Unconventional Gas Ventures

Presentation to ANIMP

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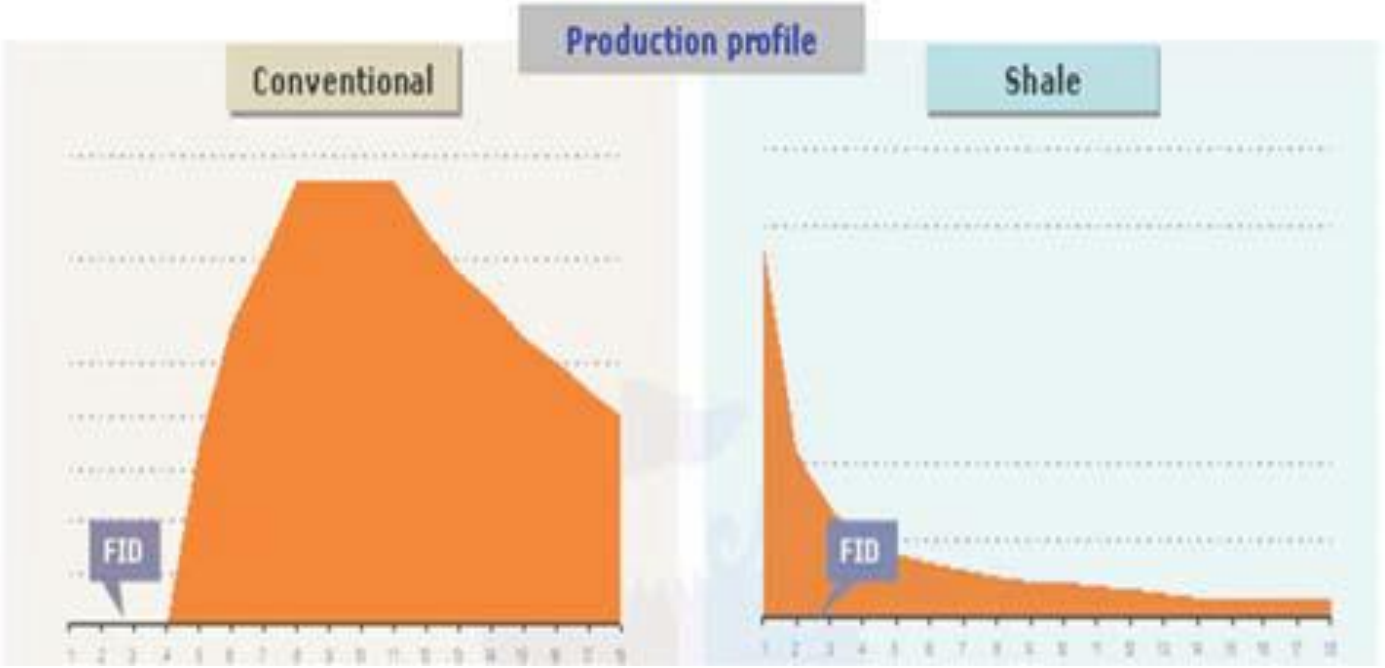
Invensys
Unconventional Gas/Oil Experience

- Major North American Producer, >15,000 wells
- Major North American Producer, >6,000 wells
- HiMount Energy, USA, ~6,000 wells
- Cimarex Energy, USA, ~1,000 wells
- PVR Midstream, USA, ~1,000 wells
- Chevron Bakersfield, ~18,000 production & injection wells
- AERA, USA, ~17,000 production & injection wells

Production Profile



Typical Production Project

- Exploration & Appraisal
- Drilling production wells, around 20 for a typical project and 100 for a large one
- Building processing facilities in parallel with the drilling of the initial production wells
- Starting up those initial wells and the processing facilities
- Periodic drilling campaigns, say every 1 to 3 years, to add more wells for greater production or to replace depleting wells

Shale Gas Production Project

- Exploration and Appraisal
- Drilling the initial production wells, say 500 or more
- Building processing facilities in parallel with the drilling of the initial production wells
- Starting up those initial wells and the processing facilities
- **Continuous** drilling, completion, connection and production from additional wells
  - To complete 5000 wells, 2 per day, will take ~6 years with about 15 drilling crews working 7/24/365

