



Advancing Wind Power in Illinois Conference 2011

Walter Ravelo

GE Intelligent Platforms

Emerging Technologies

Breakout Session

Thursday, July 21, 2011, 4:00 PM

Advancing Wind Power in Illinois-Emerging Technologies

GE Intelligent Platforms Proficiency SmartSignal



imagination at work

Agenda

- Who is SmartSignal?
- What do we do?
- What are we doing with IIT?



imagination at work

5
Dgydqfijj 2 133 Srz huq hzkr lv
:24425344



imagination at work

Who is SmartSignal?



6
Dgydqfijj 2. Igg Srz huq huq:lv
:24425344

SmartSignal

- Algorithms originated at Argonne National Laboratory in the 80's
- SmartSignal formed in 1999, Headquartered in Lisle, IL
- Started the Predictive Analytics market
- Steady growth
 - o in Power – about ½ of US power gen (by MW) uses SS
 - o and O&G industries – North Slope, GOM, refineries, midstream
- Acquired by GE Intelligent Platforms in January 2011



7
Dgydqfijj 2. Igg Srz huq huq:lv
:24425344

Avoid Surprises



8
Dgydqfijj 2. Iqg Srz huq hzkr lv
:24425344

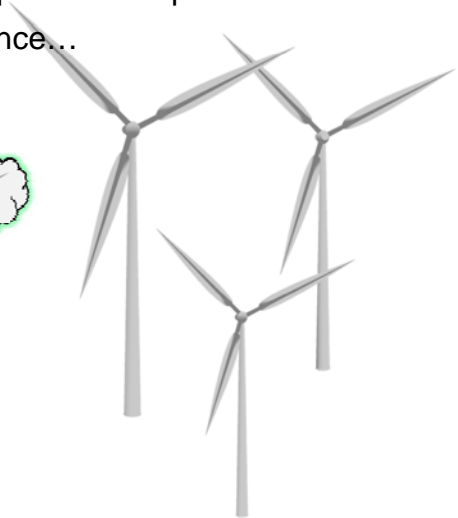
What to do we do?



9
Dgydqfijj 2. Iqg Srz huq hzkr lv
:24425344

Predictive Analytics

Acts as a Supporting Experienced Operator & Technician
 Leverages Past Experience...
 Works 24x7



Strzhuqj hszpr'lv
 :2H4Z5344

SmartSignal — Early Detection Based on Operation History

Where Your Data Is

Where Your Data Should Be

Amps	
Suction Flow	
Differential Pressure	

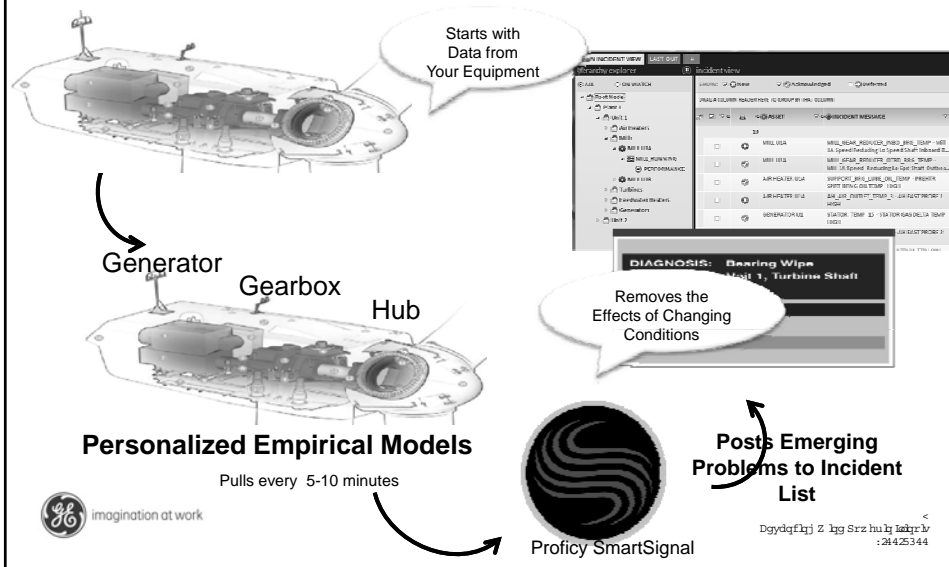


Deviations from
 Historic Patterns



Dgydqfklj 2 lgg Strz huqj hszpr'lv
 :2H4Z5344

The SmartSignal Solution



Models Focused On Failure Modes

Detect Blade Pitch & Yaw Failures:

