Integrated Modeling of Complex Gas-Condensate Networks

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Overview

Agenda

- Integrated Modelling Methodology
  - Scope of integrated modelling
  - Benefits to design and operational guidelines
- Application of Software to Gas-Condensate Networks
  - Restart Procedure Case Study
  - Removal of Pigging Case Study
Wells – Pipelines – Processing - Distribution

- Benefits of fully integrated modelling:
  - Simulate the real impacts of each system on the connecting systems
  - Develop Operating Guidelines
  - Test Operational Strategies

- Integrated Modelling Links Systems

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Realistic Boundary Conditions

• Isolating pipeline modelling requires more assumptions about boundary conditions

• Combination of pipelines with the processing units creates more realistic behaviour

• Simulates effect of downstream pipe and compressor/pump control philosophy
Thermo-Hydraulic Pipeline Integrated with Dynamic Topsides Processing

- Thermo-Hydraulic Pipeline Modelling
- All-in-one software used
- In-house software

- Dynamic Unit Operations and Processing Models
- Customized user friendly displays and controls specific to client
Case Study: Restart Philosophy Development

Network Layout

- Dehydration and stabilization units
- Dynamic Compressors and Pumps
- Dry gas trunkline and liquids trunkline
- Multiple Wells per drill center
  - Dynamic blending of compositions
- Primary separation
- Hydraulically connected gas pipeline network
- Liquid pipelines

Diagram:

- Onshore Reception
- Dehydration
- Multiphase (3-Phase) Pipeline
- Condensate Pipeline
- Separation
- Wells
Separation conditions vary during restart, the phase compositions are dynamic.

Pressure and temperature float.

Integrated simulator couples wells with gas and liquid pipelines.

Used composition tracking to capture change in fluid properties.
Goals and Results from Study

- Optimize well ramp up rates
  - Led to new well ramp up strategy and requirements, slug capacity
- Optimize depressurization rates
  - Showed optimal valve layout and sizing
- Demonstrate ability to utilize depressurization to restart topsides processing
  - Predicted timing and flowrates required to start up topsides processing
- Onshore downtime estimate
Case Study: Restart Philosophy Development

More Results from Study

- More operational cases to test line pack, partial production trips, and turndown timing
- First start up and commissioning procedures
  - Expanding network to include MEG distribution
Case Study: Pigging Frequency

Goal: Decrease Pigging Frequency

- High liquid content was resulting in high pigging frequencies
- With an integrated model, the study was able to deliver an operational strategy that removed the need to pig entirely
  - Varying well ramp up rates can remove liquid slugs safely without flooding the slug catcher
  - Required including wells, platforms, trunkline, and slug catcher in one simulator
Integrated Modelling Allows Realistic Operational Studies

- Can be used to design and develop strategies for:
  - Partial or system wide restarts and shutdowns
  - First start up and commissioning procedures and requirements
  - Ramp up and turndown procedures
- Includes restrictions of entire network
  - Increases understanding of network interaction
- Uniform software platform environment keeps the simulation stability
- Can pin-point operational bottle-necks early on in design phase