

AGL: The people story of PI and analytics

Mark Faith (Manager ODC and Technology)

Australian Gas Light Company (AGL)



- We operate the country's largest electricity generation portfolio, we're its largest ASX-listed investor in renewable energy, and we have more than 3.6 million customer accounts.
- Proudly Australian, with more than 180 years of experience, we have a responsibility to provide sustainable, secure and affordable energy for our customers.
- Our aim is to prosper in a carbon-constrained world and build customer advocacy as our industry transforms. That's why we have committed to exiting our coal-fired generation by 2050 and why we will continue to develop innovative solutions for our customers.

AGL is committed to helping shape a sustainable energy future for Australia.



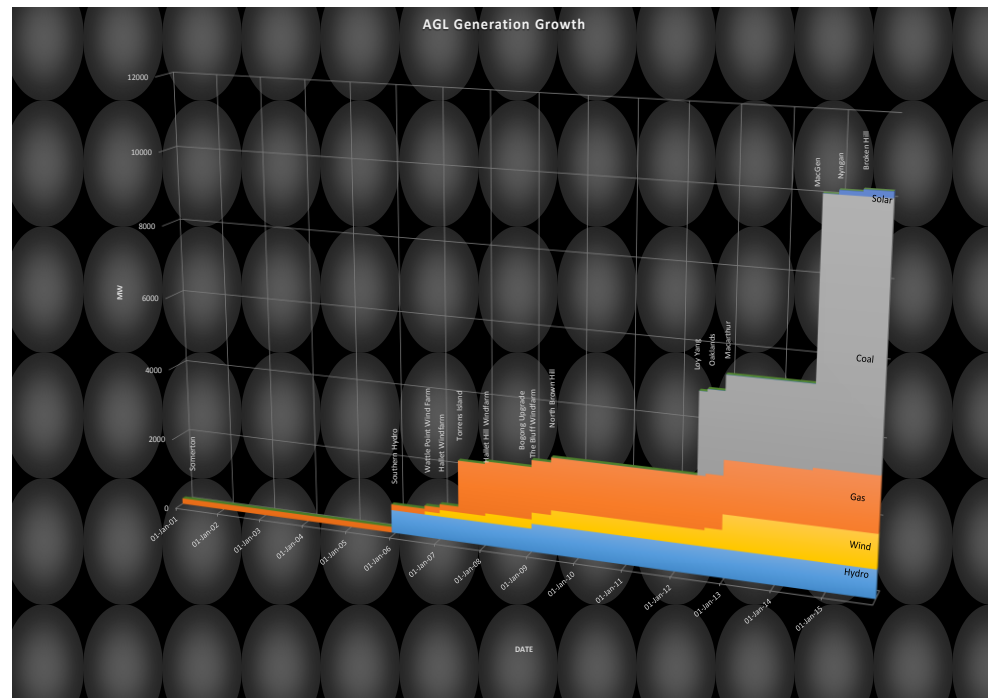
The AGL Generation Fleet

300-10,000+ MW in 9 Years!



Fast Generation Portfolio Growth via:

- Acquisitions including:
 - Southern Hydro (700MW)
 - Torrens Island Power Station (1280MW)
 - Loy Yang Power Station (2250MW)
 - Macquarie Generation (4560MW)
- Build including:
 - 9 X Wind Farms (1589MW)
 - Bogong Hydro Power Station (150MW)
 - 2 X Solar Power Stations (155MW)



