



IBM Connect 2015
Innovate. Understand. Engage.

Predictive Analytics

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Manager, Exploration and Production Technology

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Predictive Analytics

Tells us what is likely to happen and when?

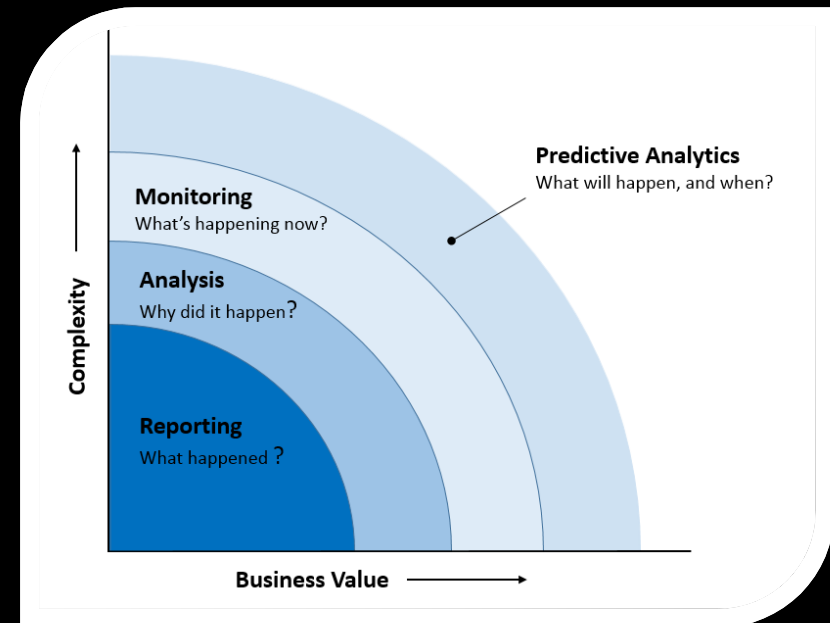
- **Facilitates reductions in NPT**
 - Advance warning, minimises downtime and investigation time
 - Notification identifies issue and indicates probable cause – prescriptive, quantifies downtime
- **Allows us to operate more efficiently**
 - Optimized efficiency of machinery use
 - Optimized maintenance scheduling
 - Savings; fix vs break fix
 - Limits HSE exposure
 - Minimise travel, less windscreen time, improved safety

Value

Significant opportunity, now **proven** technology

Est. \$3.5 - 5M p.a.

Application of 'theoretical POC' models only.



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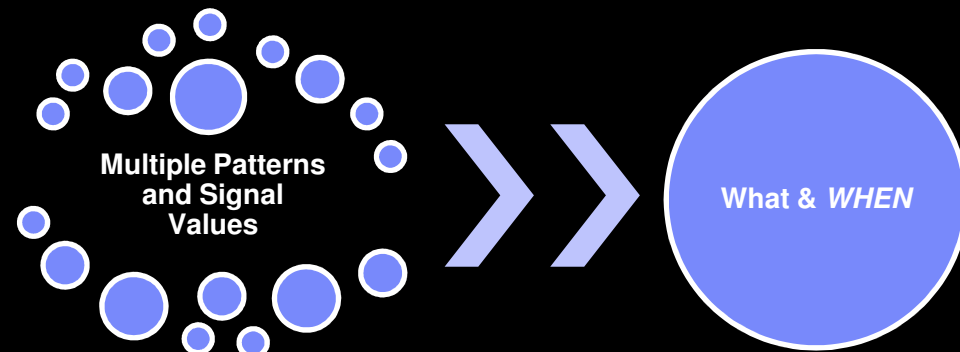
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Predictive Analytics

Making optimum use of and capturing value from systems and information that we already possess.

