Water Drive Gas Reservoir

Optimizing Production and Reserves
Basic Reservoir Data

Supplied by Client

- 0.68 API dry gas
- 11200 ft. reservoir, 5250 psi, 226 F
- 84 feet gas
- 132 Md permeability
- 25% porosity estimated from cores
- 20% water saturation
- 58 BCF original gas in place
- 4.5 inch tubing
- Infinite bottom/edge active aquifer
- 60 MMCF/D maximum gas rate for facilities
- Geologic maps
Top of Structure
Sand Thickness
Problem and Proposed Solution

Statement of the Problem:

- Uncertain aquifer influx
- Unknown effect of water coning
  - Varies with gas production rate
- Optimal production plan needed for the reservoir using early production data from first production well
  - Maximize recovery and present net value of reserves
  - Minimize water coning

RAM Production Solutions:

- Use early production/pressure information to understand aquifer size
- Investigate producing the vertical wells using:
  - Different target producing rates
  - Different number of wells (1 or 2)
  - Different limiting compression pressures
  - Different tubing sizes
Use RAM to Calculate Aquifer Size

• Small Aquifer in green and infinite aquifer in blue
• Early data with first 2 months of production shows large aquifer present
Sensitivity to Producing Rate
59 MMCF/D vs. 10 MMCF/D

- Higher rate has earlier water breakthrough time
- Higher rate reduces water production by 40%
Sensitivity to Producing Rate
59 MMCF/D vs. 10 MMCF/D

- Higher rate accelerates production
- Higher rate produces 15% more gas over producing life (4 BCF)
RAM Analysis of Compression

- Investigate compression effect
  - 1000 psi compression (blue)
  - 400 psi compression (green)
- Result - 400 psi adds 900 MMCF compared to 1000 psi
RAM Analysis of Tubing Size

- Investigate various sizes
  - 2 & 7/8 tubing (blue)
  - 3.5 tubing (green)
  - 4.5 tubing (light blue)

- Result
  - 4.5 recovers 4.2 BCF more than 2&7/8 tubing
RAM Analysis of Well Spacing

- Green curve for 2 wells in the reservoir (60 MMCF/D per well)
- Blue curve has 1 well in the reservoir (60 MMCF/D per well)
- Two wells:
  - lower abandonment pressure from 3700 psi to 3200 psi
  - recover 3.7 BCF additional gas
Conclusions

- RAM system with early downhole pressure data capable of understanding aquifer size and influx with time.

- RAM model can predict production gains or losses through:
  - Production Acceleration
  - Infill drilling
  - Tubing Size
  - Compression

- RAM provides production engineers alarms and simple tools for maximizing short and long term production and minimizing development costs.