Choosing OSIsoft PI and Partner Products

OSIsoft PI Real Time Data Infrastructure

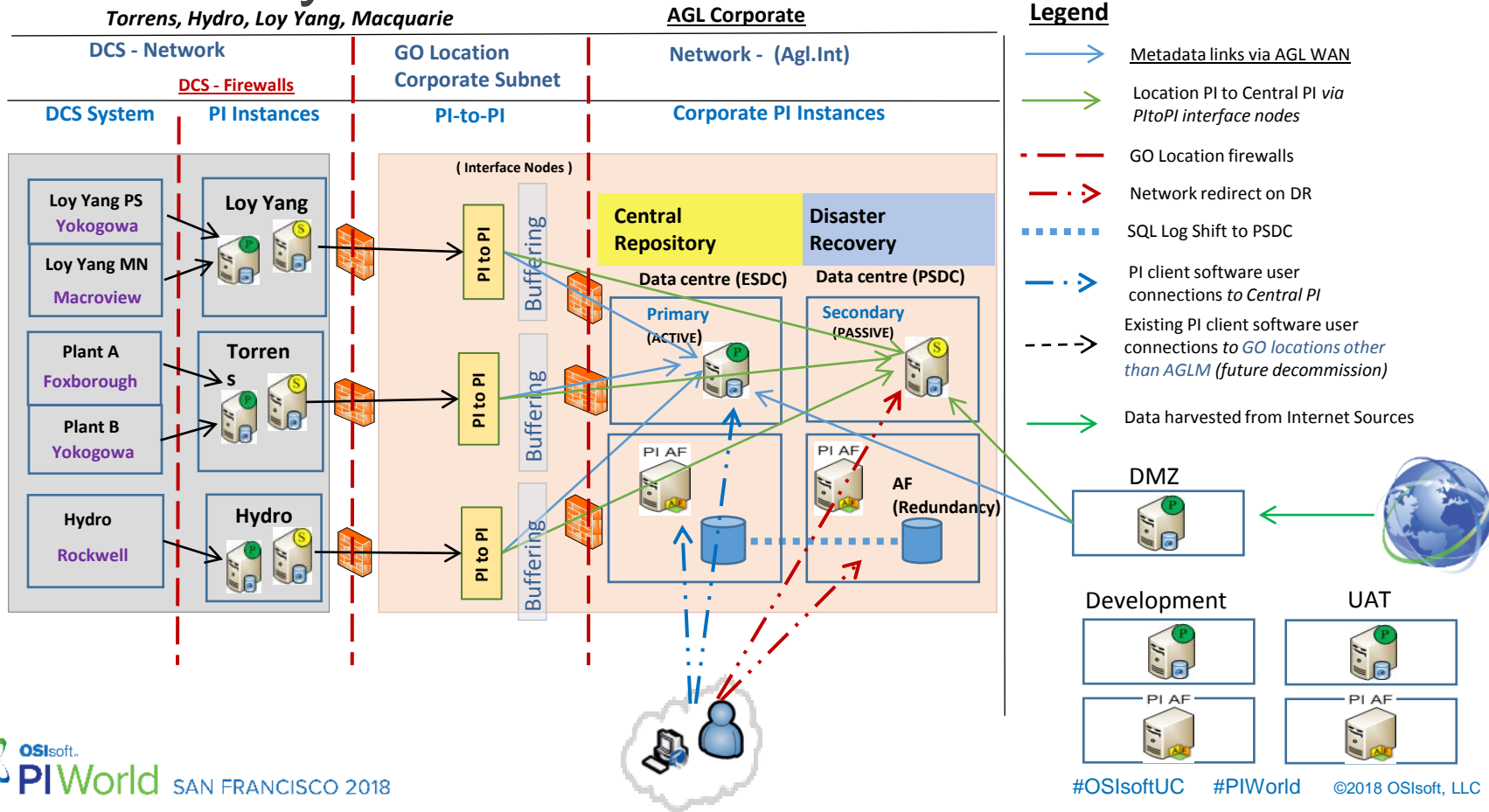
The enabling technology that changes our data culture and gets us better results

OSIsoft PI is our real time data infrastructure solution

- > It includes the high performance PI Server that acts as a highly adaptable and connectable real time data historian that can connect to almost all power station field devices including, but not limited to:
 - Distributed Control Systems (DCS)
 - Programmable Logic Controllers (PLC)
 - Field Located Digital devices (instruments, controllers etc.)
- Advanced analysis and visualisation tools that greatly increase the value proposition for AGL.
- Mobile data access that is secure for all AGL users.
- Many OSI Partner products that easily connect to OSI PI