- We have poor monitoring – particularly ‘alerts’
- We utilize ~10-12 % of our operational data; SCADA/DCS, temp sensors, vibration, voltage, etc. (Industry average 10-12%)
- Little is ‘processed’ into available **information** – we spend far too much time repeatedly searching for and collating data
- We rely on lag indicators and fixed schedules – we respond too late or operate inefficiently



- We rarely analyze a complete picture as we rely on eyeballs, we don't have enough and it's getting worse.
- In the majority of PA identified cases more would not be better – “Digital Eyeballs”

Maximize Warning Lead Time & Provide Specific Indications of Cause

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Failure Prevention

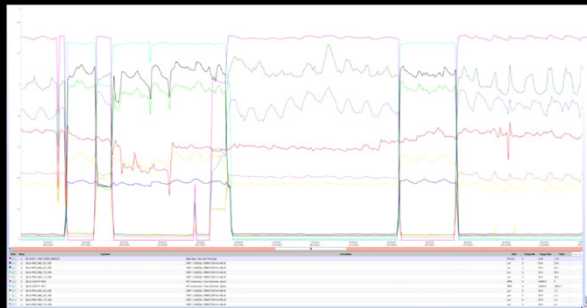


Sensor Model

\$26M of 'loss' (2007 – 2013) are attributable to Broken Sensor or Temp related events.

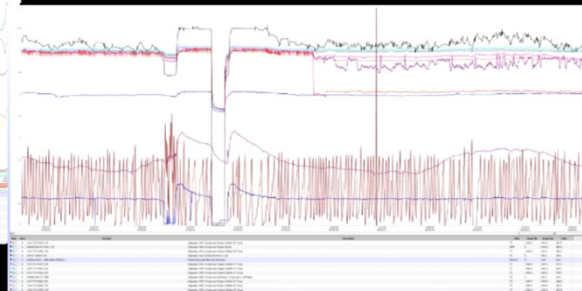
Compressor tripped twice due to broken vibration sensor.

2 Months



Breaking thermocouple signature

2 weeks



Sensor failure

10hrs



"... nobody raised this up ... before we started compressor.. This is deviation that somehow escaped from our logs..."

"Continuous monitoring and alarming has to come in play as soon as possible for us to be able to capture all these faults remotely"

"the list of essential data for review – will be great to have "flagging tool" ...indicating excursions from predefined set points as this would save much time.."



Email Alert:

"The Outboard Y-Axis Radial Vibration Sensor on Compressor 3 may be malfunctioning.

A signature indicating malfunction with vibration levels above 75 has been detected in the following time range....."

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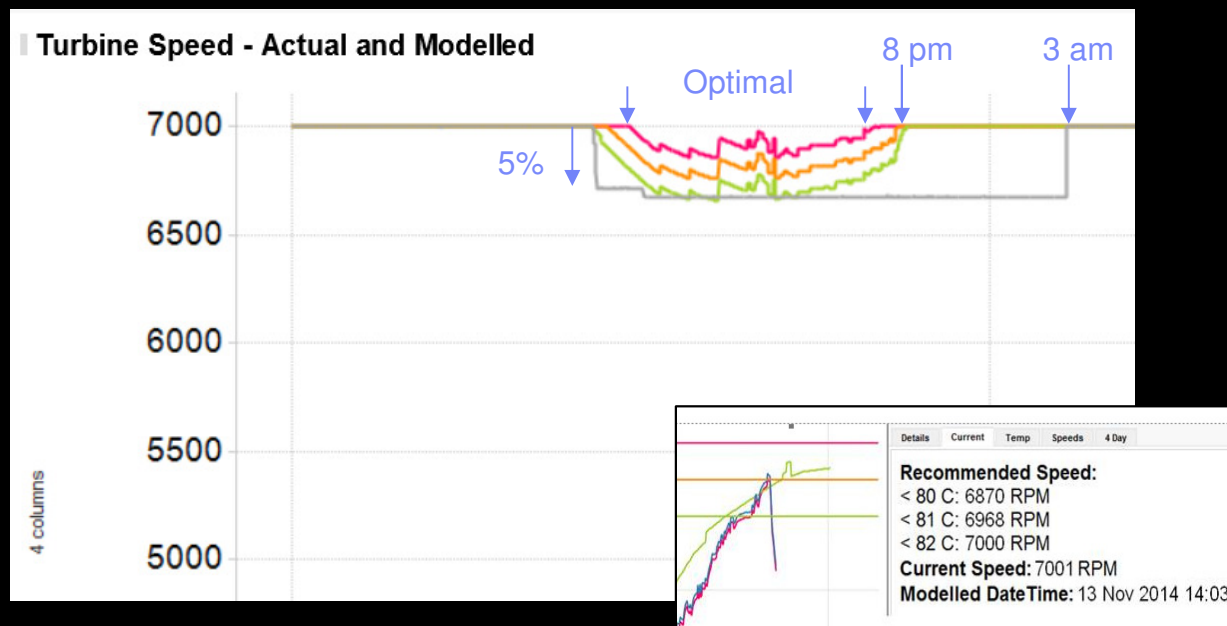
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Optimization

