ARROW ENERGY
A QUEENSLAND SUCCESS STORY

- Queensland based company - Started in 2000, first gas sales in 2004
- Currently provides >20% of gas consumed in Queensland
- 50/50 Shell and Petrochina – 2 stable owners committed to safety, environment and long term relationships with stakeholders
- 500 staff in Dalby, Moranbah and Brisbane
ARROW ENERGY

Portfolio includes:
- Domestic gas supply
- Gas transmission pipelines
- Electricity generation

Future projects
- Domestic consolidation
- Export supply of gas (LNG technology has enabled access to global markets)
PROJECT UPDATE
CSG TO LNG PROJECT

**Exploration**
- 8 10 pilots (5 wells each)
- 5 extended pilots (10 wells each)
- 60 75 core holes

**Production**
- Approx. 50 wells (existing domestic production area)

**FID**

**Project Starts**
First 4 years:
- 1200 wells
- Average 2 - 4% farm land impacted

**Pipeline construction commences**

**LNG Production**


* FID = Final Investment Decision
**PROJECT LOOK AHEAD**  
**SURAT GAS PROJECT EIS**

<table>
<thead>
<tr>
<th>EIS Process</th>
<th>Expected Timeframes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lodged Voluntary EIS Application</td>
<td>Completed</td>
</tr>
<tr>
<td>Lodged Initial Advice Statement</td>
<td>Completed</td>
</tr>
<tr>
<td>Project determined a ‘controlled action’ under the Federal Act</td>
<td>Completed March 2010</td>
</tr>
<tr>
<td>Exhibited Draft Terms of Reference for <em>public comment</em></td>
<td>Comments Closed May 2010</td>
</tr>
<tr>
<td>Arrow provided response to submissions to Government</td>
<td>August 2010</td>
</tr>
<tr>
<td><strong>Final Terms of Reference from Qld Government</strong></td>
<td>September 2010</td>
</tr>
<tr>
<td><strong>Undertake impact assessment</strong></td>
<td><strong>Underway</strong></td>
</tr>
<tr>
<td>Prepare EIS</td>
<td>Expect to complete Q4 2011</td>
</tr>
<tr>
<td>Exhibit EIS for <em>public comment</em></td>
<td>Q4 2011</td>
</tr>
<tr>
<td>Qld / Commonwealth Government decision on project</td>
<td>Q2/Q3 2012</td>
</tr>
</tbody>
</table>
UPCOMING ACTIVITIES
EXPLORATION – SURAT GAS PROJECT AREA 2011

**Exploration** activities to confirm a viable gas supply for LNG production

Exploration involves identifying:
1. Presence, depth and extent of coal seams
2. Whether coals seams contain gas – core holes
3. Whether gas can be produced (brought to the surface) – pilots
UPCOMING ACTIVITIES
SURAT GAS PROJECT DEVELOPMENT

- Target area for development between 2013 and 2023:
  - Approximately 2,000 wells

- Domestic wells (existing PLs):
  - About 15 wells over next 12 months

Detailed maps available for viewing
We’ve made some commitments to you.

- Improved community and landholder engagement
- An open and honest dialogue about issues and opportunities with our stakeholders
- Engage with landholders at least six to 12 months prior to production drilling
- Adoption of a standard approach to compensation and land access
- No development on intensively farmed agricultural areas until concerns are properly addressed
- No construction of dams for coal seam gas water or brine on intensively farmed areas
- Use of surface tanks not pits when drilling production wells on black soil
- Development of a robust groundwater monitoring regime
- Prompt response to bore owners who report a reduced water supply
- Construction of “fit for purpose” dams to government standards
- Remove produced salt from the landscape
- Work with regional communities to maximise community benefits & opportunities for local businesses
- Locate wells and infrastructure away from homes in consultation with landholders (minimum 200m)
- No hydraulic fracturing (fraccing) in the area of the Surat Gas Project
LAND ACCESS
COMMITMENT: ADOPTION OF STANDARD APPROACH

- New Land Access Code
  - We have adopted the standard Conduct and Compensation agreement
  - Best practice guidelines for communication
  - Imposes mandatory conditions regarding the conduct of activities on private land

- Current status of land access activities:
  - Completed agreements in Surat approx. 130
  - Agreements in negotiation approx. 40
  - Cases before Land Court zero

- Arrow believes good relationships make good business sense.
LAND ACCESS

COMMITMENT: ADOPTION OF STANDARD APPROACH

- We accept our activities have an impact on landholders – we understand that your land is both your home and your livelihood.

