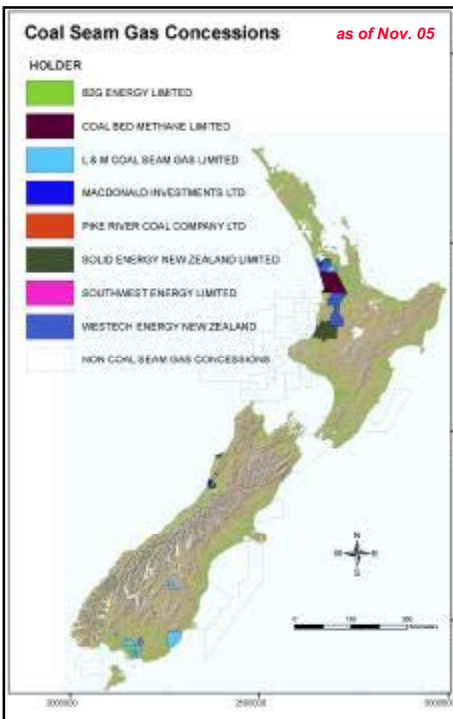


Cracking the CSG Code with the three R's: Reasoned, Rigorous and Responsive Development

Tim A. Moore¹ & Greg Twombly²

¹*Solid Energy NZ Ltd., Christchurch, New Zealand*


²*Resource Development Technology LLC, Denver, U.S.A.*



CSG Exploration in New Zealand

- *Some early evaluations by Ministry in 1980s*
- *Southgas experiences in the 1990s*
- *Westgas developments early 2000s*
- *Exploration of low rank coals*
 - *Kenham L&M Group*
 - *RDT*
 - *Solid Energy*
 - *Bridge/Westech*





Waikato Prospect

- Nov. 2002: *RDT awarded PEP*
- Nov. 2004: *CBM Ltd. JV formed Nov. 2004*
- June – Oct 05: *Exploration phase in Huntly Coalfield*

THREE STAGE APPROACH

1. *Initial basin assessment*
2. *Basin wide exploration*
3. *Appraisal wells*

Expected outcomes of each stage

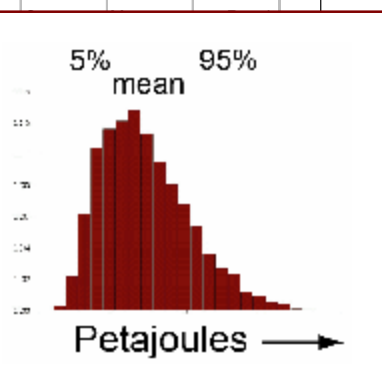
<i>Initial Assessment:</i>	→	<i>Indicative gas in-place</i>
<i>Exploration:</i>	→	<i>Gas volume, quality & water quality</i>
<i>Appraisal:</i>	→	<i>Flow rates (gas & water), completion technologies, permeabilities</i>
		↓
		<i>Field Development</i>

Stage 1: Initial Basin Analysis

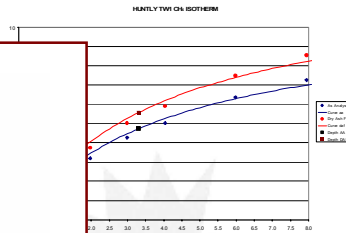
Reported coal volumes

Sector	Coal (Mt)
Churchill	
Horohoro	1
Rangiriri West	1
Huntly West	3
Okowhao	2
Huntly East	
Ralphs	
Weavers	
Kupakupa	
Raynors	
Total	1,0

Reported gas quality



Reported gas volume



Stage 2: Exploration Drill Holes

Location selection based on:

- Geology (seam thickness, depth)
- Previous reported gas shows
- Access
- Geographic spread



