

GE Oil & Gas

Prognostics for Oil & Gas

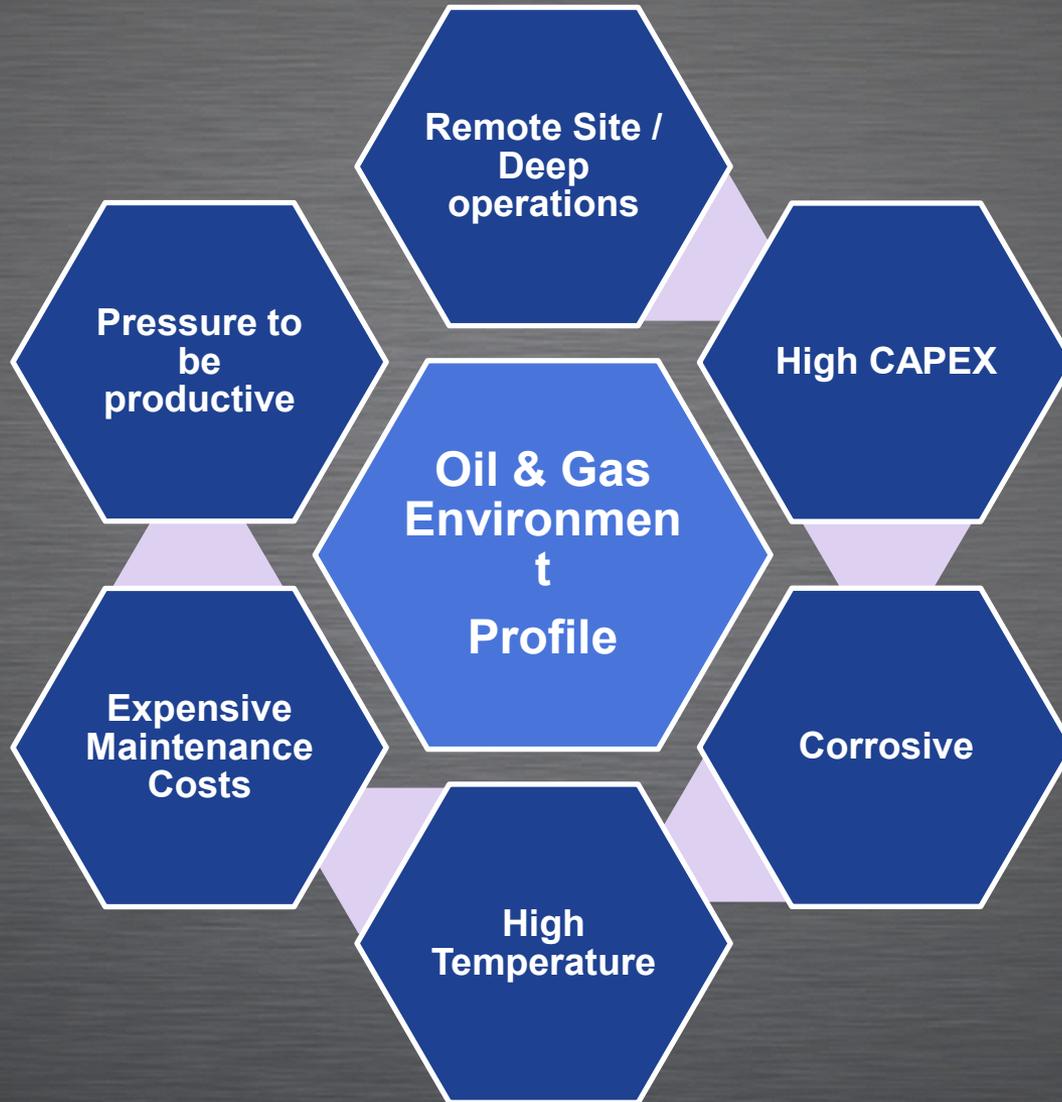
Artificial Lift applications

William Carrillo
2013 PHM Conference
New Orleans

What's our application?

