Enhancing Digital Oilfield Solutions with PI Server's Asset Framework

Presented by Alberto Dellabianca

Agenda

- eni US Company Profile & Business Challenges
- Digital Oilfield Project
- Usage of Asset Framework
- Results Obtained and Business Impact
- Conclusions & Next Steps
- Questions

eni US Operating Company profile

eni has been operating in the U.S. through its subsidiary eni US Operating Co. Inc. since the late 1960's and carries out oil and natural gas exploration and production.

eni US has offices in Houston TX and Anchorage AK

Interests are in numerous shelf and deepwater fields in the Gulf of Mexico (GOM), North Slope of Alaska and shale oil and gas in Texas.

Net hydrocarbon production has grown significantly in recent years to a production of approximately 100,000 barrels of oil equivalent per day.

Alaska Operations

- First oil in Nikaitchuq in 2011, expected production for over 30 years

Challenging conditions:

- Cold temperatures, -51C ambient and -73C wind chill
- Logistics made difficult by environmental conditions
- Unique Wellhead Shelter Design for Arctic Operations
- Long Horizontal - Multilateral wells
- Production sustained by Water Injection, voidage replacement strategy
- ESP Pumps due to Oil Viscosity

- Operating in a very sensitive environment, close to water, wildlife, and tundra. Nikaitchuq falls under 10 State and Federal Regulatory/Oversight Agencies

Gulf of Mexico Operations

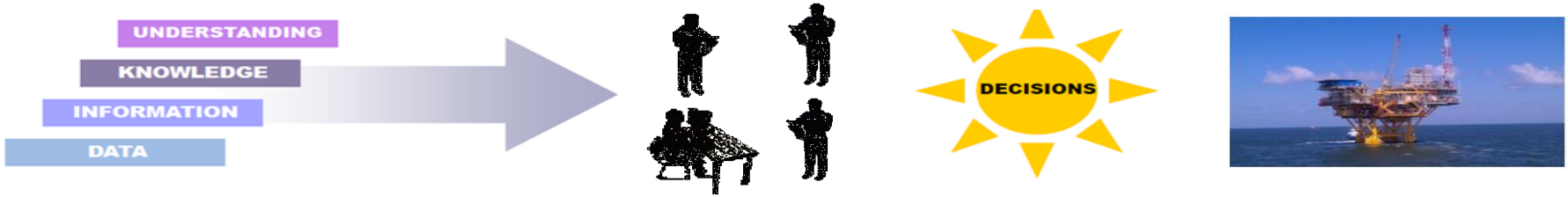
- Eni US holds interests in 233 leases in GOM of which 191 are in the Deepwater and 42 in the Shelf.

- Eni US operates the Devil's Tower, Allegheny and Corral platforms, which altogether process 50% of its production, and owns a large inventory of exploration drillable prospects in all the main GoM plays.

Challenging conditions:

- Flow Assurance in deep water subsea environment
- Fight the decline of mature fields
- Off-Shore Logistics
- High OPEX

Objective of Digital Oilfield → Improved Decision Making



Use of DOF technology to deliver an effective decision support framework for upstream operations

Business Challenges

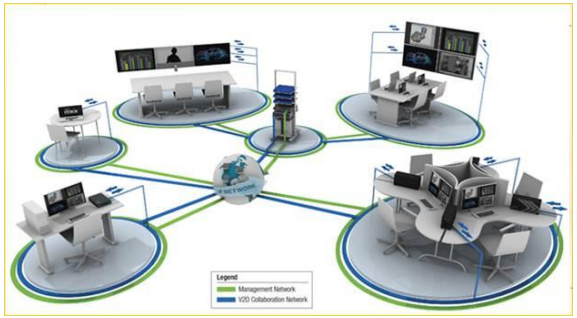
- Increasing technical complexity in O&G fields
- Stress on performance improvement
- Lack vs overload of information
- Shortage of key skills
- Remote and hazardous locations