Stage 2: Data Collection

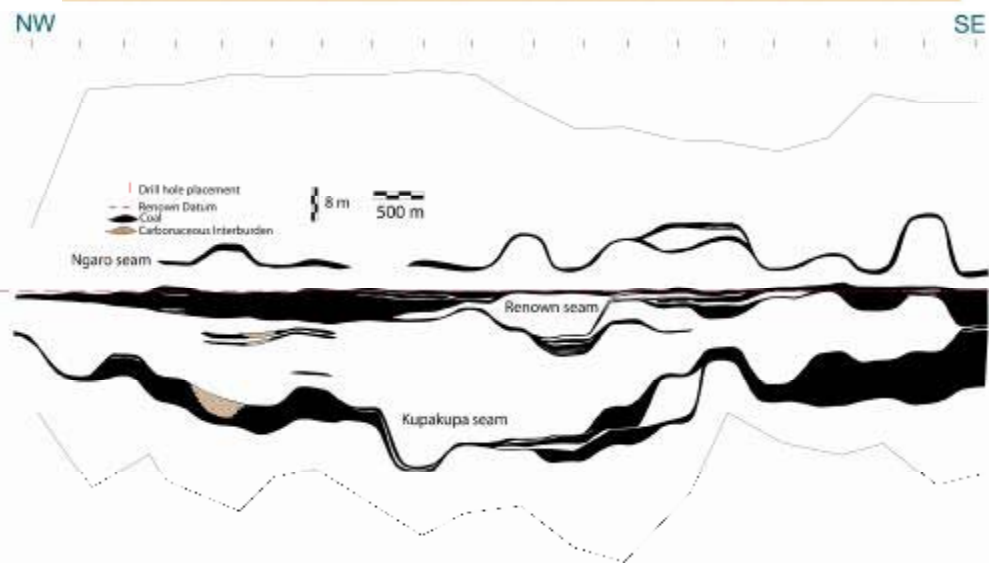
More detail in –

Reservoir delineation (volume)

Reservoir character (gas in place & flow)



Stage 2: Detailed Correlations of Reservoirs





Stage 2: Structural Re-interpretation

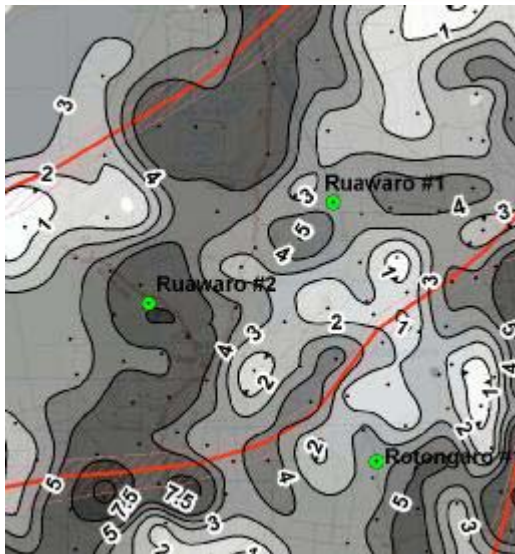
•Structural model for:

- Renown coal seam
- Kupakupa coal seam
- Basement

•Probability assessment of faults:

- Missing ~50% of faults <10m
- Fault spacing 600 – 800 m

Stage 2: Detailed isopach & structural models



- Completed while drilling
- Refinement of reservoir vol. model
- Depth related to gas volume model