Thermal Model

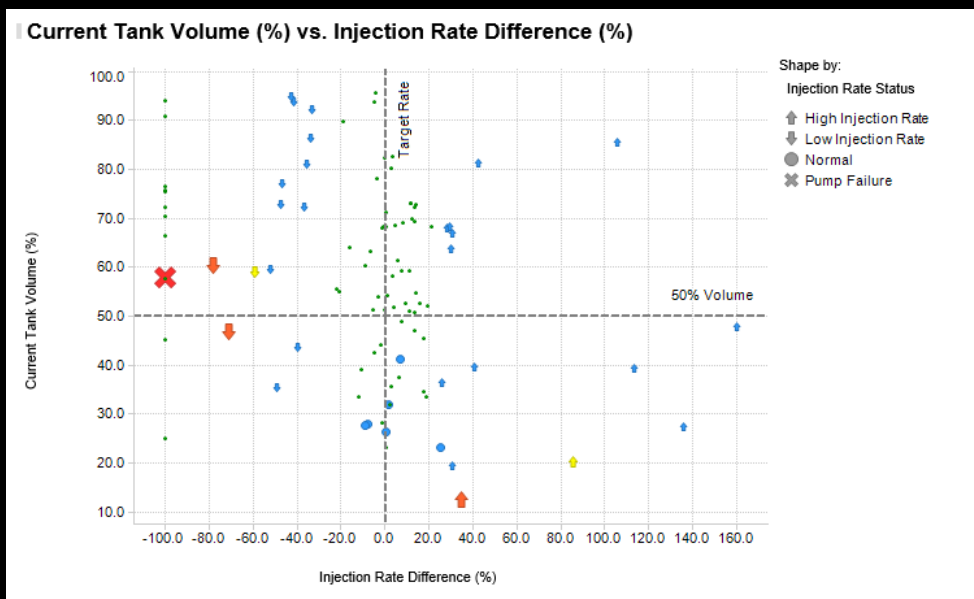
Model used to prove temperature related modelling and prediction.



- Deferred production p.a. : **\$700k p.a.**
- Multiple opportunities for application