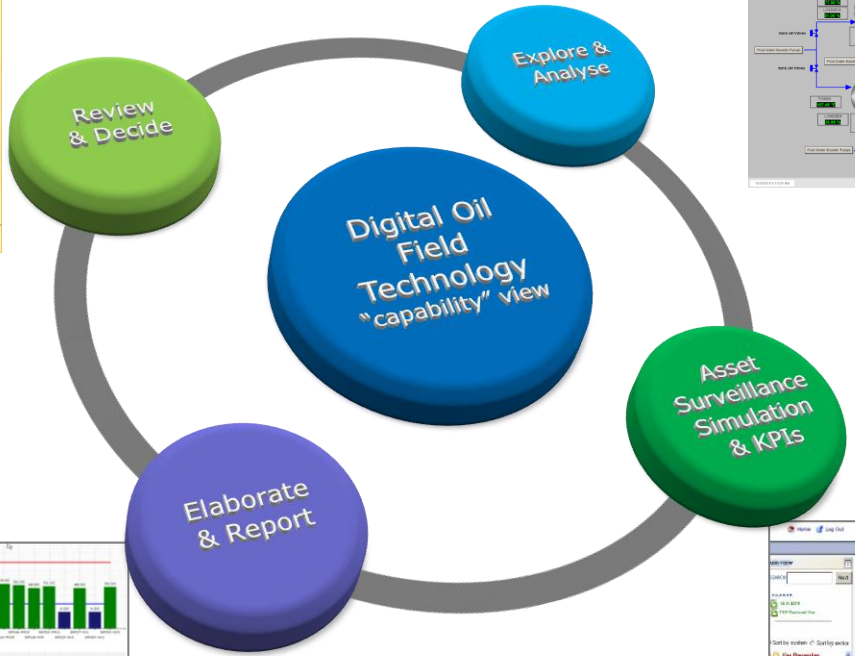
Digital Oilfield Answers

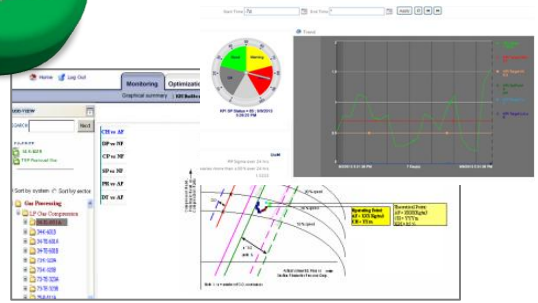
- Real-Time Automated Surveillance
- In depth analysis of the field
- Quick & easy access to key information
- Collaboration
- Mobility