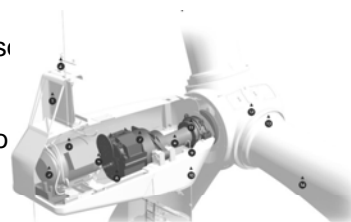
- ~ HUB model: typically 17 sensors

Detect Gearbox Failures:

- ~ MECHANICAL model: typically 17 sensors

Detect Voltage/Current Failures:

- ~ GENERATOR model: typically 19 sensors



Example Report

SmartSignal Monitoring Report 5/19/2010

smart-signal Availability & Performance Center

Alert:
Gearbox Temp and HS_BRG_TEMP_2 are about 10 degrees high

Status:
Date of Notification:
Equipment Tag: GEARBOX_TEMP,
HS_BRG_TEMP_2
Category:

Description:
The GearBox Temp and High Speed Bearing Temp 2 tags are running about 10 degrees higher than the sister turbines.

Diagnosis:
Continue to watch closely, could be indication of lube oil cooler issue...

Customer Response:
Possible Sticky Thermostat is preventing enough lube oil from being routed through the radiator



© 2009 SmartSignal Confidential
imagination at work

44
Dgydqfij 2. Igy Srz huq iakp:lv
:28425344

The SmartSignal Community



imagination at work

Illinois Institute Of Technology Project



46
Dgydqfijj 2. Igg Srz huq huqprlv
:24425344

IIT project

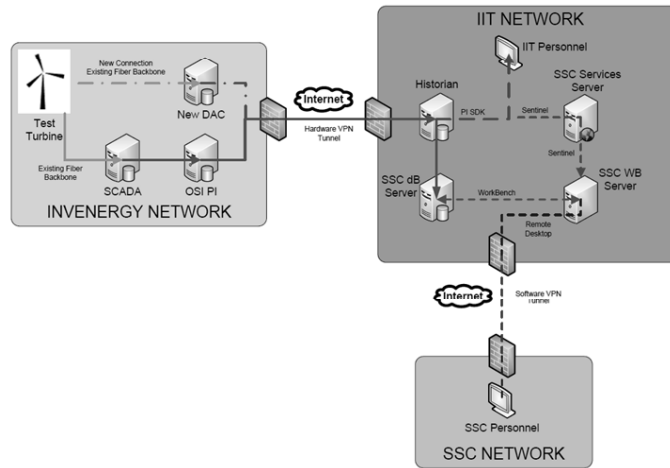
Phase 1:

- Install IT Network and Servers at Invenergy and IIT.
- Install SmartSignal Software at IIT
- Create and activate models for 1 wind turbine utilizing the existing available sensor.
- Install a local camera to visually monitor turbine condition and environment



47
Dgydqfijj 2. Igg Srz huq huqprlv
:24425344

Overall Proposed Infrastructure Diagram



IIT project

Phase 2

- Identify and Install additional sensors that would enhance condition monitoring capabilities.
- Modify the models to include additional sensors.

Additional Instrumentation

Vibration

- 6 High Frequency Accelerometers
- 6 Low Frequency Accelerometers
- Signal Processing / Data Acquisition Box
- Bentley 3701 Wind Turbine Monitor

Lube Oil

- Pressure and Temperature Instrumentation
- Particulate Counter
- Data Acquisition Box

Blade Pitch Motors

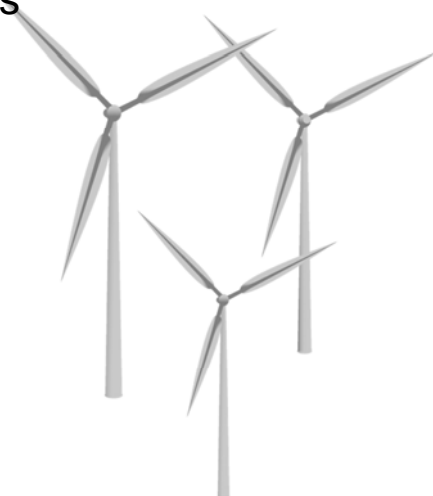
- Current and Voltage Instrumentation
- Stator Temps
- Data Acquisition Box



4:
Dgydqfijj 2. Igg Srz huq hzkr:lv
:2H4Z5344

IIT Project – Next steps

- Tune the existing models
- Finalize identification and installation of additional sensors



4:
Dgydqfijj 2. Igg Srz huq hzkr:lv
:2H4Z5344

