_2e emissions — Initial scoping study indicated this essentially a measurement challenge
- Agricultural land and open cut coal mining — No proposed projects
- Farming lifestyles / culture — Cumulative impacts assessment (Prof D Brereton); Indigenous employment and economic opportunities (Prof D Trigger)
- Fragmentation — No current proposals in biodiversity
- Water — Agriculture - CSG interactions and compatibilities (Prof N Menzies)

WATER – first round projects under development

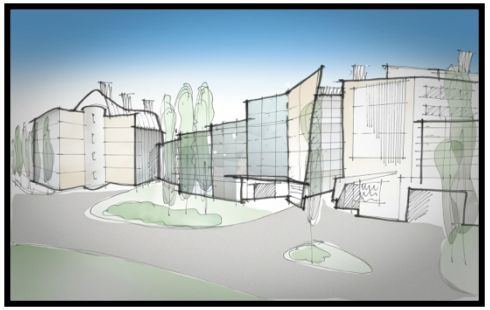
• Aquifer interactions	Improved cements for well completion (Prof V Rudolf) Water quality Atlas (A/Prof S Vink) Aquitard characterisation and regional stratigraphy (Prof J Esterle)
• Hydraulic fracturing	Minimum disturbance permeability enhancement (Profs V Rudolf & S Golding) Fraccing fluid reactivity (Dr K Steele – existing work)
• Surface water storage	Existing work in SLAFS (Prof N Menzies)
• Water treatment & Brine management	Fines and solids production processes (Profs V Rudolf & S Golding)
• (Re)-injection	Reinjection targets (TBA)
• Ecosystems & surface water releases	Water Quality Atlas (A/Prof S Vink)

Education – Teaching and Learning

- CCSG will play a key role in the delivery of new undergraduate and postgraduate coursework programs
- CCSG will provide intensive professional development courses
  - Informed by research developments
  - Up-skilling the existing workforce
  - An introduction for professionals new to the industry
- Undergraduate ‘Minors’ being explored
- Post-Graduate Coursework
  - Masters of Science and Petroleum Engineering
  - Other postgrad courses being scoped
- Increase in research higher degree cohort (PhD & Masters)

Opportunities for Involvement

- Project participation
- Membership – core projects
- Infrastructure Funding
- Non-core projects
- Contribution to Centre Capability
  - Major Research Equipment
  - Supporting staffing, eg, Chairs



Prof Chris Moran – current government advisory roles

- Expert Panel for Major Coal Seam Gas Projects (federal government)
- Interim Independent Expert Scientific Committee for Coal Seam Gas and Large Coal Mines (federal government)
- Healthy Head Waters Coal Seam Gas Water Feasibility Study (state government)
- National Groundwater technical Advisory Committee (GTAC)
- Resources Sector Supplier Advisory Forum (federal government)
- Underground Coal Gasification Independent Scientific Panel (state government)

QUESTIONS