Right information to the right people at the right time

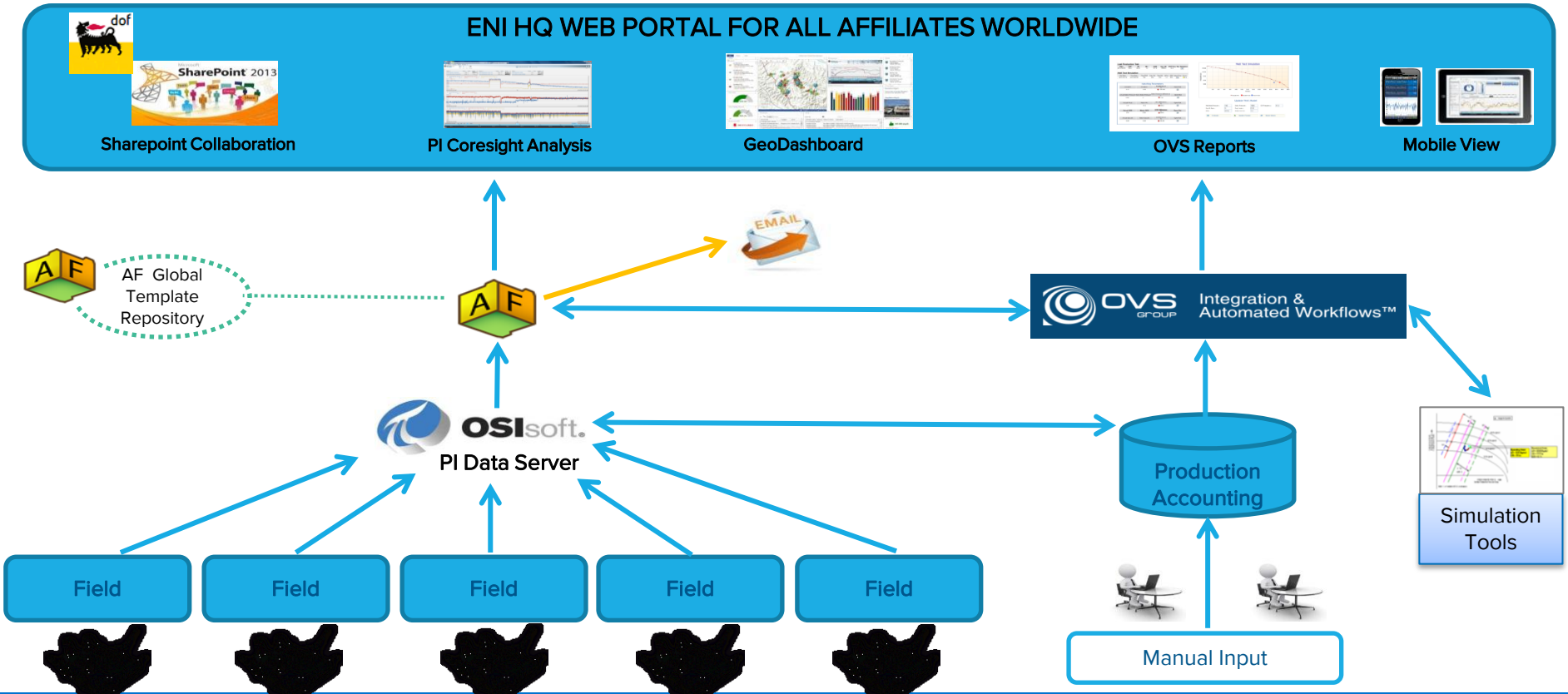
Digital Oilfield Capabilities







System Architecture

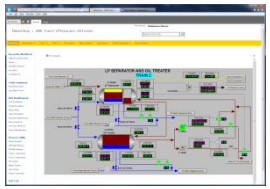


Implementation stages – Wave I (2011)

- PI Data Server used as pure historian in one single field (other fields with a different historian)
- Users accessing Real-Time data mainly through PI DataLink. Enforced tag naming convention in order to achieve a minimum level of standardization
- Reservoir Surveillance Tool fetching PI Tags and implementing Exception Based Surveillance workflows

Implementation stages – Wave II (2013)

- PI Asset Framework 2012
  - Data model implemented inside AF. Full usage of element templates for wells and main equipment
  - Exception Based Surveillance implemented inside AF. Notifications mainly used for ESP Surveillance & Vibrations Monitoring
  - Implementation of basic KPIs with AF formulas. More complex calculations still implemented with Performance Equation formulas in tags



- PI WebParts 2010 R3
  - Process displays through SharePoint portal

- PI Coresight 2013
  - Usage for well & equipment trends. Drastically reduce time to create a plot by leveraging on the AF model already built

Implementation stages – Wave III (2015)

- PI AF 2014
  - Asset Analytics enabled an higher level of templatization, thus making faster a new deployment of DOF solution as well as more sustainable in terms of maintenance. The conversion of calculations is in progress and based on the cases where a benefit in templatization is clear. Full use of the ‘backfill’ capability in order to re-populate historical calculations
  - Event Frames. Start configuring event frames for both well-related events and equipment downtimes
- PI Coresight 2014
  - Switch from PI WebParts to PI Coresight for PI ProcessBook Displays visualization

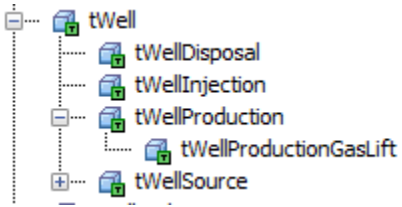
- Adopt PI System as Real-Time Data Infrastructure for all other major fields. Shutdown of legacy historians

