SE Smart Field Solutions

Martín Mancuso
Smart Field Global Solution Architect
Agenda

- Introduction
- Schneider Electric at a glance
- SE Smart Field General Overview
  - Solution Packages
  - Architecture
  - Platform
- Well automation / Artificial Lift Management
- Production Measurement
- Energy Management
- References
Our vision

Optimize the Oil & Gas field operation and production by proven Technology and Management solutions

Crude  Refine  Gas  Storage  Transport Distribution
**1. Smart Field**

Maximize production, optimize energy management and improve reservoir performance with real-time data

- Maximize availability of field operation and minimize deferred productions
- Reduce risks to environment and people incidents
- Optimize energy efficiency (Steam, CO₂, Gas, Electricity) to produce Oil and Gas
- Optimize water management
- Reliably measure data for reallocation (accounting, reservoir optimization)
- Comply with regulatory and fiscal requirements
Oil & Gas SMART Field Architecture

1. Smart Field

- Integrated, scalable R-T information and control technologies that increases recovery rate and maximise energy efficiency while reducing OPEX and maintenance
- Production optimization
- Enterprise and remote SCADA
- Field management
- Secure and safe operation

Enterprise

Field Operations

Control
One Architecture to integrate

Oil & Gas / Gas Smart Field Operation & Oil & Gas Smart Field Utilities

To achieve overall increased performance
Smart Field Operations Architecture

Enterprise

- Energy Management
- Abnormal Situations Analysis
- Asset Management
- Special Liquid & Gas applications
- PIMS Production Information Mngt System
- Reservoir Management

Operations

- Other Apps
- LMS/GMS
- Configuration

Main Control Center

- SCADA Platform
- Network Management
- Security System
- Cyber Security

Alternative Operation Center

Zone Operation Center

- SCADA Platform
- Security System

Network

Com Network

Control

Wells

- RTU
- Actuators
- Tank s
- Flare
- Separation
- Well Parameters
- NOC
- Utilities
- Security
- Wells

Flow Station

- RTU
- WIP
- Diluent Injection
- Steam Plant

Other Units

- Flow Computer
- Flow Meters
- Pressure
- Water Cut
- Pump Control
- Temperature

Treatment

- RTU / PLC
- Liquid Separation
- Treatment
- Compression
SMART Field Modelling, Planning, Operational Intelligence

Enterprise Visualization and Decisional Support

Modelling and Planning
- Artificial Lift Selection and Design
- Production Forecasting
- Reservoir Performance Analysis
- Field and Reservoir Modelling

Eng / Op Work Flow – Automation /Integration Platform
- Well Modelling
- Field and Reservoir Modelling

Real-Time Well Optimization and Operations Engines (Models, Algorithms, Rules)
- Gas
- Liquids
- Volume Measurements and Validation
- Artificial Lift Analytics
- RPC/HRPC
- PCP
- ESP
- Gas Lift
- PL Lift

Real-Time Field/Enterprise Optimization and Operations Engines (Models, Algorithms, Rules)
- OMS/DMS
- Conventional
- Unconventional
- Deep Water
- Onshore
- Offshore

Eng / Op Work Flow – Automation /Integration Platform
- Security Management
- Data Model
- Version Management
- Alarm Management
- Communication Management
- Historian and Reporting

Enterprise/Field Data Collection and Control (SCADA)
- OaSys/ClearSCADA

Sub Station /field grid
- RPC
- PCP
- ESP
- Flow Station/NOC
- Multiphase
- Water / Gas & Oil
- Measurement
- Injection
- ACT/LACT Custody Transfer
- Tank Farm
Artificial Lift Management
Artificial Lift Advisor Architecture

**SCADA**
- Gas Well / PL / Gas Lift → RTU / Controller
- RP / PCP → Controller
- ESP → Controller
- Injection → Controller
- Maintenance Activity → Outside record
- Pumper / Manual Measurements → Production Reports
- Liquid Levels
- Well Testing
- Data Standardization → Artificial Lift Database
- Outside record
- Production Reports
- Customized Analytics
- Up Time / Energy Optimization → Pump Optimization
- Well Performance
- Pump Analysis

**Customized Data Management**
- Maintenance / Operation → Other DBs
Artificial Lift ADVISOR
“Comprehensive” Analyst View
GIS Integration
Flow Station Basic Architecture for StruxureLab

Well Testing

- Manifold
- Test Separator

Tanks

- Level Interface Temperature

Flare

- Flow Pressure Temperature

Power Control

- Saitel DP Micom

Main RTU / PLC

- Saitel DP ScadaPack M340 Premium Quantum

Process Separation

- PT TT C

Network Node

- Fiber Optic Ring

Network Node

- MWR WiMAX

Telecommunications

- Base Radio Station for Wellhead

TCP / IP Network

Flow Computer

- Pumping and Custody Transfer ACT

RTU / PLC

- ESD / F&G Other Utilities Packages

Security

- Video IP cameras
- Access Control
- Intrusion Detec.