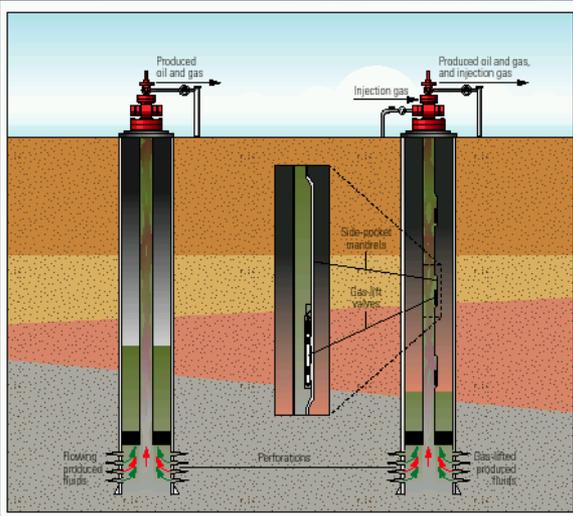


GE imagination at work

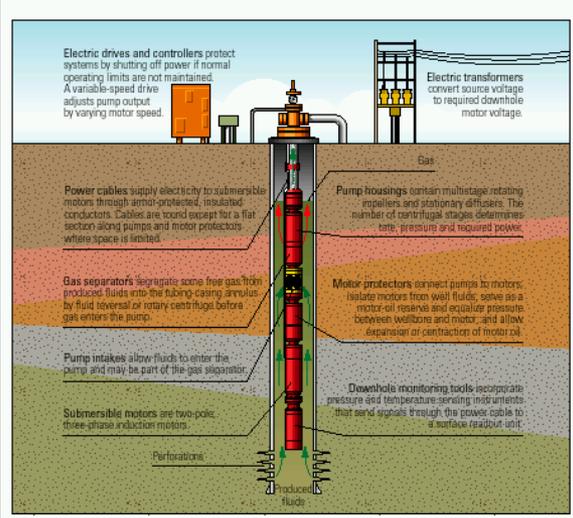


Definition of Artificial Lift

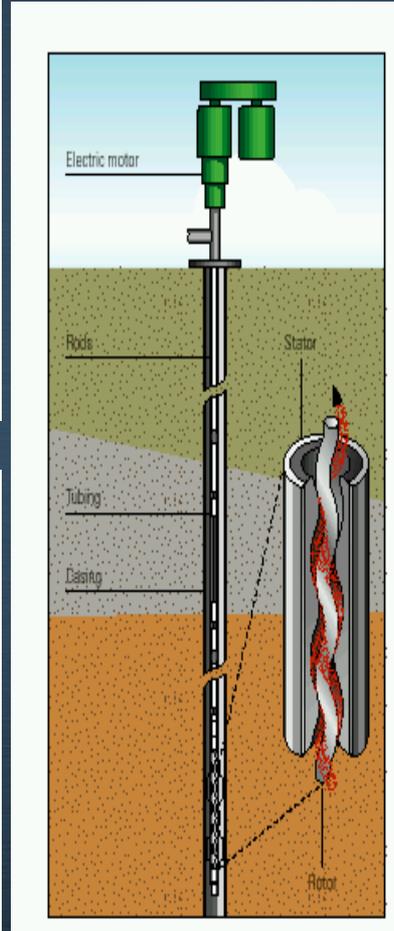
Gas Lift



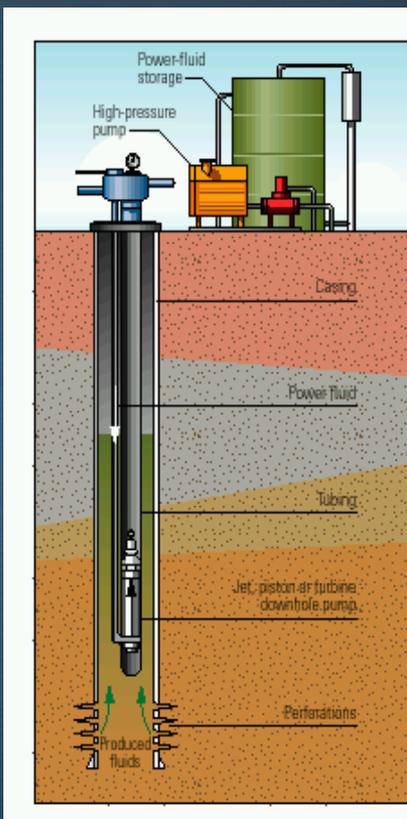
ESP's



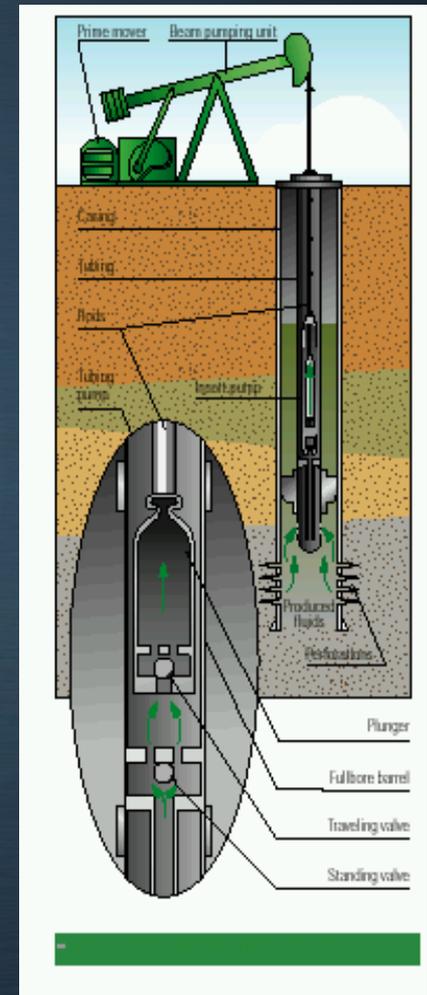
PCP



HydroLift Hydraulic Pumps



Beam pump



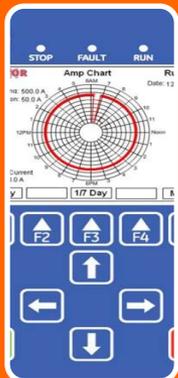