Efficiency & EHS

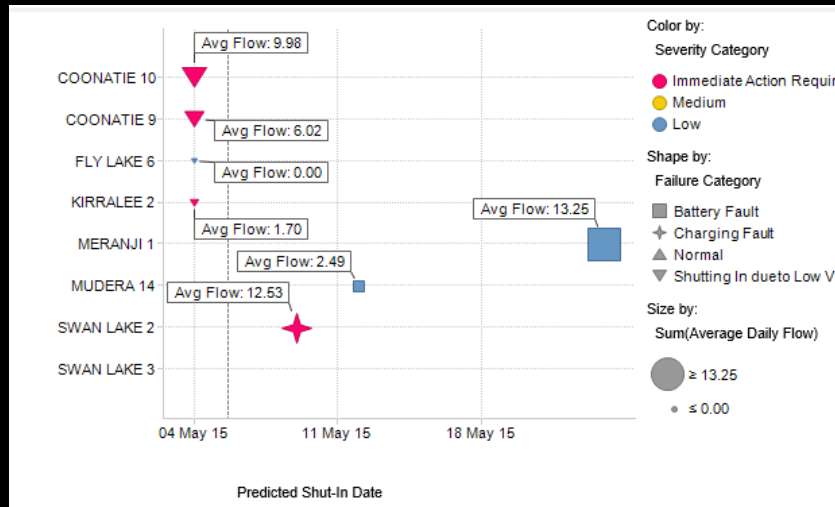
Wellhead Models Tanks



- Early warning of Inhibitor Tank refill + alerts on low and high flow rate to identify leaks, blockages and user error.
 - 30 day, 14 day warnings and 1 day alerts including forecast 'run dry' and rolling quantity required & exception event alarms
 - Pump Models
 - Saving \$1.1M p.a.

Efficiency & EHS

Wellhead Models Power

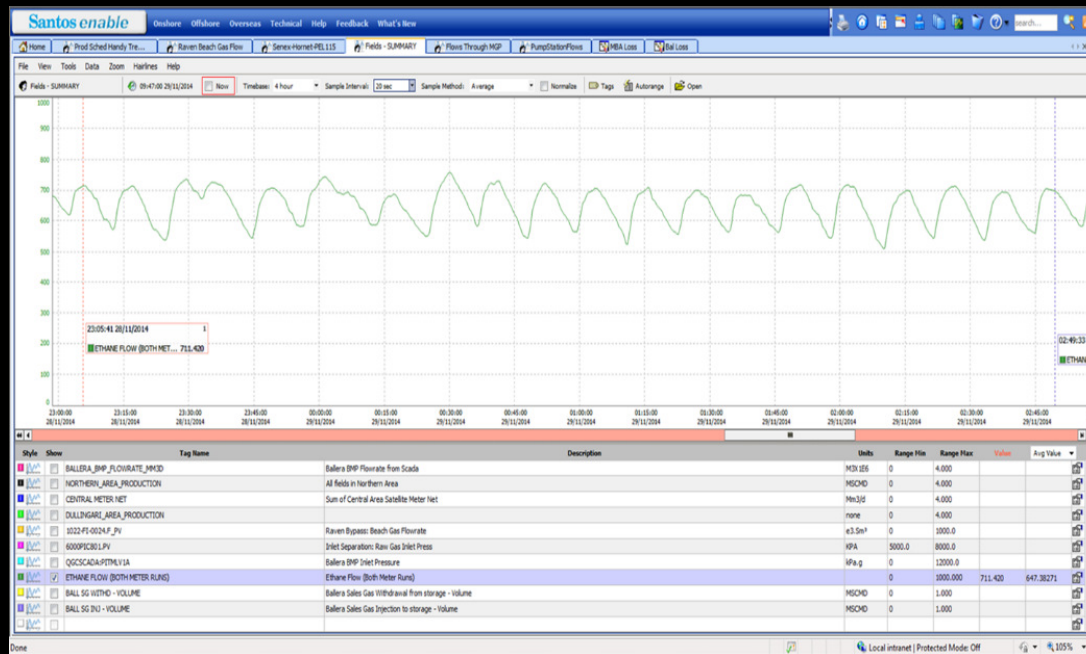


- Early warning of ROC battery and solar panel faults
 - Example: shut in of 15 wells due to offline ROCs
 - Combination Solar Panel/Battery faults)
 - Can be replicated to monitor ROCs on other equipment including essential isolated compressors
 - **Initial Savings Estimate: \$500k p.a.**
 - **Now believed to be >\$3M p.a.**

Satellite	Trend Date	Asset Description	Asset Status	Severity Category	Failure Category	Failure Description	Flow Yesterday	Flow This Month	Flow Last Month	Predicted Load Off Date
Booka/Pond	04 May 2015	COONATIE 10	Online	Immediate Action Required	Shutting In due to Low Voltage	Voltage has reached cut-off and is causing well to shut in periodically. Battery inspection required.	9.98	43.1	337.63	04 May 2015

