Arrow Energy

Arrow’s Bowen projects

Bowen Gas Project and Arrow Bowen Pipeline

March 2015
We acknowledge the Traditional Owners of the land where we gather today and pay respect to Elders past and present and to emerging community leaders. We also acknowledge the important role of Aboriginal and Torres Strait Islander people within Arrow and the communities we work with.
Session overview

About Arrow

- CSG in the Bowen Basin
- Project status
- Bowen Gas Project phase one
- Arrow Bowen Pipeline
- Local opportunities
About Arrow

• Stand alone company owned 50/50 by Shell and PetroChina
  • ~41,500 km² tenure over two major production basins
  • ~350 exploration/pilot/appraisal wells
  • ~890 production wells

• Supplies almost 20% of the Queensland domestic gas market

• Domestic gas operations
  • five gas production areas across two basins
  • Tipton; Daandine; Kogan; Stratheden
  • Moranbah Gas Project (MGP) (50/50 JV with AGL)

• Power supply
  • Braemar 1, Braemar 2 (100%), Daandine, Swanbank
  • Moranbah, Yabulu
  • Enough power generated for 800,000 average-sized Queensland homes
Session Overview

- About Arrow
- CSG in the Bowen Basin
- Project status
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- Arrow Bowen Pipeline
- Local opportunities
• CSG is natural gas trapped in underground coal beds by water and pressure
• To extract CSG a 300-750 m deep well is drilled
• Water is pumped from the coal seams to release gas
• Gas and water flow up the well to the surface separately
• Wells are constructed using multiple layers of steel casing. The exterior of the casing lengths is cemented from the bottom to the surface ensuring isolation of coal seams from any potential groundwater aquifers
• At the surface, CSG is treated and compressed for transportation to Gladstone via a high-pressure steel pipeline
• Commercially produced in Queensland for more than 15 years
• Gas-fired power stations create less than half the greenhouse gas emissions of equivalent sized coal fired power station
- **Basin geology**
  - Surat – multiple thin coal seams with good permeability which means vertical or deviated wells are used
  - Bowen – small number of thicker seams with lower permeability, which means horizontal (multibore) wells are used

- CSG water production – significantly lower in Bowen Basin

- ‘Multi-lateral’ wells - horizontal wells that run along the coal seams with multiple laterals from central bore
  - typically combined on a multi-well pad
  - significantly reduces footprint
About Arrow

CSG in the Bowen Basin

Project status

Bowen Gas Project phase one

Arrow Bowen Pipeline

Local opportunities
## Bowen Gas Project

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<th>Details</th>
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<tr>
<td>Queensland Government approval</td>
<td>- State Government approval BGP Environmental Impact Statement (EIS) September 2014</td>
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<tr>
<td>Federal Government approval</td>
<td>- Federal Government approvals BGP EIS October 2014</td>
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</tbody>
</table>
| Next steps | - Environmental Authorities  
- Define phase, including Front End Engineering and Design, and pre-award contract management  
- Tender packages  
- Conduct and Compensation Agreements for access to the construction area |

## Arrow Bowen Pipeline

<table>
<thead>
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| Next steps | - Environmental Authorities  
- Define phase, including Front End Engineering Design  
- Propose route has been established based on feedback from various stakeholders (including landholders)  
- Construction tender process has commenced |
Project Status

- Concept studies
- Pilots and geotechnical surveys
- Define phase
- Construction
- Production

- Environmental Impact Statement (EIS)
- Supplementary Report to the EIS
- Shareholders Final Investment Decision

Range of project design

- BGP and ABP today
Development regions, starting from Moranbah and extending north to Glenden

Three project phases:
1. Moranbah extending North to Glenden
2. further north
3. south of Moranbah

Phase one:
• Concept planning complete for phase one of the project (Moranbah to Glenden)

Information is currently being collected to further define (engineering) phase, including landholder discussions and geotechnical surveys
Phase one infrastructure:

- **500 wells**
- **FCF**
  - Four Field Compression Facilities (FCF) to boost the gas pressure for transport to the CGPF

- **CGPF**
  - One Central Gas Processing Facility (CGPF)

- **ARROW BOWEN PIPELINE (ABP)**

- **Low pressure water and gas gathering pipelines (from wellheads to FCF)**
- **Medium pressure infield pipelines (to transport gas from FCF to CGPF)**
Field Compression Facility:

