What’s our application?
Oil & Gas Environment Profile

- Remote Site / Deep operations
- High CAPEX
- Corrosive
- Expensive Maintenance Costs
- High Temperature
- Pressure to be productive

GE Imagination at work
Definition of Artificial Lift

Gas Lift

ESP’s

PCP

HydroLift Hydraulic Pumps

Beam pump
Electro Submersible Pump System

Monitor
- Intake Pressure
- Intake Temperature
- Motor Temperature
- Discharge Pressure
- Vibration
- Motor Current
- Casing Pressure
- Tubing pressure

Control
- ESP Motor Frequency
- ESP Remote Start
- ESP Remote Stop
Diagnostics using Analytic Analysis
Typical ESP failures & causes

**FAILURES**

**Mechanical**
- Leaking
- Failed pressure test
- Stuck *(e.g. does not rotate)*
- Burst
- Bent
- Broken
- Disconnected

**Material**
- Burn
- Corroded
- Worn
- Melted
- Overheated

**Electrical**
- Short circuit
- Open circuit
- Faulty power

**Others**
- Plugged with solids
- Contaminated fluid

**CAUSES**

**Design related**
- Improper:
  - Equipment capacity
  - Material selection
  - System configuration

**Fabrication**
- Manufacturing problem
- Improper quality control
- Improper storage
- Improper transportation

**Storage & Transportation**
- Improper storage
- Improper transportation

**Installation**
- Assembly procedure
- Installation procedure

**Operational**
- Normal wear and tear
- Installation or inadequate training

**Reservoir**
- Reservoir fluids
- Reservoir performance

Source: C-FER
Diagnostics for ESP

**Program**
- Development of a functional M&D system for ESPs
- Transition to live field system

**Advantage**
- Reliable lift performance
- Reduced equipment downtime
- Increased installed base and margin
Deliverables and Business value

**Deliverables**

- **Models & Tools:**
  - Long term service agreements
  - Optimize Spares & Logistics
  - Optimize Maintenance

- **Models & Tools:**
  - Survival Analysis
  - Recurrent Event Analysis
  - Probabilistic design models

- **Tools & Algorithms:**
  - Anomaly Detection
  - Change-Point Detection
  - Data Fusion

- **Report & Algorithms:**
  - Data mining – identify issues (known, emerging)
  - Data for probabilistic design

**Business Impact**

- Lower cost of quality
- Lower lifecycle costs

- Improved reliability
- Improved availability

- Reduce downtime
- Services revenue

- Optimized operation
- ESP improved tracking
How much will a failure cost?

• Lost production cost (Estimated):
  Price of oil barrel: $100
  Typical production: 500 b/d
  Water cut: 70% (percentage of water per each barrel produce)
  Estimated downtime: 2 days (per incident in remote areas)
  Estimated incidents per year: 10
  Estimated savings: \(500 \text{ b/d} \times 20 \times 0.3 \times $100 = $3MM!!\)

• Intervention cost (Estimated):
  Onshore conventional well: $5K to $25K per intervention
  Onshore unconventional well: $150K to $250K per intervention
  Offshore well: Up to $1MM per intervention

Intervention costs is often a deciding factor for customer sale!
Industrial Internet

200 sensors across the turbine generate 300 data points per second of performance and operation every hour.

Intelligent Machines + Advanced Analytics + People at Work

GE imagination at work
Industrial Internet creating value in Oil & Gas

Intelligent Machines + Advance Analytics + People at Work
In conclusion

The key for a successful Prognosis solution implementation is an adequate management of Big Data. At GE Oil & Gas, the Industrial Internet will provide the tools and means necessary to achieve this goal and facilitate the transition to Brilliant Machines.
For more information, please visit...

**GE Oil & Gas Artificial Lift (ESP)**
- [http://www.ge-energy.com/products_and_services/products/electric_submersible_pumping_systems/index.jsp](http://www.ge-energy.com/products_and_services/products/electric_submersible_pumping_systems/index.jsp)

**Industrial Internet**

**GE Predictivity™ Industrial Internet Solutions**
- [https://www.ge.com/b2b/predictivity](https://www.ge.com/b2b/predictivity)

**Data Management & Data Analytics Software**