Shale Gas Automation Project

- New wells will be added **every day** → new automation, new reports, new screens, new alarms will be added **every day**
- Unconventional wells have a dynamic life cycle requiring frequent changes to operating equipment and operational mode.
- Span of Control issues – manage many more wells with same resources

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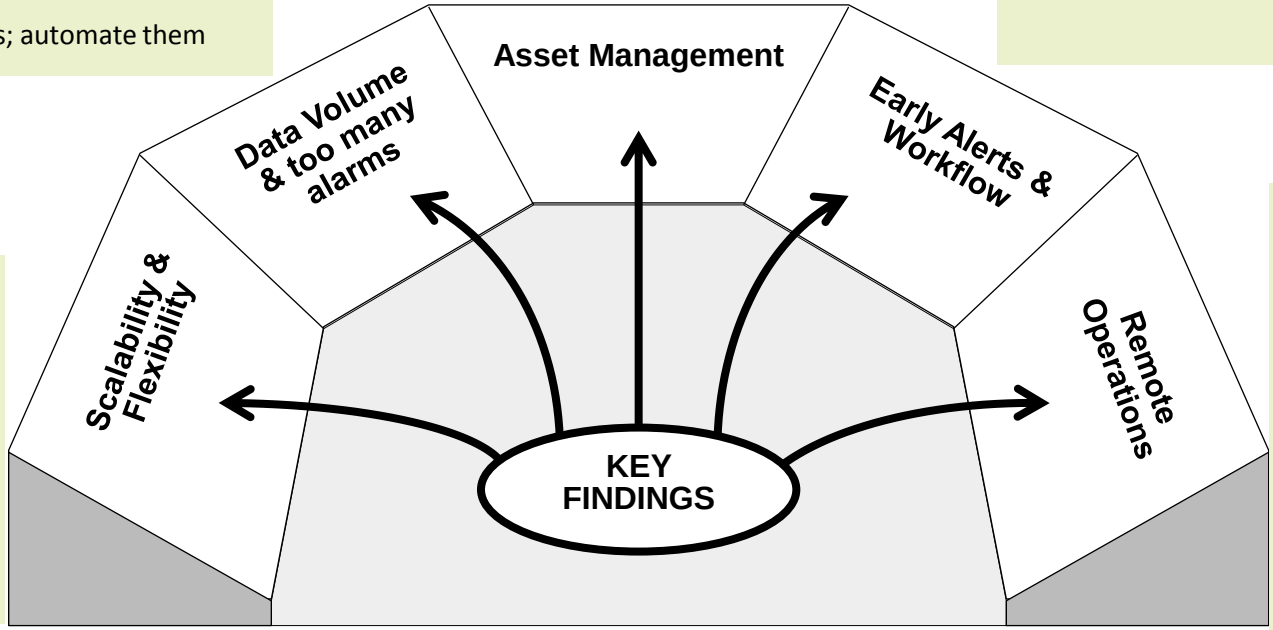
Unconventional Gas Automation Challenges

- Too much data creating confusion.
- Present information for easy analysis/ solving problems
- Avoid multiple historization steps and data replication
- Too many alarms; prioritize them.
- Handwritten Operator logs; automate them

- Improve Quality of well data, Equipment status.
- Avoid unscheduled down time
- Avoid costly round trips to wells.
- Reduce asset maintenance costs.
- Integrate of Work Orders and Work Permitting

- Monitoring 1,000's of wells with fewer operators is complex, challenging
- Operate on Exception basis
- Early alerts on impending problem
- Alerts trigger workflows & automatic escalation



- Scalability from 1 to 5,000 wells without costly engineering .
- Ability to add, modify wells "on the fly"
- DCS, SCADA, OMS in single architecture.
- Operate from 'anywhere'