Local HMI
Well Architectures

Rod Pump Controller

Progressive Cavities Pump Controller

ESPs / Gas Lift Controller

Gas Well RTU / Plunger Lift Controller
Artificial Lift Pumps Controllers

- **ESP**
- **PCP**
- **Rod Pump**
- **Plunger / Gas**

- Telemetry Control Room
  - Workstations
  - GSM/GPRS/PSTN/SST
  - Maintenance Operator
  - Controller
  - Temperature
  - Injection Pressure
  - Return Pressure
  - Flow Control
  - LEL Sensor
  - H2S Sensor

- VFD

- Plunger Lift Control
Benefits of Artificial Lift ADVISOR

- Smart Pump controllers.
  - Extend pump life.
  - Reduce energy consumption.
  - Reduce deferred production.

- Efficient, accurate correction of field problems
  - Automatic pump diagnosis.
  - Performance analysis and deviation detections
  - Problems prioritization.

- Raise the quality of operation
  - **Consolidate** well and pump performance data.
  - **Integrated** Automation and Analysis package.
  - Standardization across the field, **Single point of configuration**.
  - Monitoring, Reporting, Surveillance and Management of **Distributed Asset**.
  - **Facilitate** Maintenance tracking and crew Management.
Production Management
SMART Field Modelling, Planning, Operational Intelligence

Enterprise Visualization and Decisional Support

Modelling and Planning

Well Modelling
- Artificial Lift Selection and Design
- Production Forecasting
- Reservoir Performance Analysis
- Surface Facility Modelling and Planning

Field and Reservoir Modelling
- Artificial Lift Analytics
- Volume Measurements and Validation
- Gas, Liquids
- RPC, PCP, ESP, Gas Lift, PL Lift

Real-Time Well Optimization and Operations Engines (Models, Algorithms, Rules)

Enterprise/Field Data Collection and Control (SCADA)
OaSys/ClearSCADA

Environment
- Conventional
- Unconventional
- Deep Water
- Onshore
- Offshore

Work Flow - Automation/Integration Platform

Security Management
Data Model
Version Management
Alarm Management
Communication Management
Historian and Reporting

Sub Station / Field Grid
RPC, PCP, ESP, GL/PL
Wells
Flow Station/NOC Multi-phase
Water/Gas & Oilfield Measurement/Injection
ACT/LACT Custody Transfer
Tank Farm
Measurement Advisor Architecture

- Gas Chromatograph
- Flow Meter
- Meter
- Gas Chromatograph
- Sample
- RTU
- Chart Readings
- Outside Volume record
- Lab Analysis
- Flow Computer
- Polling Engine
- Data Standardization
- Measurement Database

- Calculation Engine
- Validation Engine
- Estimation Engine
- Flow Editor
- Balancing
- Financial

Control
Operations
Enterprise
What does a measurement system do?

- Field Devices
  - Field I/O
  - Flow Calculations
  - Local Control

- SCADA
  - Data Acquisition
  - Remote Control
  - Monitoring
  - Alarm Management

- Measurement
  - Validate
  - Adjust
  - Balance
  - Close

- Commercial Logistics
  - Contracts
  - Nominations
  - Allocations
  - Billing
  - Reporting

- Accounting
  - Receivables
  - Payables
  - Ledger
  - Financial Reporting
Validation Rules

Volumetric

- Field vs. Host Volumetric comparison
- Operational & reasonability range tests
- Low flow check
- Redundant meter tests
- Frozen value test
- Historical average tests
- Orifice plate tests
- Data integrity tests (rejected reading)
- Multiple meter run tests
- Multiple run checks (run ratio)
  - Daily check
  - Rate contribution (%)
  - Can configure any list of meters in a check
  - Meter can belong to two checks
  - Dynamic run ratio check
  - Fixed run ratio check
- Station average pressure, temperature check
- Average temperature check
- Redundant meter checking (check/custody)