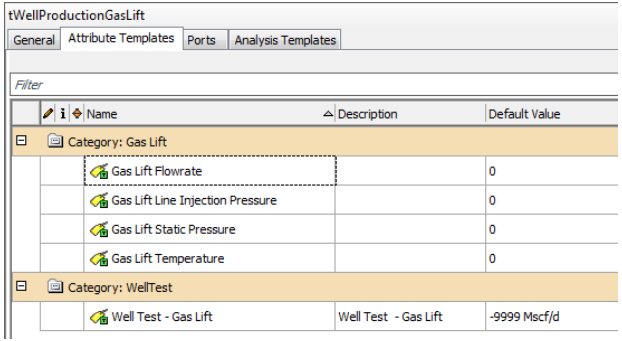
Role of Asset Framework (AF)

- AF is core in the solution, since it contains the logical representation of the field as well as KPI calculations
- Asset Framework make deployments faster. Usage in the US of the same templates as the global template repository corporate-wide in headquarter
- Templates prevent human mistakes in configuring calculations manually → improved quality
- Tag mapping may be time consuming at the beginning, but the benefits will overcome the effort
- The key is to keep it simple. We don't map all field tags into element attributes. Only the ones relevant (20-30%)

AF – Element Template Inheritance

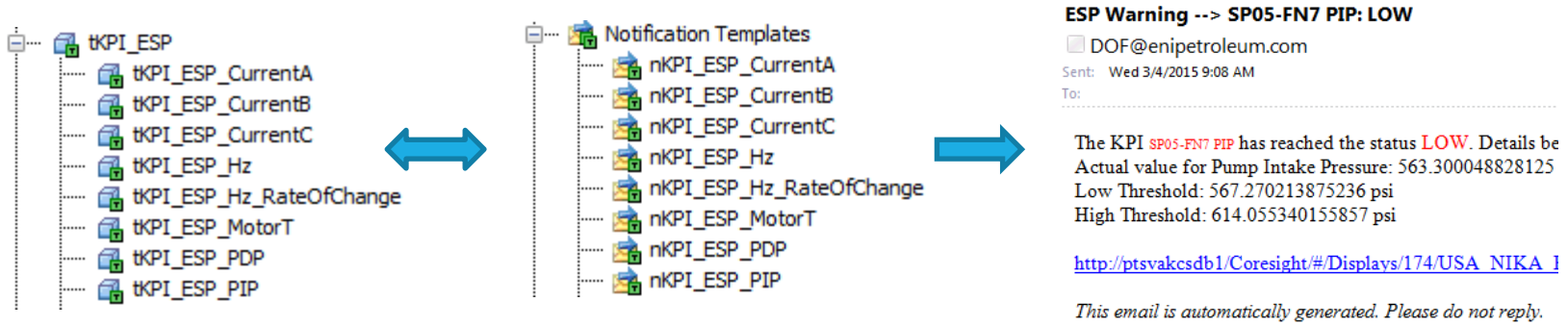
- Usage of parent-child templates in order to have a flexible yet sustainable representation of elements
- Allows the solution to be adapted to different conditions (e.g. different artificial lift types for production wells)
- Coupling inheritance with Attribute categories makes it even more organized