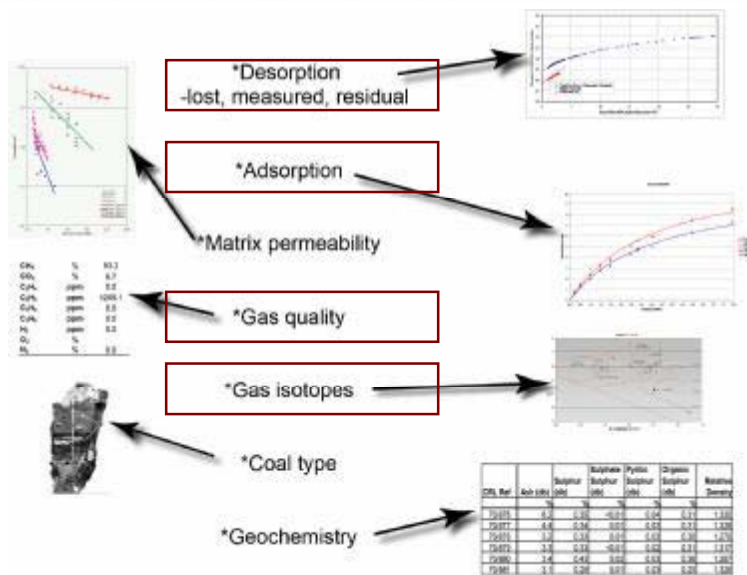
Stage 2: Data Collection

More detail in –

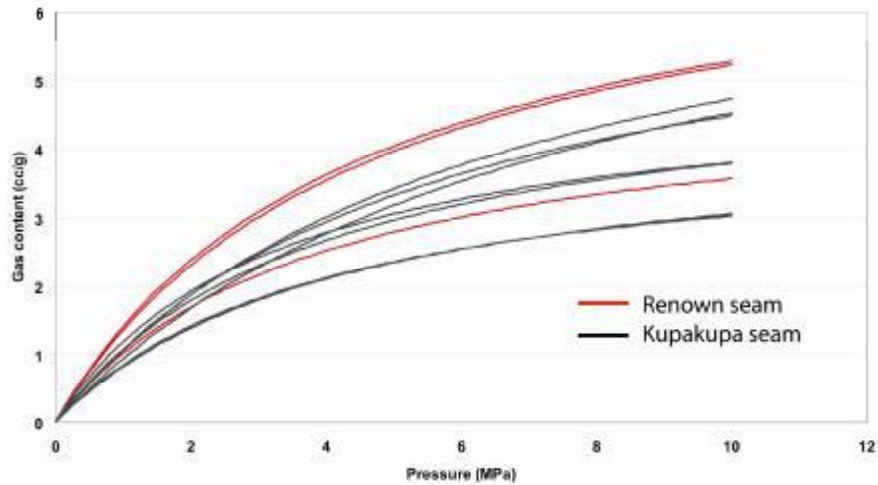
Reservoir delineation (volume)

Reservoir character (gas in place & flow)

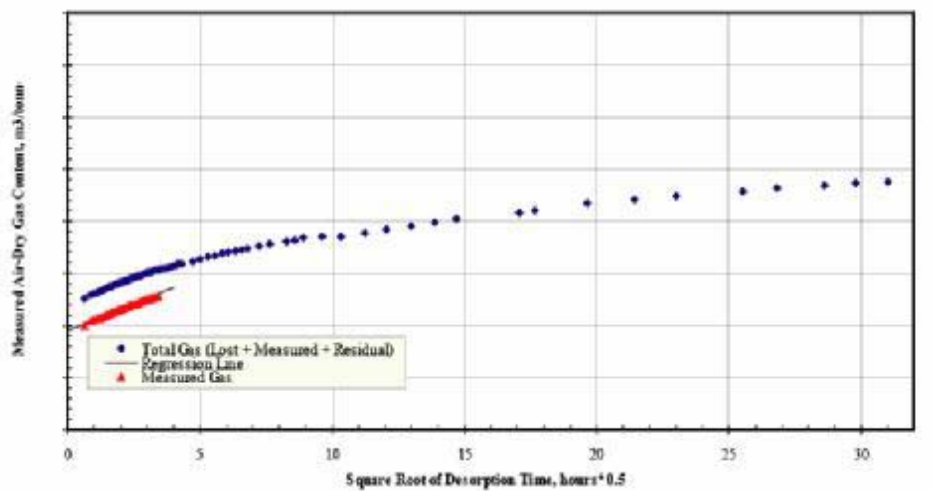
Stage 2: Reservoir Character Data Types



Stage 2: Holding Capacity (Adsorption)



Stage 2: Measured Gas Content (Desorption)