Electro Submersible Pump System

Monitor

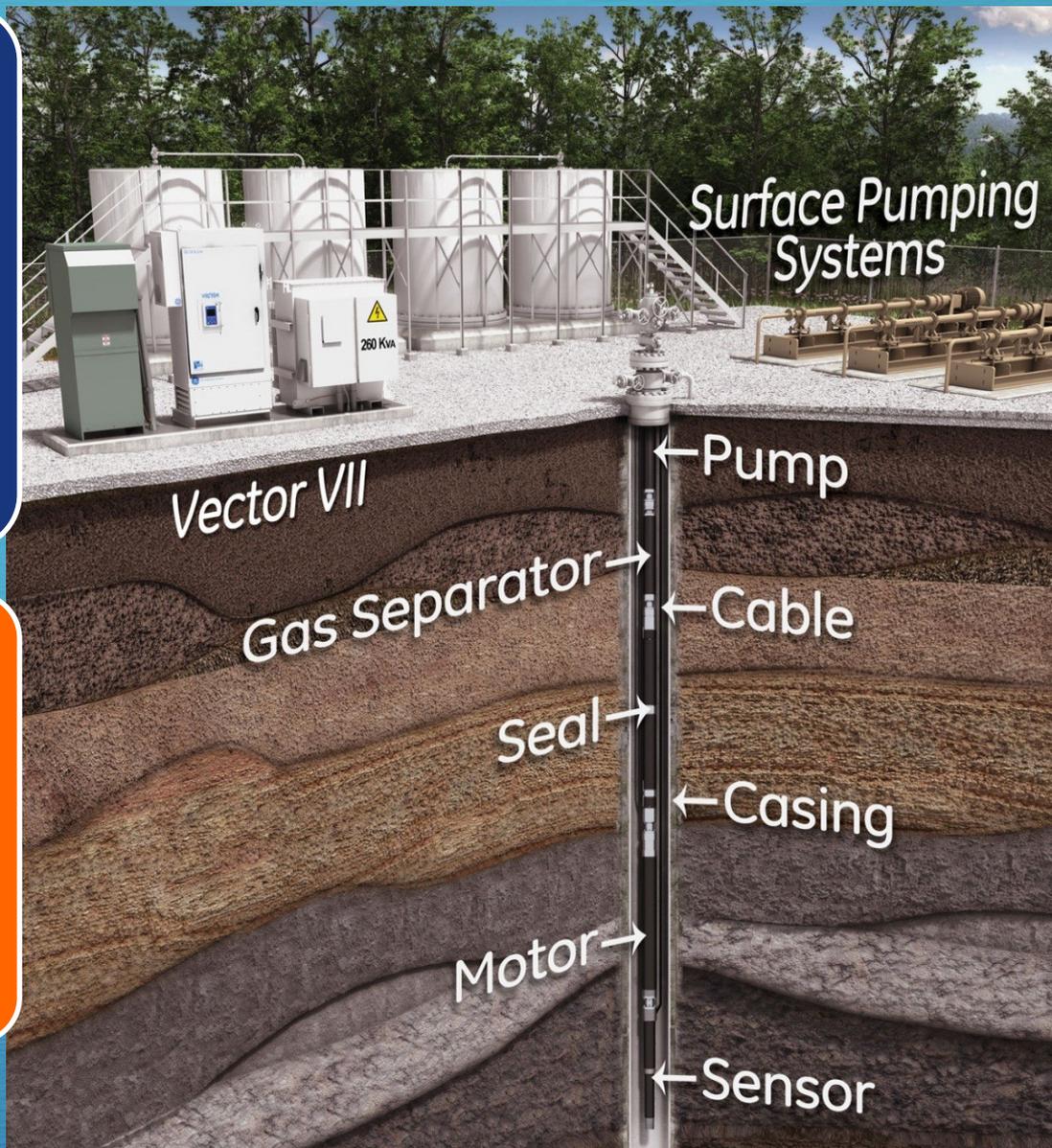


- Intake Pressure
- Intake Temperature
- Motor Temperature
- Discharge Pressure
- Vibration
- Motor Current
- Casing Pressure
- Tubing pressure

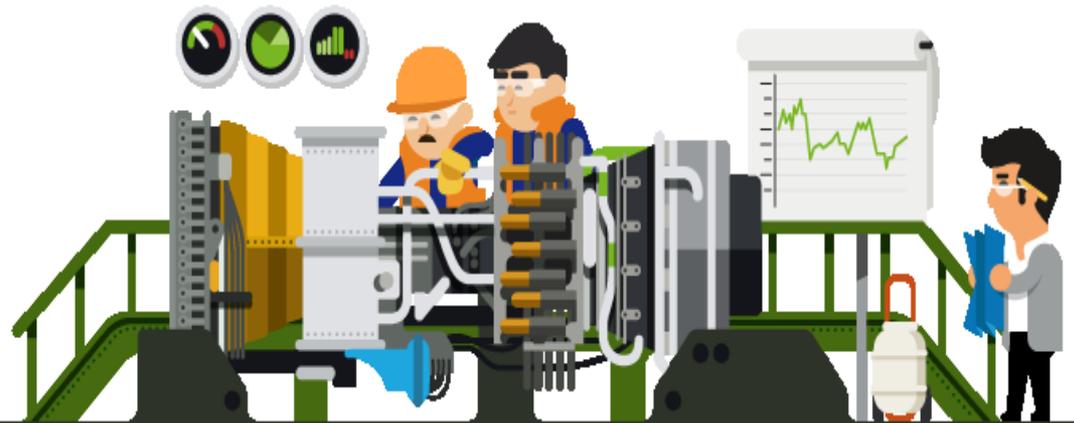
Control



- ESP Motor Frequency
- ESP Remote Start
- ESP Remote Stop



Diagnostics using Analytic Analysis



GE imagination at work

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

Storage & Transportation



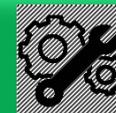
- * Improper storage
- * Improper transportation

Installation



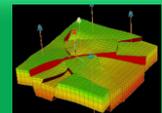
- * Assembly procedure
- * Installation procedure

