Coal Seam Gas Development
Environmental Impacts

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Outline

- Unconventional gas resources and CSG
- Resource management in Queensland and elsewhere
- Environmental authorities
- Environmental impacts
- Hydraulic fracturing
- Other issues
Unconventional gas resources and CSG
World Energy Consumption
(Quadrillion Btu)
Hydrocarbon resource triangle

- **High quality**
  - Tight gas
  - Coal seam gas
  - Shale gas
  - Gas hydrates
  - 1,000 md
  - Small volumes easy to develop
  - Increasing need for hydraulic fracturing

- **Medium quality**
  - Low permeability oil, shale hydrates
  - Low quality
  - Oil shale hydrates
  - 10 md
  - Large volumes difficult to develop

- **Low quality**
  - Gas hydrates
  - 0.1 md
  - Decreasing permeability
  - Increasing cost

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US Coal Seam Gas Basins
Australia Conventional Gas and CSG
Petroleum Tenures
Resource management in Queensland
Queensland Legislation and functions

- Petroleum and Gas (Production and Safety) Act
  - Department of Mines and Energy
  - Tenure
  - Process safety
  - Front line management

- Environmental Protection Act
  - Department of Environment and Heritage Protection
  - Environmental protection
  - Audit/compliance

Tenure and Environmental authority
CSG regulation in the US (Wyoming)

- Oil and Gas Conservation Commission
- State Engineers Office
- Department of Environmental Quality
- Bureau of Mines and Geology
- Environmental Protection Agency (Fed)
- Bureau of Land Management (Fed)
Environmental authorities
Environmental Authority Model Conditions

- General conditions
- Water
- Groundwater
- Regulated structures
- Land
- Disturbance to land
- Environmental nuisance
- Air
- Waste
- Rehabilitation

- Well construction, maintenance and stimulation activities
- Community issues
- Notification
- Sewage treatment
- Release to water of good quality CSG water
- Disturbance to land with biodiversity values
Environmental impacts
Seismic line
Light weight vertical drill rig
CSG well, power supply and water
Pennsylvania countryside

• Shale gas wells
Instant tank
Aggregation dam
Severe erosion to dam wall
Pivot irrigation, Wyoming
Pipeline and cattle crossing
Condamine River crossing

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Compressor station
Compressor station
Main line compressor
Well integrity problem
Surat Basin Hydrogeological Model
Cumulative Management Area
Hydraulic fracturing
FRACKING: the debate
THE UNBALANCED RESPONSE...
FRACKING: the debate

THE UNBALANCED RESPONSE...

THE BALANCED RESPONSE...
Typical frac spread for shale
Frac Fluid Make-up

Source: ALL Consulting based on data from a fracture operation in the Fayetteville Shale, 2008
Hydraulic fracturing risk

• Detailed understanding of the local stratigraphy including aquifers, faults, linear features, hydraulic conductivity, porosity, seismic risk and groundwater dependent assets
• Installation of a multi-barrier casing string isolating hydrocarbon bearing formations from water resource aquifers and currently demonstrating internal and external mechanical integrity
• Requiring the presence of vertically
Hydraulic fracturing risk mitigation: 2

- Ensuring injected fluids have low human toxicity, eco-toxicity and contain no persistent, bio-accumulating constituents
- Applying advanced process control incorporating real-time analysis, fracture modelling and formation understanding utilising techniques such as microseismic measurements
- Detailed engineering understanding of the impacts of production drawdown on connectivity to aquifers above and below the fractured zone subsequent to the hydraulic fracturing activity
- To initiate and maintain a high level of effective
Barnett Shale gas wells, Texas
Other issues
Land access issues

I'll give you 500 clams to let me drill on your land.

Well, I don't know...

The drill only takes up half an acre -- you have 50! You won't even notice it's there!

That sounds reasonable.
Issues

• Strategic Cropping Land
• Health issues
• Competing tenures
• Salt
• International Network for Environmental Compliance and Enforcement
Questions?