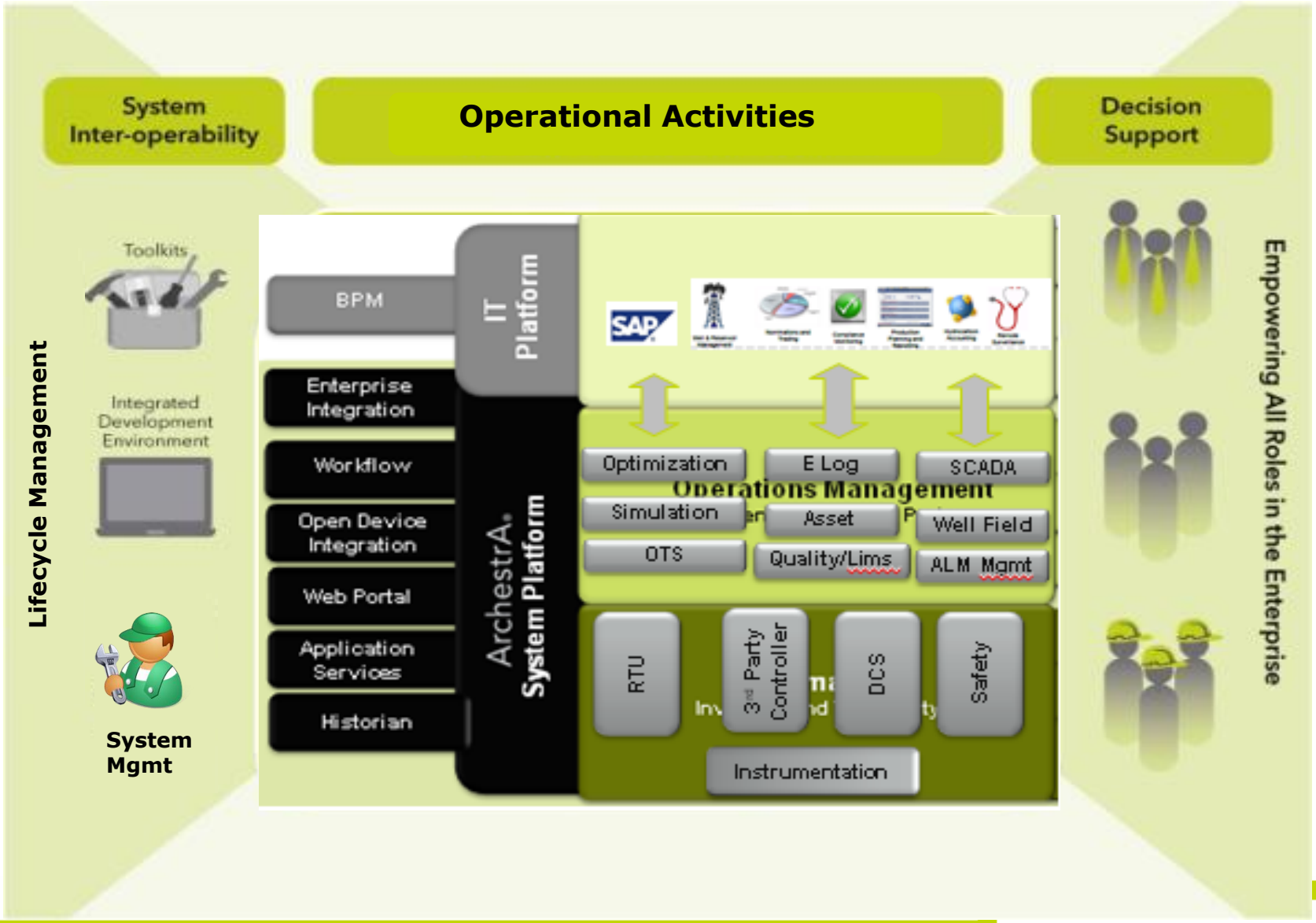
- Operations with fewer mobile operators
- Prioritize problem wells
- Mobile viewing tools
- Work order & scheduling
- Automatic trigger for routine daily tasks

Unconventional Gas Internal Learning Cycle

- Close linking of Drilling-Completion-Operations Cycle
- Lean Manufacturing Approach
- Shale Fracking example

- Equidistant frac pattern: cheaper, quicker, but maybe lower rate of production & lower eventual recovery
- Targeting frac pattern based on logging: more expensive, more time but potential for higher production and recovery
- Takes a year of careful measurement, event tracking to make evaluations

