Real-time Gas Lift Optimisation using Production Universe RTO

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Outline

• Production Universe – What is it?
• Real-Time Optimization
  – Introduction
  – Functionality
  – Key Users
  – Modeling Framework
  – Examples
• Key elements for success
Production Universe: What is it?

- **Real Time Monitoring (RTM)**
- **Real Time Optimization (RTO)**

- **Real Time Production Surveillance & Optimization**
  Real time oil/gas/water rates to identify well performance and optimization opportunities

- Data driven, non-linear modeling tool providing on-line surveillance, reconciliation and diagnostics for individual wells.

- **Modeling & Optimization tool specifically developed for Oil & Gas industry (reconciliation / well testing)**

- Award-nominated, proprietary Shell technology
Real-time Surveillance & Optimization with Data Driven Models

- More sustainable in production operations:
  - Data driven models naturally from standard and disturbed well tests
  - Use std well instruments, e.g., tubing head & flowline pressures, liftgas rates
  - Only need repeatability, not absolute accuracy
  - Minimal dependence on assumptions & parameters
  - Daily validation & reconciliation against export meters

- Need for disturbed well tests / accurate well test data
Real-time Optimisation: Introduction

- Optimise production revenue by pushing your platform/wells to full potential in real-time.
- Use of data-driven models; flexible & easy to maintain.
- Automatic set point application; apply the set points in the fields (after verification).
- Automatic scheduling/triggering of the optimisation; optimise when the need is highest.
Real-time Optimisation: Functionality

- Makes full use of PU Real-time Monitoring (RTM) models and functionality.
- All well types are supported.
- Ability to tailor objectives, constraints and optimisation preferences.
- Ability to model the interaction between wells.
- Different types of validation and set point application mechanisms possible.
  - Manual
  - Semi-Automatic
  - Automatic
Real-time Optimisation: Key users

• Production Programmers / Operators
  – Automatic management / operational optimisation of gas lift and production choke settings, particularly as production environment changes.

• Petroleum Technologists, PSO Engineers
  – Tracking the performance of production facilities such as well gas lift utilization curves, sensitivities of production to bulk separator pressures, header pressures.

• Super Users
  – Monitor, check and maintain the application as required, or when requested by the other users.
Real-time Optimisation: Model framework

*optional
Real-time Optimisation: Model framework

Optimal Liftgas setting

Well Net Oil Flow vs LG Flow Curve, based on real production data.
Real-time Optimisation: Example #1

- CPDP10 was the first site for deployment of RTO V1
- Simple plant, wells and optimization objectives.
- Objective: Maximize gross production.
- Processing facilities constraint / well interactions.
- CPDP10 highest gas lift efficiency in BSP.
Real-time Optimisation - Example #1

Gross Liquid Production - Jul-03 to Jan-07.
- Red – FW PU Estimate
- Blue – Ultrasonic Meter Reading

- Deployed since 2003
- Stabilized Production
- Triggered installation of new production line

Original production decline rate

Jul 03 - Manual Optimization

Aug 03 – FW PU Optimizer operational

Additional header installed
Real-Time Optimization – Example #1

- Typical Gaslift Optimization Curve
- Huge potential for increased gas lift efficiency
Real-Time Optimization – Example #1

- Total gas lift injection
- Gross production

Optimisation started

• 25 % increase in gas lift efficiency
• Resulted in more gas lift availability for other fields
Real-Time Optimization - Example #2

- Nelson Platform
- Located 200km North East of Aberdeen
- 30 platform wells, 4 sub-sea wells
- First oil in 1994 – (Enterprise)
- Shell operated since 2002
- Current export levels:
  - 6000 m$^3$ oil
  - 0.5 Mm$^3$ gas
- Oil exported via the Forties Pipeline System (FPS) to Sullom Voe
- Gas exported through the Fulmar gas line to St Fergus
• Well gas compressed and used for fuel and gas lift
• Other than cold start not (commercially) possible to import gas.
• Sum (max gas lift per well) > compressor capacity
• Individual platform wells have gas lift metering and controller valves
• Controller set points set in control room DCS.
• Individual wells have different gas lift response for net oil produced
• Operationally wells may be changed on/off during the course of a shift
Real-Time Optimization – Example #2

- **Control** of optimisation remains in the hands of offshore operations.
- **Optimisation boundary conditions** set by onshore process / petroleum engineers, typically in the office
- Everyone sees the **same** set of data
- Faster and quicker than existing spreadsheet solution
- Reduction of “admin” for offshore operations
- Meets all HSE and Integrity rules
“Old” Gas Lift Optimisation Process
PU-RTO Solution

- **PU Client**
- **PU Server**
- **Process Historian**
- **DCS**
- **Onshore Production Technologist**
- **Petroleum Engineering Staff** e.g. RE / PC
- **Offshore Operator**
- **New SP's**
- **Accepted Set Points**
- **Gas Rate**
- **Valve Position**
- **Wellhead and Process data**
- **Set Points**
- **Model Updates**
- **Well Modelling + Limits**
- **Optimisation Request**
- **Optimisation**
- **Trigger**

**Flow:**
- Gas Lift Valves & Controller
- Onshore Production Technologist
- Petroleum Engineering Staff e.g. RE / PC
- Well and Res. Limits
- Onshore Updates
- Well Modelling + Limits
- Offshore
- PU Client
- PU Server
- PU Client
- Offshore
- DCS
- Process Historian
- Set Points
- New SP's
- Accepted Set Points
- Trigger Optimisation
- Gas Rate
- Valve Position
- Wellhead and Process data
Real Time Optimization - Key Success Factors

• Technical:
  – Good quality data
  – Automatic set point application (closing the loop)

• Organisational:
  – Identify Champion in OU
  – Building competencies in OU
  – Making it part of daily business
Real Time Optimization

• Questions?
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Implementation Timeline: 2006

- **April**: Kick off Meeting including Operators
- **June**: Delivery of Product Version PU-RTO
- **Aug**: Risk Assessment and DCS work
- **Oct**: Optimise “on the Table”
- **Dec**: Final Go Live & Turn off Old system