Operational



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

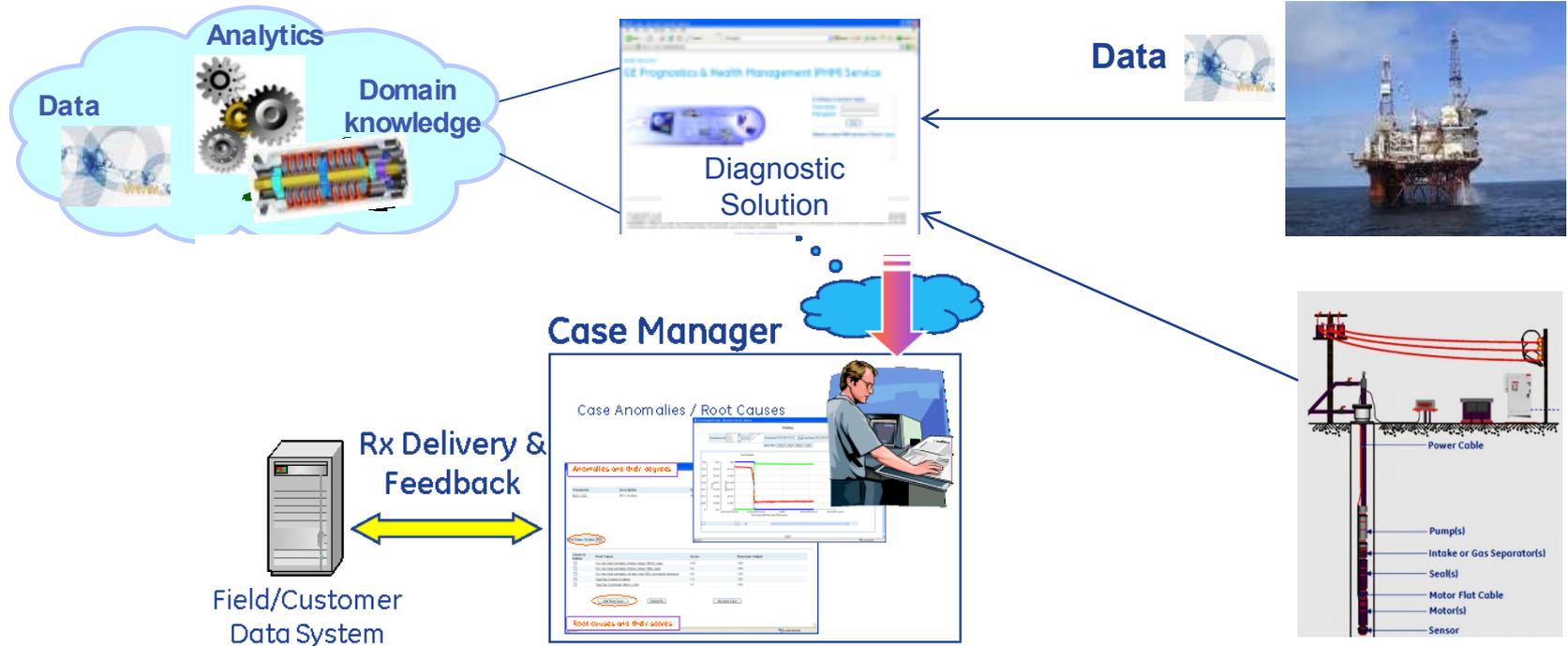
Reservoir



- * Reservoir fluids
- * Reservoir performance



Diagnostics for ESP



Program

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

Advantage

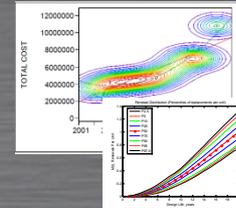
Reliable lift performance
 Reduced equipment downtime
 Increased installed base and margin

Deliverables and Business value

Decision Optimization

Models & Tools:

- Long term service agreements
- Optimize Spares & Logistics
- Optimize Maintenance



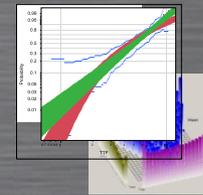
Business Impact

- Lower cost of quality
- Lower lifecycle costs

Advanced Reliability

Models & Tools :

- Survival Analysis
- Recurrent Event Analysis
- Probabilistic design models

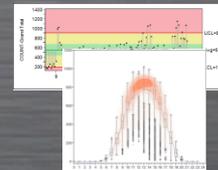


- Improved reliability
- Improved availability

Anomaly Detection

Tools & Algorithms :