High Level Architecture for Shale



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Well Field Application

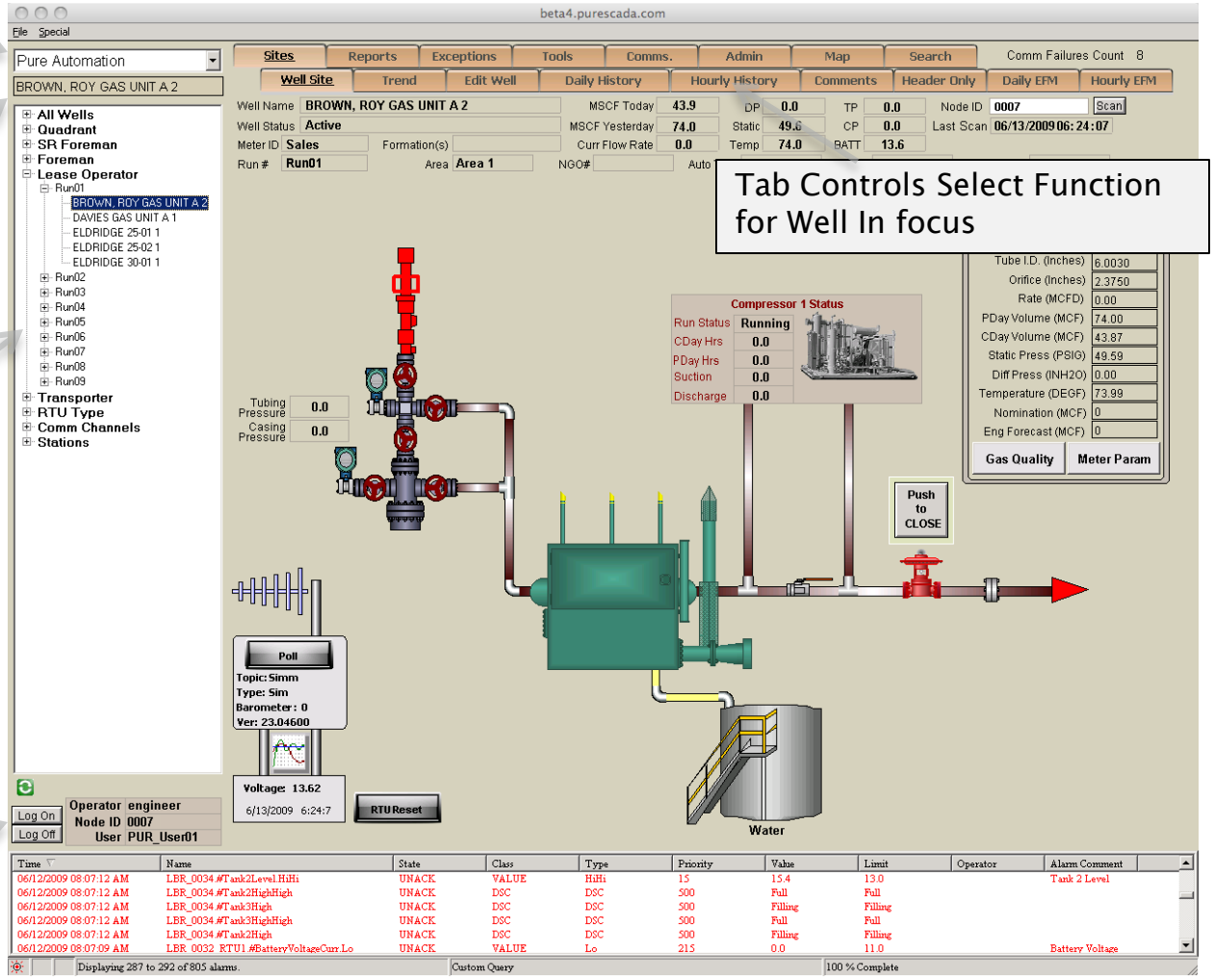
Field Office Select (Distributed Architecture)

Well in Focus

Tree View – Main Well Navigation. Select Well to be in Focus.