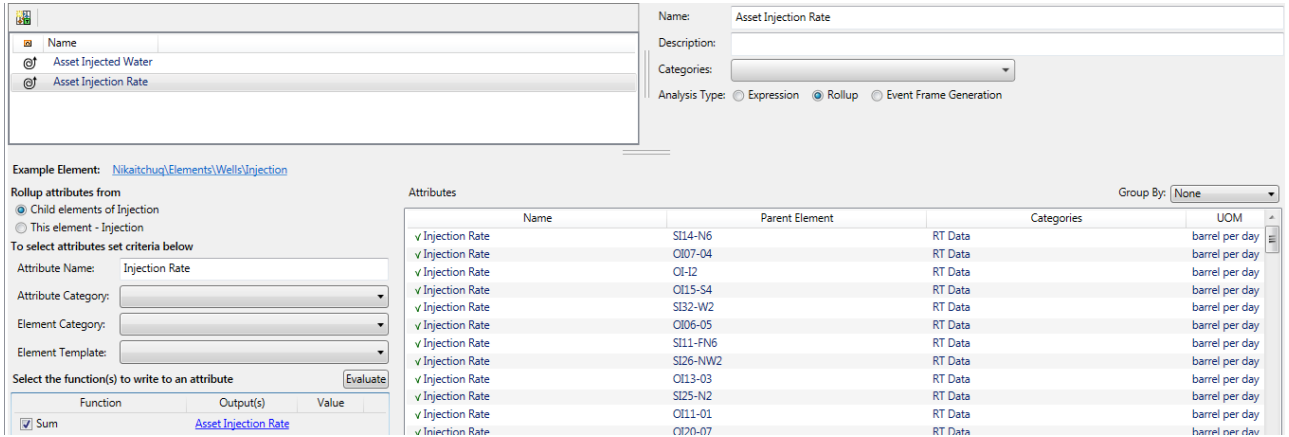
AF – Exception Based Surveillance

- Implementing exception rules as Element Templates with Formulas detecting deviations
- Element Template coupled 1-1 with Notification template
- Example: ESP Surveillance



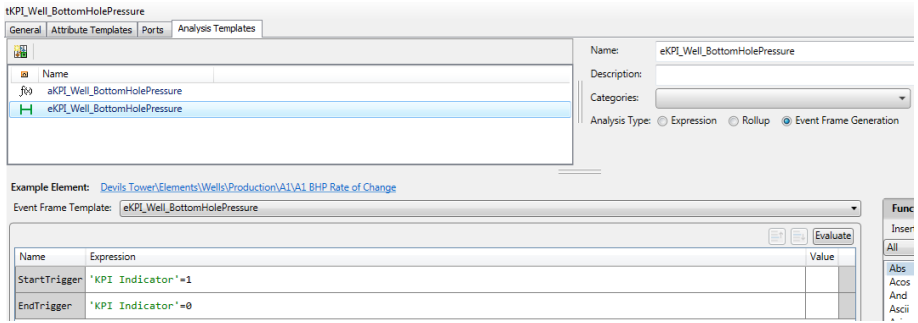
Asset Analytics – Rollup

- Need to calculate total rates in real-time for a group of elements – e.g. Water Injection Rate for injection wells
- Previous approach: AF Formulas or Calculated Tags → need to update the formula every time you have a new well
- New approach: usage of Rollup → no maintenance



Asset Analytics - Event Frames (EF) Generation

- Still at the early stages of EF usage, but see a big potential
- First attempts with Well events and facility downtimes
- Example of Well Bottom Hole Pressure drawdown events (reservoir pressure drops too fast during a time range)



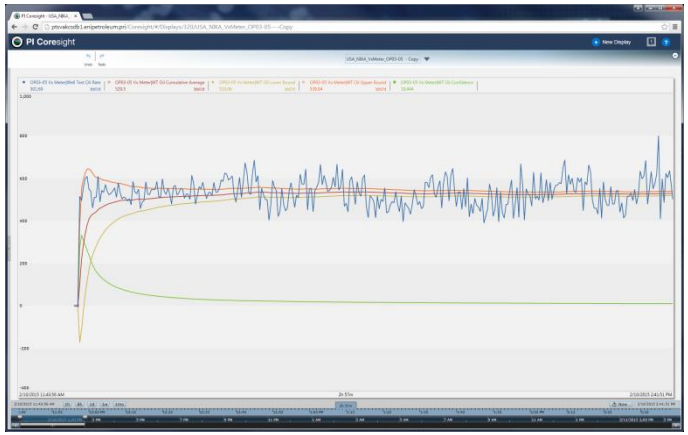
Asset Analytics - Calculations

- Several new calculations made possible, for both well and process KPIs
- Long expressions divided in multiple steps for easier reading and maintenance
- Parameterization of all constant coefficients

- Example: well test validation calculation with Oil Rate confidence at 95%, coupled with Event Frame Generation for the Well Test

