Barnett Shale Artificial Lift Experience

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Agenda

Overview of Barnett Shale Artificial Lift
Artificial Lift Selection Process
Gas Lift
Plunger Lift
  • Automation and Surveillance
  • Optimization
Challenges and Plans
Overview of Barnett Shale Artificial Lift

Over 1,000 XTO Barnett wells are currently on some form of artificial lift

- Gas Lift – approx 450 wells
- Plunger Lift – approx 450 wells (50% automated)
- Foamer – at least 125 wells (5 with capillary strings)
- Gas Assisted Plunger Lift – at least 25 wells
- Rod Pump – 3 wells with more planned
Artificial Lift Selection Process

Guidelines

• > 8 GLR plunger lift
• < 4 GLR gas lift or rod pump

Further Evaluation

• Between 4 and 8 GLR evaluate options
  • Multistage plunger
  • GAPL
  • Gas lift
• > 450 bbls consider AL alternatives or water shut off
Gas Lift

Configuration

• 2-3/8” tbg in 5-1/2” csg, ±7800 ft TVD with 2500 ft lateral (some have 2-7/8” tbg)

• Three typical downhole configurations
  – GLV’s and packer
  – GLV’s with open ended tubing
  – No GLV’s with open ended tubing (Poor boy)

• Lowest injection point ~ 50 deg, ±200 ft TVD from landing depth

• Typical injection rates 100 mcfd – 500 mcfd
Plunger Lift

Standard Configuration

- 2-3/8” tbg in 5-1/2” csg, ±7800 ft TVD with 2500 ft lateral
- Downhole spring set at 45 deg, ±200 ft TVD from landing depth
- Using many plunger types including bypass, quick trip, pad, and barstock plungers

Other Types

- Gas Assisted Plunger Lift (GAPL) with and without GLV’s
- Multi-stage systems
Automation and Surveillance

Downtime occurs at lower frequency and shorter duration

Example: Hung dump valve
Automation and Surveillance

Improved production with surveillance

Example: Motor valve stuck open
Optimization

Example

• Spent ~$700 on a new plunger and altered the settings

![Graph showing gas production and casing pressure with an optimized increase of +160 mcf/d.](image)
Optimization

Example

• Spent ~$700 on a new plunger and altered the settings

Graph showing:
- Gas Production
- Optimized +150 mcfd
- Gas Target
- Casing Pressure
Optimization

Based on study of > 40 Barnett wells, if the casing pressure exceeds the “expected” pressure, then it is producing in a loaded state.

**Expected Csg psi Regions**
- Green: Plunger <300 psi csg
- Orange: Plunger btw 300 and 400 csg
- Light blue: Plunger btw 400 and 500 csg
- Purple: Plunger >500 csg

**Barnett Shale AL Selection (~150 psi FWP)**

- Daily Production (mcfd)
  - 100 - 250
  - 250 - 400
  - 400 - 700
  - > 500 psi

- Water Prod (bbls)
  - 50 - 100
  - 30 - 50
  - 20 - 30
  - 10 - 20
  - 0 - 10

- 300 - 400 psi

- < 300 psi
Optimization Results

- Requires diligence surveillance both onsite and remote to maintain
- Total spend < $150k

Uplift for Plunger Optimizations - 38 wells

- Less time for surveillance
- Surveillance a priority
Challenges and Plans

Challenges

• Commitment to surveillance and capacity to adequately watch over all the artificial lift wells
• Training and documentation
• Downtime associated with surface equipment failures
• Sand/plug debris, well interference, line pressure spikes

Plans

• Further evaluation to increase confidence in the artificial lift selection method (based on rate and GLR)
• Establish Best Practices
  – Assist with training operators and engineers
  – Plunger reliability and maintenance program
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