Nappamerrri Trough Natural Gas – Project Update
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Nappamerringi Trough Natural Gas

- A staged and methodical exploration and appraisal program
- Delineation of a significant untapped resource
- Flexible program to adjust to results
- Multiple formations present
- Process takes time and each piece of information important
- Mid-stride in an important stage of our assessment
- Moving up the learning curve

Permian section equity interests: PEL 218 (Beach 70% and operator, Chevron 30%) and ATP 855 (Beach 46.9% and operator, Chevron 18%, Icon Energy 35.1%)
Confirmation of resource potential

- Proven gas saturated target zones
- Established ability to fracture stimulate
- Established ability to flow gas from target zone
- Initial volumetric estimates and resource booking
Learning curve

**Vertical and horizontal exploration phase**

- Geographically and vertically delineate target zones
- Build conceptual geological models
- Experiment with different stimulation techniques
- Increase resource booking with new wells
- Gain information on subsurface fracture stimulation
- Gain preliminary information on deliverability
Learning curve

Continued appraisal
- Determine production variability
- Build resource confidence
- Potential small scale pilot
Learning curve

Pilot projects

- Stepwise optimisation:
  - Refine well design and stimulation
- Build deliverability
- Scale efficiencies
- Targeted development
Learning curve

**Development**
- Ongoing optimisation
- Competitive services
- Infrastructure expansion
Exploration concept

- **Rocks**
  - Porosity
  - Gas content
  - Maturity
  - Stress
  - Permeability

  **Target intervals**

- **Technology**
  - Drilling
  - Tiltmeters
  - Microseismic
  - Coil tubing
  - Fluid tracers

  **Productivity**

- **Flow tests**
  - Zonal contribution
  - Geographical variation
  - Rate transient analysis

  **Productivity**

  **Target intervals**
Exploring rocks – regional scale

• Contributing to delineation of gas in place through the study of:
  – Trough architecture
  – Depositional environments
  – Maturity variation

• Contributing to understanding of productivity through the study of:
  – Structural history
  – Stress orientations and magnitudes
  – Geological facies variation
  – Overpressure
Exploring rocks – well scale

- Contributing to delineation of gas in place through the study of:
  - Organic content
  - Diagenesis
  - Porosity preservation
  - Lithology heterogeneity
  - Gas saturation

- Contributing to understanding of productivity through the study of:
  - Natural fracture distribution
  - Mechanical properties of the rocks
  - Permeability variation
  - Rock-fluid interactions
Exploring rocks – micro scale

- Contributing to delineation of gas in place through the study of:
  - Micro porosity distribution
  - Adsorption capacity in shales
  - Free gas characterisation
  - Porosity enhancement through diagenesis

- Contributing to understanding of productivity through the study of:
  - Pore connectivity
  - Pore throat size distribution
  - Bound water behaviour
  - Micro fractures

Boston-1 Roseneath Shale, horizontal field of view ~20μm
Exploring technology

Increased understanding of the rocks resulting in reduced drilling times.
Exploring technology

- New well design and stimulation designs are being evaluated
- Stimulation/isolation methods:
  - Sand plugs (applied)
  - Flow through stimulation plugs (applied)
  - Coil tubing jetting (being utilised)
  - Coil conveyed stimulation (considering potential for downhole mixing)
  - Sleeve techniques (in consideration)

Down hole mixing of water and proppant
Source: Halliburton
Exploring flow rates

- **Holdfast-1**: 7 stages, 2.0 MMscfd
- **Holdfast-2**: 9 stages, awaiting flow test
- **Moonta-1**: 10 stages, 2.6 MMscfd
- **Encounter-1**: 6 stages, 2.1 MMscfd
- **Halifax-1**: 14 stages, 4.5 MMscfd
- **Streaky-1**: 9 stages, awaiting flow test
- **Marble-1**: 12 stages, awaiting flow test
- **Nepean-1**: 12 stages, awaiting flow test
- **Redland-1**: awaiting drilling
- **Geoffrey-1**: currently drilling
- **Rapid-1**: awaiting stimulation
- **Boston-1**: currently drilling
- **Boston-3**: awaiting stimulation
- **Keppel-1**: gas to surface unstimulated
- **Dashwood-1**: awaiting stimulation
- **Holdfast-2**: awaiting stimulation

Nb. Subject to JV approval. Stated flow rates are peak flow rates.
Exploration and appraisal cross section

Note: Well locations are approximate only and may have been shifted to show their correct structural position on the cross section.
Holdfast-2 update

- Holdfast-2 drilled laterally into the Murteree shale
- Fracture stimulation completed
- Stimulation monitored by both downhole and surface micro-seismic tools as well as tiltmeters
- Utilised monitoring technology to trial different fracture stimulation designs to increase understanding of formation response to:
  - Change in fluid types
  - Different stage volumes
  - Perforation/jetting options
- Clean up flow commenced
- Initial flow data expected by mid-December

New technology being applied to optimise future stimulation design
Focused learning – Boston

- Boston area selected for detailed program due to:
  - Strong gas shows while drilling
  - Good reservoir quality
  - Proximity to raw gas line
- Boston-3 horizontal well drilled in the lower Murteree Shale
- Boston-2 drilled in optimal location to micro-seismically monitor fracture stimulation in Boston-1 and Boston-3
- Boston project aims to increase understanding of:
  - Sand body continuity
  - Well spacing
  - Fracture geometry
  - Stimulated rock volume
  - Optimal fracture spacing
NTNG wells and proposed timeline

Note: Timeline subject to third party equipment delivery, weather and joint venture and regulatory approvals