AGL – PI System Architecture Hi-Level Overview

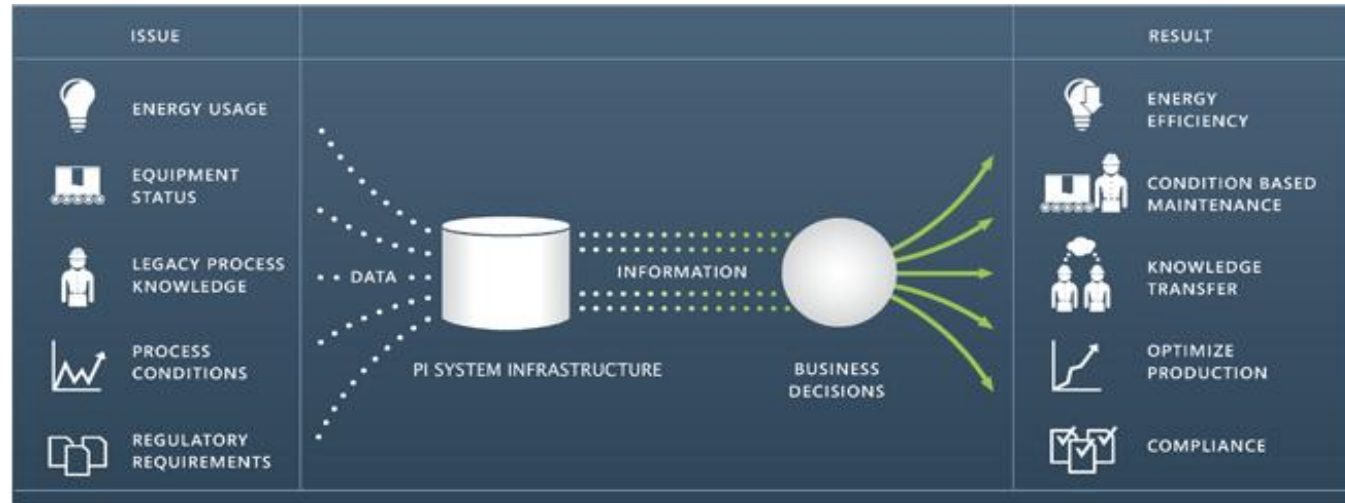


OSI PI - What is next

Adding Value through...

- Operational Excellence
- Reliability Improvements
- Strategy Development
- **Central Diagnostics**

From reactive to proactive



Operational Diagnostic Centre and APR Deployment

Operations Diagnostic Centre



Predict It

Advanced Pattern Recognition

*"Finding failures before they
find us"*



Early Warning System

- Providing diagnostic service to Group Operations Business Units
- Foresight through early fault detection (weeks & months vs hours)

Procurement

- Four initial tender applications
- Predict It software selected
- Centralised or Site Diagnostics
- 3 month evaluation period.....



USA site visit to two advanced pattern recognition users

Challenges -

- **Installation**
- Resources
- Site engagement
- Model Build
- Communications

Installation of the Software
That was the easy bit.

Challenges -

- Installation
- **Resources**
- Site engagement
- Model Build
- Communications
- One resource – first 6 months
- Three month assistance from Predict It
- Secondment
- Site knowledge

Challenges -

- Installation
 - Resources
 - **Site engagement**
 - Model Build
 - Communications
- Started with Site information sessions – Symposiums
 - Engage one on one with engineers
 - Types of Engagement
 - Welcomes the technology and functionality
 - Passive Resistance
 - Not Engaged – We don't need this product
 - The most challenging to overcome

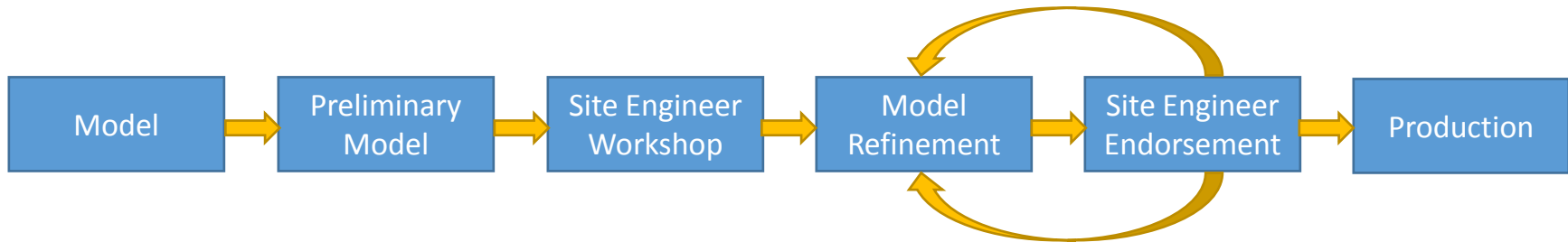
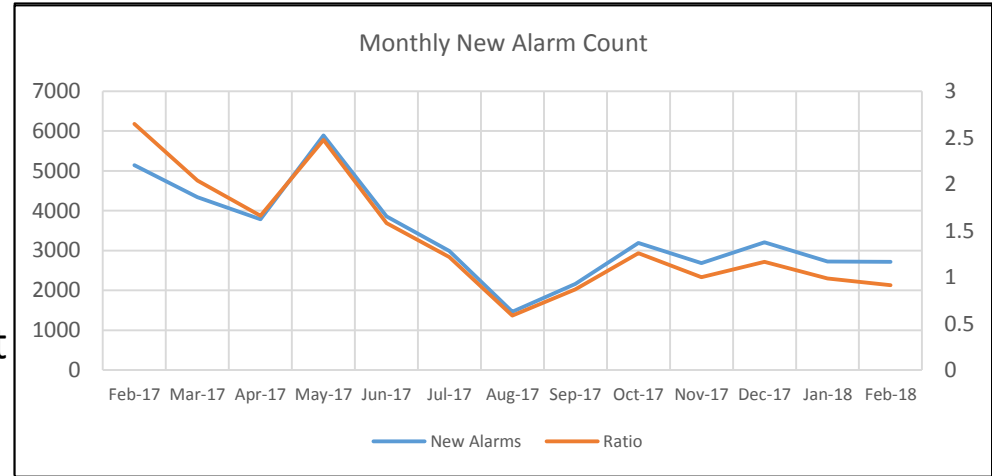