- We recognise that development on land needs to consider:
  - **Where?** – we place our infrastructure
  - **When** and for how long? – amount and timing of site access
  - **How?** – we conduct our drilling and construction activities

- Our compensation is based on:
  - Landowners’ time
  - Impact on operations and amenity (eg disturbance, loss of profit)
  - Change in value and or/use of land
  - Legal, valuation and accountant advice
Established 12 clear, concise and non-negotiable rules for our staff and contractors

Mandatory compliance for work-related activities

Each reported non-compliance will be investigated

Failure to comply may result in disciplinary action, up to and including termination of employment, or discharge in case of contractors

Supervisors are held accountable to communicate and ensure compliance

We will continue to improve based on feedback from the community
COMMUNITY ENGAGEMENT
COMMITMENT: OPEN & HONEST DIALOGUE WITH STAKEHOLDERS

➢ Arrow Surat Community Reference Group

➢ Arrow Intensively Farmed Land (AIFL) Committee
  ▪ **Purpose:** To provide a consultative forum that, with regard to Arrow Energy’s development of a coal seam gas resource on intensively farmed land within its tenements in the Surat Basin, can:
    - Effectively identify issues
    - Provide feedback
    - Consider opportunities to co-create a plan for co-existence for coal seam gas development on intensively farmed land

➢ EIS Agricultural Study to assess:
  - Current land uses and agricultural practices
  - CSG methodologies
  - what impacts and mitigations mean to agricultural activities

➢ Development of formal complaints management system
## CSG vs UCG
### THE KEY DIFFERENCES

<table>
<thead>
<tr>
<th>Coal Seam Gas</th>
<th>Underground Coal Gasification</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CSG – naturally occurring gas</td>
<td>Ø UCG – synthetic gas</td>
</tr>
<tr>
<td>• 95-98% methane, trace amounts of Nitrogen and Carbon Dioxide</td>
<td>Ø Composed of (in decreasing order) Hydrogen, Carbon Dioxide, Carbon Monoxide, Methane and possibly Nitrogen</td>
</tr>
<tr>
<td>• Petroleum Activity</td>
<td>Ø Mineral Extraction activity</td>
</tr>
<tr>
<td>• Water and gas pumped from the well</td>
<td>Ø Oxidants pumped into well to sustain insitu combustion</td>
</tr>
<tr>
<td>• CSG has been commercially produced in Qld for 15 years</td>
<td>Ø Under trial to determine viability</td>
</tr>
</tbody>
</table>
ADDRESSING YOUR CONCERNS

DRILLING

➢ Arrow understands you may have concerns that drilling of numerous gas wells could interconnect aquifers or pollute them with chemicals.

➢ Arrow’s **safeguards** to prevent this from occurring include:

➢ Well **construction** – wells drilled to a detailed plan with strong focus on quality of casing and cementing aspects

➢ Drilling **fluid management** – proper management and use of drilling fluids and non-BTEX products

➢ “Zonal isolation” – ensures aquifers remain separate, and do not allow cross-contamination

➢ Well **integrity** – systems to keep check on the wells over their life

➢ **Qualified** drilling personnel – required to hold accreditation from Australian Drilling Industry Training Committee
## ADDRESSING YOUR CONCERNS
### EXPLORATION WELL CONSTRUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Depth</th>
<th>Hole Size</th>
<th>Casing Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor</td>
<td>Base of gravel &amp; alluvium</td>
<td>7 7/8”</td>
<td>6 5/8”</td>
</tr>
<tr>
<td>Surface</td>
<td>Into competent rock</td>
<td>5 ½”</td>
<td>4 1/2”</td>
</tr>
<tr>
<td>Drill</td>
<td>200 m</td>
<td>4”</td>
<td></td>
</tr>
<tr>
<td>Core</td>
<td>600 m</td>
<td>4”</td>
<td></td>
</tr>
</tbody>
</table>
ADDRESSING YOUR CONCERNS
WELL CONSTRUCTION