- receives gas, through gathering lines, from an area of wells
- boosts gas pressure (low to medium) to move gas to CGPF
- includes a water transfer station (storage tanks and pumps)
- construction ~12 months/FCF
- operational life ~25-30 years
Central Gas Processing Facility:
- receives gas from FCF via medium pressure pipelines
- dries and compresses the gas
- co-located infrastructure:
  - Water Treatment Facility
  - water storage dams
  - offices for maintenance staff
  - accommodation village
  - marshalling yard
- construction ~4 years in total for early works and to build the CGPF
- operational life ~25-30 years
Accommodation Village

- accommodation village near the proposed CGPF
- current Expression of Interest to market will assist to progress planning
- will also consider accommodation available locally and local accommodation allowances
- long term housing for operational staff, ongoing drilling and gathering
- construction ~12 months

Construction workforce

- peak in the second and third year of construction with up to 600-900 personnel
- workforce will reduce over time to ~300 personnel
- long term accommodation village to provide housing for ~150 personnel
<table>
<thead>
<tr>
<th>Early works</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
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<tbody>
<tr>
<td>Construction of wells and pads</td>
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<td>Construction of gathering pipelines</td>
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<td>Construction of FCF 1</td>
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<td>Construction of FCF 2</td>
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<td>Construction of CGPF</td>
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<td>Construction of power network</td>
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<td>Construction of FCF 3</td>
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<td>Construction of FCF 4</td>
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<td>Construction of ABP</td>
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<td>Commissioning</td>
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Arrow Bowen Pipeline

- Transport CSG from Arrow's Bowen Basin gas fields, north of Moranbah to a Gladstone Gas Hub located near Gladstone

- ABP will follow the Stanwell Gladstone Infrastructure Corridor

- Technical specifications:
  - 428 km buried, high pressure steel pipeline
  - 50 year design life
  - 40 m construction right of way
  - 40 m final easement width

- Depth of cover:
  - 750 mm (non-agricultural land)
  - 900 mm – 1200 mm (agricultural/ cropping land/deep ripping)
  - 1500 mm (crossings – roads and water courses)
• Construction will generally be contained within the 40m right of way
• Additional temporary working areas may be required in some locations to ensure safety
• Typical working area shown above
1. Survey
2. Prepare access tracks
3. Clear and grade
4. Stringing and bending

5. Welding
6. Weld inspection
7. Weld joint coating
Arrow Bowen Pipeline

- Anticipated ABP workforce
  - peak construction workforce ~700
  - commissioning workforce ~10
  - operational workforce ~15

- Construction workforce accommodation
  - up to five temporary camps
  - progressively relocated along route - two operational at any time
  - spaced ~100 km apart
  - accommodate up to 700 workers
  - close to pipeline right of way and above-ground facilities to minimise travel distance to worksites

- Construction logistics
  - construction ~2 years
  - logistics required for personnel, line pipe, construction materials, equipment and consumables
  - transport and logistics management plan currently in development to consider traffic and road impacts around communities (including schools)
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<th>Stage</th>
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<th>Year 2</th>
<th>Year 3</th>
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<tbody>
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<td>First line pipe delivery</td>
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<td>Establishment of logistics centres</td>
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<td>Establish first temporary camps</td>
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<td>Main line valve construction (4 MLVs)</td>
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<tr>
<td>Construction on right of way (commencing from south)</td>
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<tr>
<td>Progressively establish additional temporary camps</td>
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<td>Construction of GGH</td>
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<tr>
<td>Hydrostatic testing of pipeline</td>
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<td>Pipeline pre-commissioning</td>
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• Arrow is committed to providing full, fair and reasonable opportunities for capable and competitive local suppliers to compete for work

• The following contractors will be engaging the market on behalf of Arrow:
  - Clough AMEC JV is managing the BGP FEED
  - DHL is managing the project logistics
  - WorleyParsons is managing the ABP FEED

• ICN Gateway will be the main source of information for contractors and suppliers – www.arrow.icn.org.au

• Arrow advertises all direct employment opportunities with Arrow on its website
• Brighter Futures program supports local, not-for-profit community projects focusing on health and safety, education and the environment

• The program places significant importance on the inclusion of indigenous projects and initiatives

• **Community funding grants** - small scale investments to meet direct needs

• **Sponsorships** - moderate scale investments supporting community projects and events

• **Partnerships** - large scale investments to support community development

• Funding rounds
  • Round 1 - April
  • Round 2 – October

• Apply via the Arrow website
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