Next Iteration

Plant Gas Product Optimisation



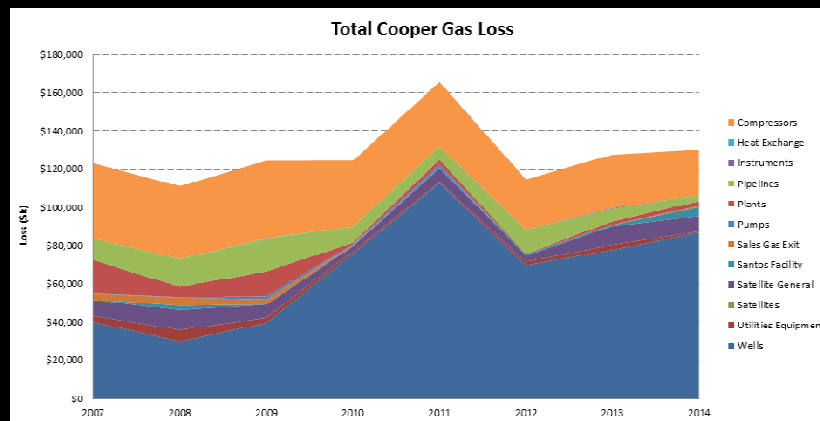
- We have a well instrumented plant and historian – the key foundations for PA, we can build models.
- Estimated impact from application of PA to a single specific production chain 5-20% (\$2.5 -\$10M p.a.)



Next Iteration

Apply PA across our operations

Direct requests for assistance, there are many more....



Description	Comments
Ethane Production *	Maximising the amount of Ethane we produce over the next 5 years
Tank 3000	H ₂ O Intrusion, vapour event prediction (process safety). Can we 'monitor' without re-engineering.
Compressor Cylinder Temp Model	Request to Fast Track
Integration of well cycling and blowdown	Combine optimised well cycling profile with optimised blow down
Real Time Drilling Modelling	Predictive events based on previous drill runs.
Plant Modelling	Early warning of CO ₂ and Boiler events (Chemistry)
Bookabourdie I/O Modelling	Link to IOps strategy for SA
Tirrawarra Separator Modelling	Early warning of liquid handling events including pigging, separators and slug catchers
Variable Speed Drive Modelling on Beam Pumps	
Wells ...	

Partnerships



Only possible as a result of working with a committed multidisciplinary team

Santos:

Steve Lechowicz
Brett Matheson
Michael Valenzisi
Ben Moretti
David Storey

IBM:

Cameron Wilkinson
Ronnie Chan
Mary Webb

Oxford University:

Dr. Steven Roberts
Dr. Michael Osbourne

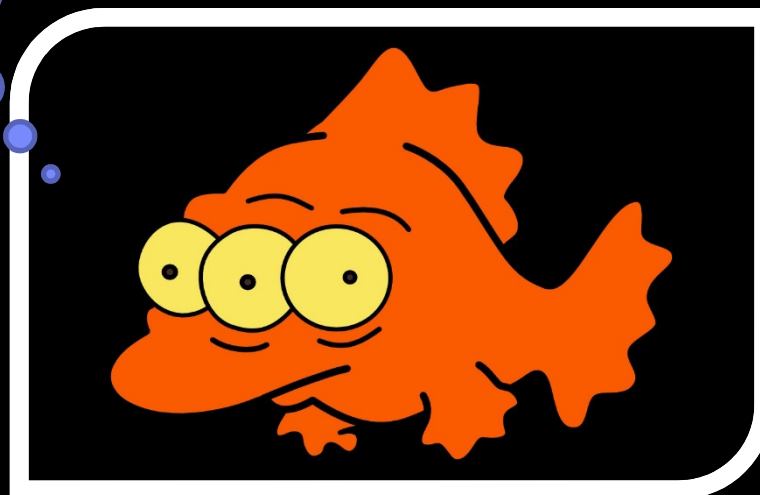
And many others.....



Questions and follow up requests?



"I wish I had this 20 years ago"



**Join me now in the
Speaker lounge
during the break
following this
session.**

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