- Wells drilled to a detailed plan
- Casing and cementing are extremely important
- Well must be water and gas tight
- At end of well life, well is plugged and rehabilitated to requirements set out in Petroleum Regulations (Schedule 3)
- Details of decommissioning recorded in report submitted to Government
8 November: minute traces of benzene detected in three of 60 water samples from Arrow Energy gas wells in northern Bowen Basin

Relevant authorities and neighbours were immediately notified

Further independent testing confirmed initial results

More research is being conducted to determine if the benzene detected is naturally occurring or introduced by other means

Benzene is one of the group of BTEX* chemicals, recently banned by the Government in CSG processes

Arrow does not use chemicals containing benzene (or other members of the BTEX group of chemicals in its fracking fluids

*BTEX = acronym for chemicals group including benzene, toluene, ethylbenzene & xylene
KEY POINTS OF DIFFERENCE:

- Movie based on extraction of gas from shale in the USA – not gas from coal seams
- Australian CSG industry is subject to strict Government regulation with regards to environmental impacts, including water
- Coal seam gas is almost pure methane and does not contain ‘condensate’ which are lighter hydrocarbons (like butane, propane and ethane) found in conventional gas or shale gas
- Where Arrow uses fracpping, we have historically used a range of 22 chemicals – no BTEX suite of chemicals – most recent frac wells use only two different types of chemicals;
  - Sodium hypochlorite (pool chlorine)
  - Acetic acid (vinegar)
GROUNDWATER LEGISLATIVE CHANGES

- **Independent regulator** – Queensland Water Commission (QWC)
  - Arrow regional groundwater model
  - Groundwater **impact report**
- **QWC cumulative** groundwater model
  - **Impact report** – immediately impacted areas
  - Bore supply **Impact Agreements**
- **Baseline** bore assessments
- Bore inventory
- Claims on reduced supply
  - Investigation
  - **Make Good Agreements**
WATER AND SALT
LEGISLATIVE CHANGES

- Coal seam water **use and disposal**
  - Specific **approvals**
    - Injection, discharge, irrigation
  - **Recycled** water management scheme
    - Queensland **Health** water quality
    - **Risk assessment** apply for exclusion

- **Brine/salt** disposal
  - Commonwealth Government requires:
    - Injection
    - Commercial beneficial use
    - Disposal into a regulated landfill
  - Arrow has previously **committed** to the removal of salt
WATER MANAGEMENT PROJECTS
MONITORING & MODELLING

Monitoring Program
- **Leakage detection** systems for dams
- Developed a field layout for **new bores**
- Land access and **approvals**
- **Resources** for the extended program

Groundwater Model
- **Review** of model developed early this year
- **Scenarios** for Arrow Energy LNG Project
- **Collaboration**
- QWC **cumulative** groundwater model
WATER MANAGEMENT PROJECTS

SURFACE INFRASTRUCTURE

- Tipton Reverse Osmosis water treatment plant
  - Concept study complete
  - Design and construction of water treatment system

- River Road/Glenburnie Pipeline
  - 20km water pipeline to join 2 pilots to the Tipton RO plant
  - Aim to locate along road easements wherever possible

- Dam upgrades
  - Dam specifications for Arrow operations
  - Work program for upgrade of existing dams
  - Work to commence in 2011
WATER MANAGEMENT PROJECTS

BENEFICIAL USE & DISPOSAL

- Injection
  - Seeking approval for trial
  - Treated water
  - Into Precipice at Glenelg

- Irrigation Trials
  - Theten, Glenelg and Moranbah
  - Research to understand sustainable application

- Water balance
  - Objective to keep water within the local area
  - Exploring opportunities and approvals necessary to substitute entitlements
  - Dependent on:
    - Injection trial
    - Irrigation trial
    - Approval framework
Questions & Answers
CONTACT DETAILS

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- Email: suratgas@arrowenergy.com.au