Gas Quality

- Energy check
- Check/custody checking
- Historical checks
  - Frozen value
  - Comparison against historical average
  - Hydrocarbons
  - Inerts
  - Wobbe
  - cricondentherm
  - C5+
  - CO2 + N2
  - etc.
- Limit/reasonability checking
- Gas composition normalization check
- Calculated heating value/specific gravity check
Simple Validation
Differential Pressure Operational Limits

Differential Pressure DEMO13328

Validation Limits

Invalid
Complex Validation
Recalculate Volume, Compare, Auto-adjust

Flow rate Calculator

Within Limit?
Yes
Valid
No
Autoedit
Invalid
Easily Identify Data Issues
Flow Editing

Edit data in both tabular and graphical formats
Full Audit trail for Corporate Governance

Flow edit auditing
Balancing

- “Virtual Station” balances
- Account totals balances
- Customer totals balances
- Supplier totals balances
- District totals and balances
- Area Sendout totals

\[
\text{inlet} = \sum \text{measured input}
\]

\[
\text{outlet} = \sum \text{measured output} + \text{shrinkage}
\]

\[\text{Plant Balance} = \text{out} - \text{in}\]

- Production Accounting is complex. Balancing supports a production accounting system by being able to separate where component delivery comes from.
# Centralize Reporting of Daily Production

- **Build Using Microsoft Reporting Services**
  - Export to .pdf, .xls, .csv
  - Send via email
  - Intercompany data transfer

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**FIELD PRODUCTION REPORT**

- **Current Date/Time:** Dec 06 2011 08:26:08
- **Reporting Period:** Nov 30 2011

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**Totals**

- **Field Production Report**

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**Total**

- **Total:** 3546.88
Closing

- Closing measurement data is a primary role of measurement analysts.
- Supports full accounting closing functionality as well as the support for modifications to data after it is closed.
- Measurement stations can either be closed individually or as part of a set.

Flow Data Editor

Closes all meter associated with close group in one step

Revised Unclosed data invokes Prior Period Adjustment (PPA)

Pending PPA

Billing System

Measurement Data from FC

Investigate, Edit, Accept

Close Group
The management Solution for Electric Distribution in Oil & Gas

Smart Field ADMS / OMS

Advance Distribution / Outage Management Systems
SMART Field Modelling, Planning, Operational Intelligence

Enterprise Visualization and Decisional Support

Modelling and Planning
- Artificial Lift Selection and Design
- Production Forecasting
- Reservoir Performance Analysis
- Surface Facility Modelling and Planning
- Well Modelling
- Field and Reservoir Modelling

Real-Time Well Optimization and Operations Engines (Models, Algorithms, Rules)
- Gas
- Liquids
- Volume Measurements and Validation
- Artificial Lift Analytics
- RPC/HC, PCP, ESP, Gas Lift, PL/LG

Eng / Op Work Flow – Automation / Integration Platform

Real-Time Field/Enterprise Optimization and Operations Engines (Models, Algorithms, Rules)
- OMS/DMS

Enterprise/Field Data Collection and Control (SCADA)
- OaSys/ClearSCADA

Operations / Regional

Security Management
Data Model
Version Management
Alarm Management
Communication Management
Historian and Reporting

Enterprise Visualization and Decisional Support

Enterprise Visualization and Decisional Support

Enterprise Visualization and Decisional Support
How complex this network can be?

- 1 to 10 thousand wells
- 1 to 5 Connections to Utilities
- 50 to 1000 MW in generation
- 10 to 200 Flow Station
- 200 to 2000 Square Miles area
- Low Power availability can cost up to 8MU$S/year/feeder

And IS DYNAMIC
The challenge: Reduce outages Quantity and Duration.

► Associated cost

- Production loss.
- Restoration crews.
- Unproductive time.
- Equipment damage.
- Installation damage.

