Leveraging economics for effective produced water management

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Agenda

• Produced Water Overview
• Challenges and Opportunities
• Oilfield Water Management
• Decision-making
• Case Example
• Conclusions
• Questions
Produced Water

Produced water originates in underground formations and is brought to the surface during oil and gas production.

- Complex composition
- Flows and volumes vary
- Impacts infrastructure
  - Scaling
  - Corrosion
  - Erosion
  - Fouling
- Hydrogen sulfide gas production
Opportunities

Large water volumes are needed for hydraulic fracturing. Reusing produced water for fracking reduces demand on local water supplies.
Opportunities

Minimizing produced water disposal reduces induced seismicity risk.

Locations of USGS temporary seismic deployments
Oilfield Water Cycle

Water affects oilfield logistics, and becomes more complex as fields develop.

Field Development (Walsh 2013)

Stage 1:
Remote, isolated wells.

Stage 2:
Well clusters with some infield drilling and completions.

Stage 3:
Extensive in-field development.
All produced water management decisions come with costs. Economics enables options comparison and arrival at appropriate solutions.
What have we done before?

Trade-off evaluations can be time-consuming, cumbersome, and incomplete.

**Methods**
- Rigorous designs
- In-house models
- Consulting studies

**Challenges**
- Quality of information
- Geographic specificity
- Operating time horizons
- Integration of disparate factors

**Sensitivities**
- Oil price
- Drilling Schedule
- Good and service cost fluctuations
What can we accomplish today?

Economic modeling allows for rapid, equivalent, and relevant options analysis.

Operations Recycle

Sourcing + Storage + Treatment + Transportation + Disposal → Treated water revenue

Beneficial Reuse

Wells to Central - Trucking
Wells to SWDs - Trucking
Wells to Central - Pipeline
Central to SWD - Trucking
Example: Infield Development

Assets:
- 12 Production Wells
- 3 Salt water disposal wells (SWDs)
- 1 Centralized Treatment Plant

Treatment Assumptions:
- 50% uncertainty applied
- Mobile $2 - $6 per barrel
- Centralized $0.75 - $2.25/bbl

Other Logistics Assumptions:
- 30-year project lifespan
- Injection Cost $0.30/bbl
- Trucking Cost $75 per hour
- Reuse savings $0.65/bbl
Results

A phased approach will enable holistic, cost-effective field development.

Years 0 – 5:
- SWDs are most economical for produced water disposal.
- Centralized + pipe < mobile.

Years 5 – 15:
- Centralized + pipe < mobile.
- Centralized + pipeline competes with SWDs when trucking costs are low.

Strategy:
- Phased approach
- Year 1 – 5: SWDs
- Shift to centralized treatment.
- Consider options to reduce desalination costs.
Conclusion

• Produced water is a critical bottleneck.
• Effective management can achieve operational, economic, safety, environmental, and sustainability goals.
• Sourcing, storage, treatment, transportation, reuse and disposal comprise key decisions.
• Current methods are time-consuming, cumbersome, and incomplete.
• Economic modeling enables rapid, equivalent, and relevant analysis.
• Economics can drive creative solutions.
Questions?

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