User Logged In

Interface – Graphical Well Site View



Tab Controls Select Function for Well In focus

Well Field Application

Almost Self Configuring

Select Edit Well from Tab

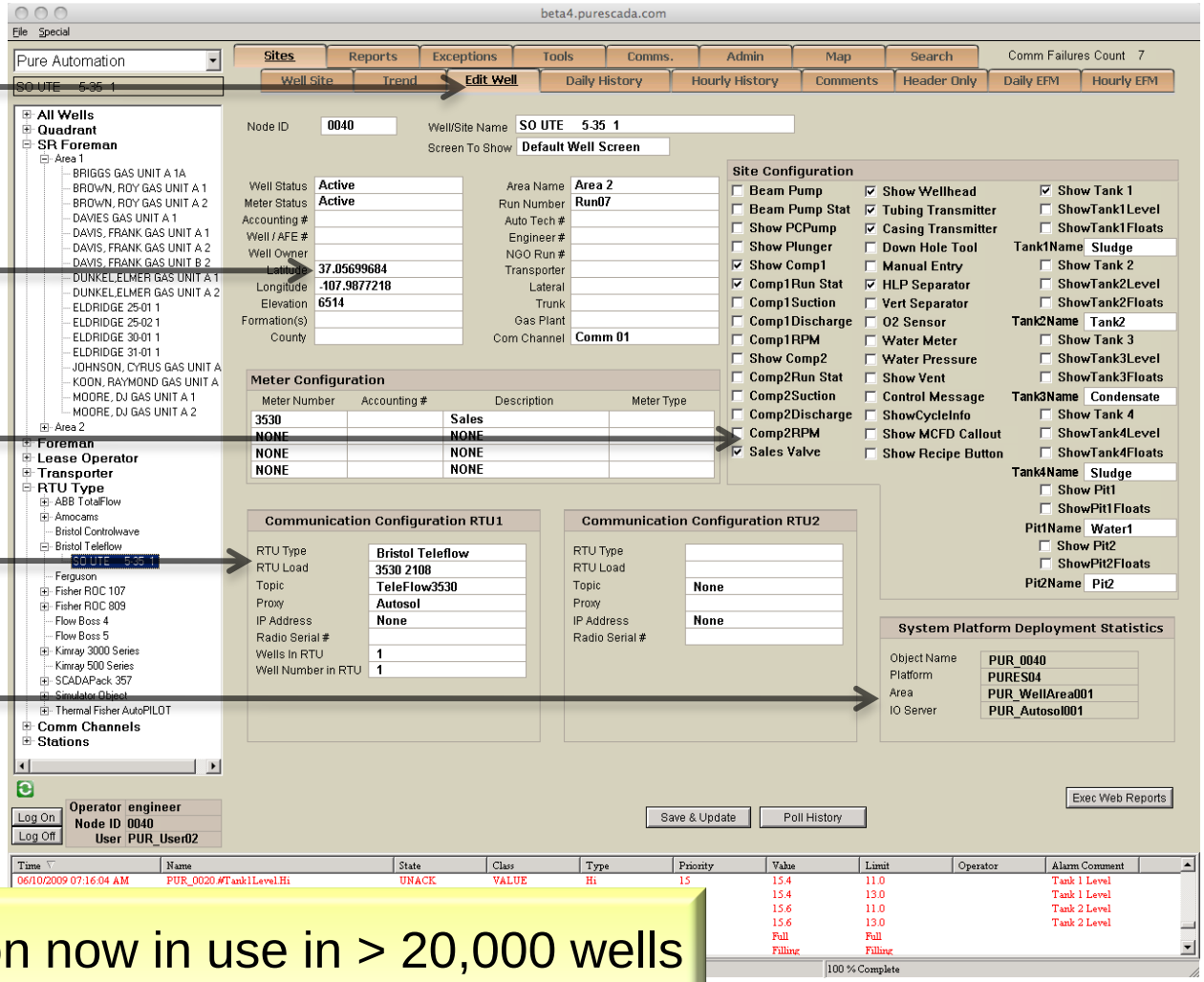
Set Well Status, Location, Accounting ID, Partners

Configure Equipment Associated with a well

Set RTU Type, Register Definition, Route to IO Server

Set RTU Type, Register Definition, Route to IO Server

Interface - Manage Well



Well Field Application now in use in > 20,000 wells in North America

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