Camden Gas Project Status

- AGL acquired operatorship from Sydney Gas February 2006
- 106 production wells drilled since 02/99, of which 71 producing (9 deviated, 4 SIS, 93 vertical)
- PPL 5 granted 27th February 2007
- Completed 82km 2D Mini-SOSIE seismic program late 2006
- 3 compressors now installed at Rosalind Park Gas Plant
- Currently producing ~14.5TJ/day, ramping up to 20 TJ/day by year end
- Evaluating potential of tight conventional gas sandstones
- Second campaign of SIS pilots to spud 07/07
- Current 17 well frac program with BJ services
Current Project Constraints

• Surface
  - Land Access & Regulatory Approvals
  - Encroaching & existing developments
  - Noise & light emitted during 24hr operations

• Sub-surface
  - Bulli seam split
  - Relatively untested Balgownie production potential
  - EM steering tools: Signal strength diffusion
  - Data control for inaccessible areas
Reservoir Characterisation

• Full field geostatistical analysis and production history matching undertaken in 2006 for the Bulli seam wells
• 3 sub economic reservoir provinces identified and classified based upon key reservoir characteristics and production
  - Under saturated coal (<11 m³/t indicated by >1% ethane)
  - Lower effective permeability coal (lower kh relationship)
  - Lower kh & under saturated coal (combination)
• Remaining acreage identified as priority drilling until production can be proven within sub economic provinces
• SIS drilling proposed as most likely completion method to achieve the greatest reservoir coverage and establishing economic production from within these provinces
SIS Pilot Program

• EM21/22 trial SIS well online for ~3½ years
  - Producing only marginally more than offset verticals
  - Final well geometry deemed unfavourable (spoon & dome)
  - Geologically unfavourable location
  - Barefoot completion maintaining stable wellbore conditions

• A 9 well pilot program was proposed to further test the horizontal production potential of the Bulli seam

• Initially, one well offset from a proposed horizontal Bulli completion will be drilled to test the Balgownie seam production potential
SIS Pilot Program – initial trials

- Three wells of the pilot program have been successfully completed to date

**GL14**
- 25 days drilling
- 1994m TD
- Slotted PVC liner run
- No sump drilled

**GL15**
- 29 days drilling
- 2031m TD (main)
- 1634m TD (sidetrack)
- Barefoot completion
- Sump drilled

**EM34**
- 30 days drilling
- 1965m TD
- Barefoot completion
- Sump drilled
SIS Pilot Program – initial trials

• GL14 & GL15 drilled based upon
  – optimal reservoir and geological conditions
  – highest average offset vertical production

• EM34 based upon
  – need to test higher risk well location
  – no proximal offset production

• Well paths oriented ~50° orthogonal to face cleat & fractures
  – intersecting maximum number of cleat & fractures whilst maintaining well bore stability
  – drilling up dip or slightly up dip eliminating the need for a vertical intersect well. Water production is historically very low
GL14 & GL15 Well Paths

VE = 1:18
Results To Date

- **GL14**
  - Initial completion failed & required early workover
  - Early production signs excellent
    - Spikes over 2.1 MMcfd (688 L/s)
    - Now steadily increasing from 0 – 700 Mcfd (0 – 229 L/s)
    - Water production via a velocity string

- **GL15**
  - High losses to formation upon drilling
  - Still producing relatively high amounts of water via velocity string
  - Steady production increase now over 1.2 MMcfd (393 L/s) and climbing

- **EM34**
  - Under saturated province boundary closer than anticipated
  - Well currently cleaning up, not expected to see production rates in excess of 500 Mcfd (163 L/s)
• Under-balanced air drilling vertical wells
• Over-balanced mud drilling deviated wells
• Over-balanced, long radius surface to inseam (SIS) horizontal wells
• CBM & tight conventional gas exploration
• Tight radius drilling (TRD) trials—Moranbah field
• Rig 15# assigned well type and drilling method

• Drill 15” conductor hole to 10m

• Air drill 11 7/8” Hole to 140m

• Install & cement 8 5/8” surface casing

• Air drill 7 7/8” Hole to +700m

• Install & cement 5 ½” production casing

• Allow drift of no greater than 3 degrees verticality
Deviated Mud Drilled Well Profile

- Batch drill surface hole with air (Rig #15)
- Install 8 5/8” surface casing to 100m
- Rig up circulating system Rig #16 and drilling assembly
- Drill deviated hole at 4.5 degrees/100ft build rates
- Drill 7 7/8” bit to build and hold / build, hold and drop well paths
- Deflection distance from hole centre ~400m
- 30–45hrs of actual drilling time for deviated section
- Using continual electro–magnetic (EM) steering systems
SIS Horizontal Well Profile

- 12 ¼” surface hole to 100m cased & cemented 9 5/8” casing
- 8 ½” intermediate hole deviated to ~85 degree inclination
- Cased & cemented with 7” casing after tagging top of target seam
- 5 7/8 ” hole horizontally through target seam +1500m
- Total +2300m MD

SIS Well Schematic
Long, Medium & Tight Radius Well Paths
Future Drilling Methods
Applications & Constraints

- Multi-lateral and multi-seam wells
  - accessing Bulli & Balgownie seams utilising the same build section
  - reduced incremental costs
- Medium radius drilling with coil tubing
- Batch drilling multiple wells on single sites
- 24hr/7 day operations to support quality drilling contractors
- Sound levels and lighting requirements
- Fully automated drilling improves safety & reduces risks
- Continual monitored gas sampling including QED making
- Site access and approval for long term planning requirements
Future Drilling Methods Considerations

- Wells drilled: reducing $ spent / days drilling / returns generated
- Equipment levels, training proficiencies, skill sets
- Down hole data acquisition while drilling
- Logging while tripping
- Closed loop circulating systems, solid control systems
- Low filtrate, low intrusive mud types, homogenous
- Chemically enhanced well stimulation trials at end of drilling
- Data management, data acquisition via digital Geolograph
- Satellite uploaded real time drilling parameters to all users
- Rig viability with 24hr 7 day/week operation induces critical mass
Implications for Successful Trials of SIS Drilling Technology

- Significantly reduce well density & overall footprint
  - alleviate up to 4 vertical surface locations per SIS drilled
  - multiple SIS from single well pad
  - access roads and gathering network less complicated
  - environmental impact minimised
- Access to stranded resource
  - considerable addition to booked reserves
- Effective resource management
  - multi-seam production
  - sub economic provinces, may include fracture stimulation
- Refined operational practise
  - drill fluid reclamation, flocculation, recycling
  - drill fluid programs to support environmental considerations as well as petrophysical constraints
  - drill cutting segregation and solid control systems
ADR– Super Single
ENSIGN AUSTRALIA
Semi-Conventional Coiled Tubing Rig