- Anomaly Detection
- Change-Point Detection
- Data Fusion

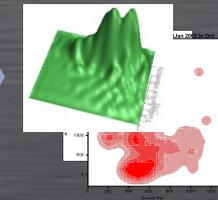


- Reduce downtime
- Services revenue

Data Mining & Reporting

Report & Algorithms :

- Data mining – identify issues (known, emerging)
- Data for probabilistic design



- 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 b/d x 20 x 0.3 x \$100 = **\$3MM !!**

- Intervention cost (Estimated):

Onshore conventional well: **\$5K to \$25K** per intervention

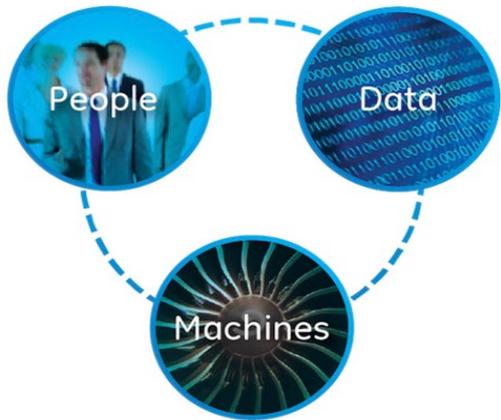
Onshore unconventional well: **\$150K to \$250K** per intervention

Offshore well: Up to **\$1MM** per intervention

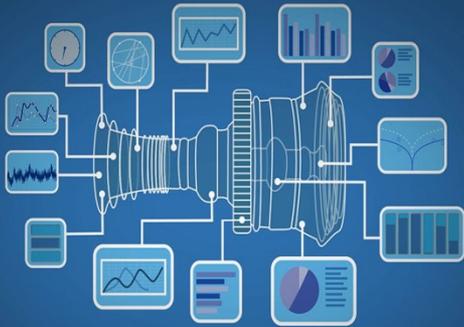
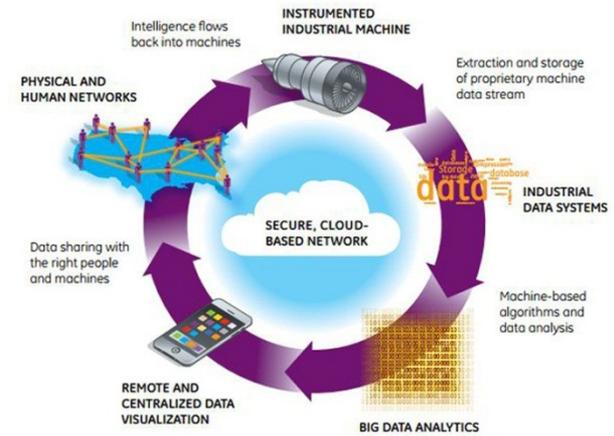
Intervention costs is often a deciding factor for customer sale!



Industrial Internet



Industrial Internet: Pushing the Boundaries of Minds and Machines



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



Intelligent
Machines

+

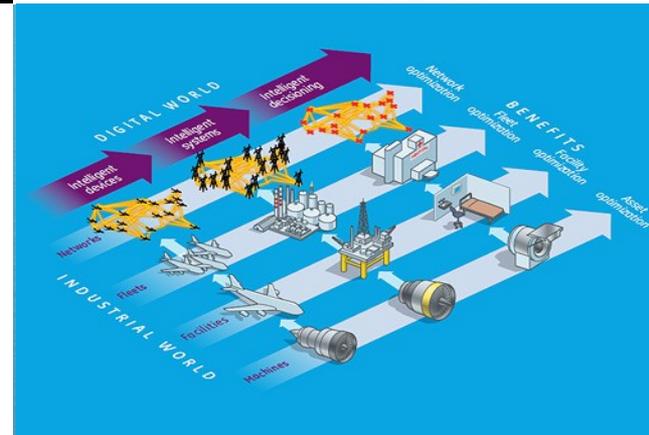


Advanced
Analytics

+



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/artificial_lift_controls/index.jsp

Industrial Internet

- http://www.ge.com/sites/default/files/Industrial_Internet.pdf

GE Predictivity™ Industrial Internet Solution

- <https://www.ge.com/b2b/predictivity>

Data Management & Data Analytics Software

- <http://www.ge-ip.com/products/data-management-data-analytics/c557>