Example Element: Nikaitchuq\Elements\Wells\Production\OP03-05\OP03-05 Vx Meter

Name	Expression	Value	Output Attribute
eventStartTime	`if TagVal('Test Indicator') <> 0 and PrevVal('Test Indicator', PrevEvent`		Click to map
deltaMinutes	`if TagVal('Test Indicator') <> 0 Then (Int('*')-Int(eventStartTime))/60`		Click to map
SQRTMinutes	`if TagVal('Test Indicator') <> 0 Then Sqr(deltaMinutes) else NoOutput()`		Click to map
StdDeviation	`if TagVal('Test Indicator') <> 0 Then StDev('Well Test Oil Rate',eventSt`		Click to map
OilCumAvg	`if TagVal('Test Indicator') <> 0 Then TagAvg('Well Test Oil Rate',event`		WT Oil Cumulative Average
ConfCoefficient	`1.96`		Click to map
OilConfidence	`if TagVal('Test Indicator') <> 0 Then (ConfCoefficient * StdDeviation /`		WT Oil Confidence
OilConfUpper	`if TagVal('Test Indicator') <> 0 Then (OilCumAvg + OilConfidence) Else !`		WT Oil Upper Bound
OilConfLower	`if TagVal('Test Indicator') <> 0 Then (OilCumAvg - OilConfidence) Else !`		WT Oil Lower Bound



Results Obtained & Business Impact

- Enable quick decision making based on contextual information
- Less time spent in searching data, more time spent in analyzing (e.g. 2h per day saved for each Production Optimization Engineer)
- Effective Monitoring of the field → situation awareness and early detection of potential issues (e.g. early detection of ESP problems avoiding well workover)
- Identification of improvement opportunities (e.g. tuning ESP frequency on a daily basis)
- Designed a scalable internal solution, previous third party tool used was costing 250k USD / year in a single field
- Repeatable implementation in different fields with the possibility to have certain degrees of flexibility (10% shorter deployment time with PI AF 2014 compared to PI AF 2012)

Next Steps

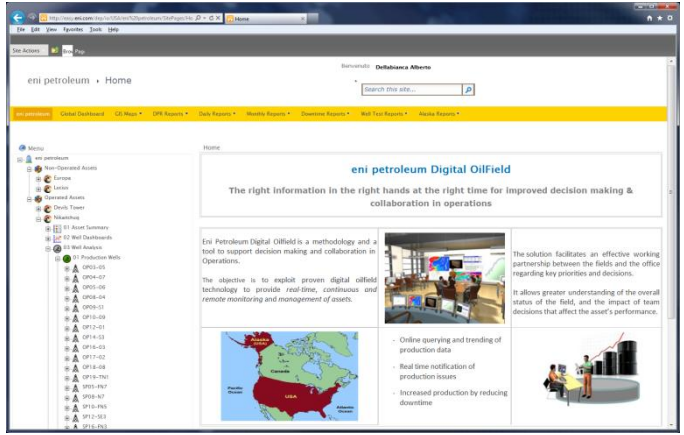
- Conclude Implementation of DOF framework on remaining major fields
- Leverage PI Server 2015 future data & Asset Analytics for implementation of basic predictions
- Microsoft Power View integration with AF to allow users to embrace self-service Business Intelligence

Summary

Digital Oilfields are part of the effort to bring more efficiency in Oil & Gas upstream industry

Usage of AF, including the latest Asset Analytics, helps in making a Digital Oilfield solution more scalable and effective

PI System implementation widely recognized as successful – Ongoing activity to implement in all other major fields because of the initial success



Business Challenges

- Operating in challenging environments
- Need Real-time monitoring solution that can be applicable to multiple fields with different conditions
- Limited internal resources

Solutions

- Business engagement through DOF project
- Usage of AF for asset logical representation and condition based monitoring
- Web Collaboration Environment

Results and Benefits

- Enable quick decision making
- Early detection of potential issues and identification of optimization opportunities
- Scalable solution

Alberto Dellabianca

alberto.dellabianca@enipetroleum.com

Digital Oilfield Advisor

eni US Operating Co. Inc.

Questions

Please wait for the microphone before asking your questions

State your
name & company

THANK YOU