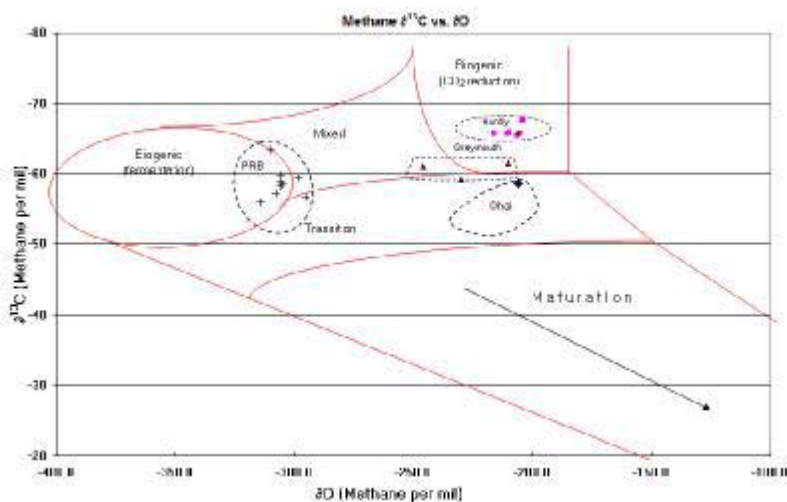


Stage 2: Gas Quality

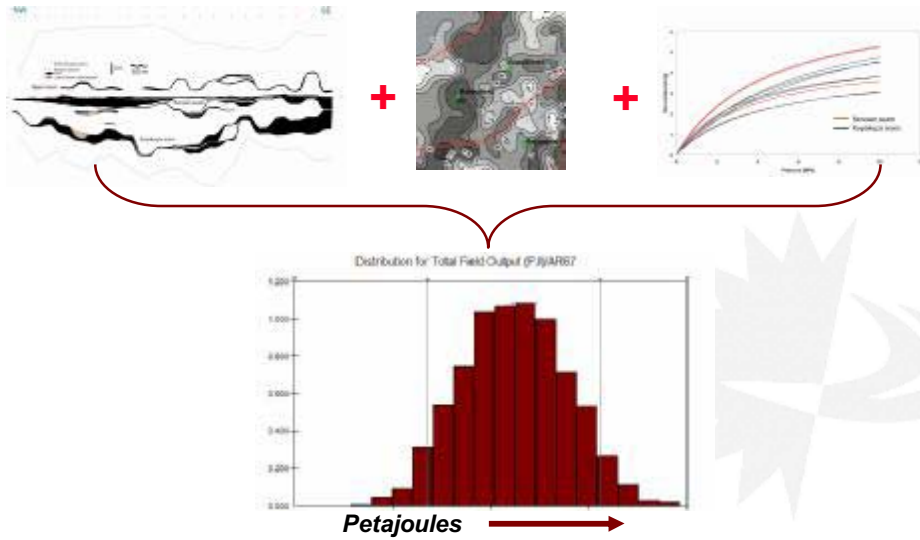
Gas	basis	Mean	Stand. Dev.
CH₄	%	98.43	1.77
CO ₂	%	1.52	1.77
C ₂ H ₄	ppm	0.00	0.00
C ₂ H ₆	ppm	338.72	280.38
H ₂	ppm	154.90	403.96
O ₂	%	0.00	0.00
N ₂	%	0.00	0.00

n = 41

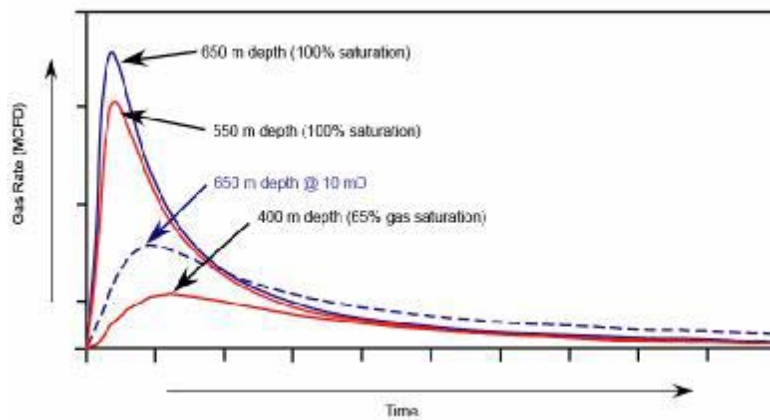
Stage 2: Origin of Gas – Isotopic Analysis



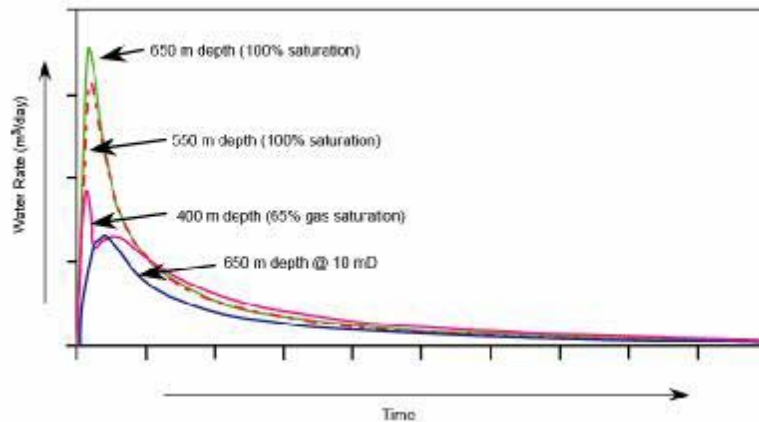
Stage 2 Output: Gas in-place uncertainty



Stage 2: Gas flow modelling - Scenarios



Stage 2: **Water** flow modelling - Scenarios



Outcome – Next Stage

Stage 2: **Exploration results**

- *Gas in-place good (25 – 200 PJ)*
- *Gas quality great (98%)*
- *Gas flows good, 2-5 PJ/yr*
- *Water quality good*



Stage 3: **Appraisal Well Drilling**

- *Five closely spaced wells (~450m)*
- *Test permeability (reservoir character)*
- *Determine completion methodology*
- *Establish gas flow profiles*



Conclusion

- **Exploration phase successful:**
 - Reservoir & gas data good
- **Appraisal phase underway:**
 - Begin drilling April 06
 - Testing for 4-8 months
- **Decision to go forward:**
 - By March 07
- **Commercial development of gas:**
 - Possibly by Feb. 08