### Estimated outage cost per production scenarios

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<th>BPD</th>
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<th>&gt;1000</th>
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<td>Wells per feeder</td>
<td>20 to 50</td>
<td>20</td>
<td>5</td>
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<td>Avg. time to restoration</td>
<td>4h</td>
<td>3h</td>
<td>2h</td>
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<td>Outage cost</td>
<td>10 to 20K U$S</td>
<td>20 to 40K U$S</td>
<td>100 to 300K U$S</td>
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<td>Yearly cost 90% Reliability</td>
<td>400K</td>
<td>1200K</td>
<td>6000K</td>
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Advanced Integrated Solution

- Convergence of SCADA, EMS, DMS, OMS, SM
- State estimation, OPF, AGC, Economic dispatching, Unit commitment
- Network automation closed-loop control, VVO, FLISR, SSM
- Monitoring, analysis, security, control, optimization, storm operation

Common: Platform, Data Base Model, Infrastructure, Cyber security, History, UI, etc.
Key modules in the SE SG IT product

SCADA

- New expanded features of SCADA:
  - Specially designed SCADA,
  - Huge dimensions, scalable up to 10 million points
  - Parallel processing
  - Additionally powered with DMS
  - Check before operate
  - Intelligent alarming
  - Events log

ADMS – SCADA functionality, with commanding window and SCADA alarms
### Key modules in the SE SG IT product

#### Integrated SmartGrid Solution

#### CURRENT STATE of V3 ADMS

Gartner ADMS Report 2013

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**Schneider Electric ADMS Rating:** Strong Positive

ADMS – DMS functionality with list of power applications
Key modules in the SE SG IT product

Integrated SmartGrid Solution

Integrated DMS and OMS – Storm Mode

- **Predictive Mode**
  - Based on integration with weather forecast
  - Determines part of the network affected by storm
  - Determines the line affected by the storm
  - Network Reconfiguration is used to minimize impact of the storm

- **Corrective Mode**
  - Optimal Crew Dispatching
    - Helps Operator to optimally schedule field crews based on different criteria (outage distance, outage priority, crew workload)
  - Currently, OMS can handle up to 50000 calls/hour
  - Dispatching functionality is not interrupted with incident handling
  - Smart grouping of incidents

ADMS – OMS, fault location with call processing
Key modules in the SE SG IT product

Integrated SmartGrid Solution

- ADMS = EMS, calculations for HV side
- Demand Side Management
- Information about outages
- Distributed Generation Coordination Support
- Reduction of Pump and Facilities Peak Load and Energy Efficiency
- Billing
ADMS Benefits

● Enables efficiencies and substantial cost savings
  ● Optimize capital investment (get more out of existing assets)
  ● Cut operational and non-operational losses
  ● Reduce truck rolls and time to create switch plans
  ● Simplify deployment and support with common platform
    ➢ Network Model, Alarming, Historian, Administration, Security

● Improves network reliability and resiliency
  ● Advance fault management processes and reduce outage frequency
  ● Enhance operational decisions and forecast system and localized load
  ● Prepare for and manage storm activity proactively
  ● Meet regulatory compliance requirements

● Supports distributed energy resources
  ● Monitor, model, and analyze distributed generation
  ● Facilitate both reliability and economic decision making processes
  ● Enable comprehensive energy management via prioritized options
Smart Field Integrations
Smart Field IT integration Model

Field Processes

Control & Monitoring

IT Engineering and Deployment Services

Mid Term Analysis Tools

Energy Management

Measurement & Allocation

Trucks Management

Performance Calculations

Real Time Monitoring

Well Integrity

Data Integration Platform

Notifications Deviations

Business Rules

Business processing

Data Warehouse

Reservoir Systems

Accounting

Work Order Management System (SAP)

IT Engineering and Deployment Services

Scada Solution

Performance Data

Energy Data

Alarming & Monitoring

Production data

Field Opps Data

Electric Generation and distribution (INFRA)

Gas Processing (IND + INFRA)

Artificial Lift (TRSS)

Field Processes

Engineering & Construction Services

MITC

MEC & MAC

• ED
• TRSS
• Plant Structure
• Surveillance
• Safety
• Etc.
Smart Field enables the cross integration of disciplines and systems.

Enterprise Visualization and Decisional Support

Modelling and Planning
- Artificial Lift Selection and Design
- Production Forecasting
- Reservoir Performance Analysis
- Surface Facility Modelling/Planning and Design
- Field and Reservoir Modelling

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Operational / Regional
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Enterprise/Field Data Collection and Control (SCADA)
OaSys/ClearSCADA

- Sub Station/field grid
- PCP/Gas Lift
- Artificial Lift
- Wells
- Flow Station/NOC Multiphase
- Water/Gas & Oilfield Measurement Injection
- ACT/LACT Custody Transfer
- Tank Farm
Smart Field Values

● **Collaboration**
  ● Integrates the disciplines and systems to enhance operations and production

● **Simplification**
  ● Bring the systems, knowledge and field activities to a common point.

● **Operational Excellence**
  ● Enhance the field operations by early detection, optimization and decision support.
Thank you