Model Build

Model build must be sustainable
Build engineering and site buy in
Alarm and build management

Morning – Alarm management

Afternoon – Model build



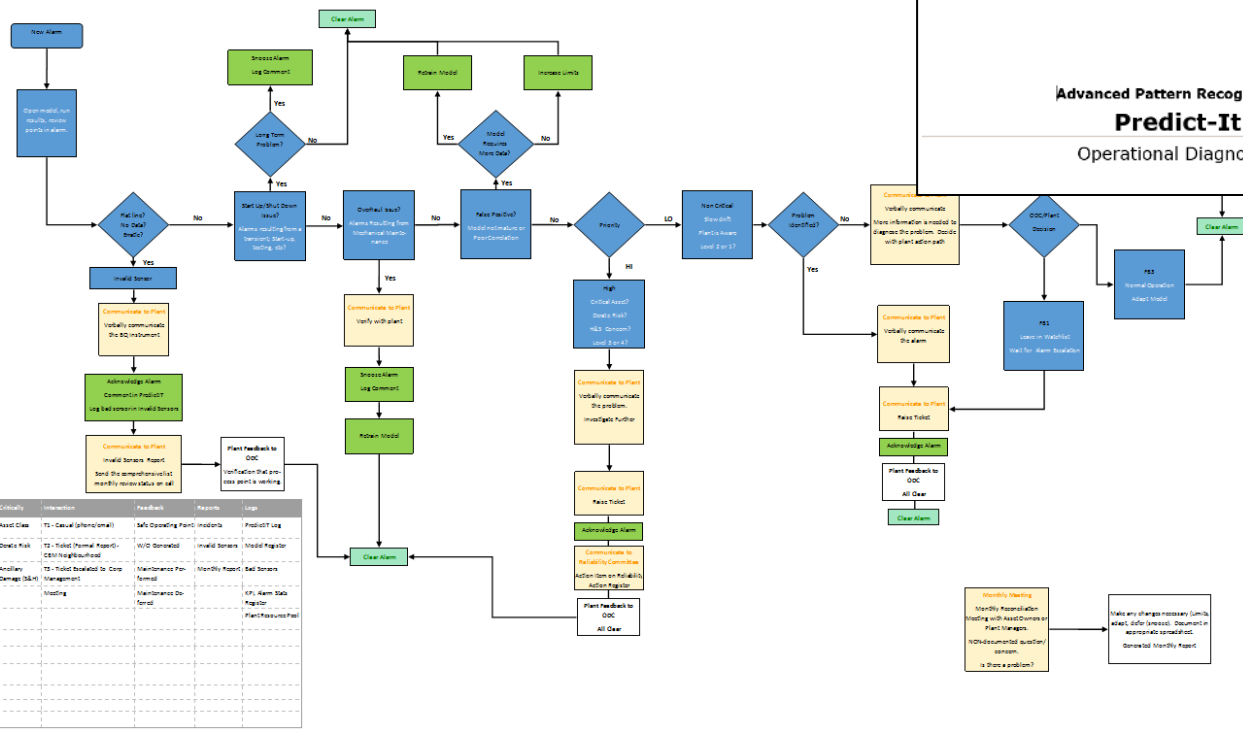
Communications

Energy in
action.

OSIsoft
PIWorld

Advanced Pattern Recognition (APR) Software
Predict-It User Manual
Operational Diagnostics Centre (ODC)
Group Operations

- Step 3: Select**
1. View all New Alarms (under Acknowledged and Hide Snoozed Alarms)
 2. Filter by Normal and review alarms for critical points. Investigate critical intermittent alarms, acknowledge normal alarms that require further review. Clear other normal alarms.
 3. Filter by High and Low to list current alarms. Review list for critical asset alarms. Note the Severity and Duration % of alarms to help prioritize queue.
 4. Sort alarms by model
 5. Select a model (double-click) with the most alarms first.
 6. Cycle through all new alarms taking action to completely clear the list of new alarms by one of the following means:
 - A. Acknowledge - Recognize alarm condition, severity and duration. Commit to investigating alarm further when time allows.
 - B. Snooze - Dismiss the alarm for a period of time (e.g. Startup condition).
 - C. Change Deviation Limits.
 - D. Adapt new data into model. Retrain.
 7. Address Acknowledged Alarms



Action	Resource Pool	Toolset	Alarm Types	Category	Interaction	Feedback	Reports	Log
Run Model	ODC New Analyst	Predict-It	Invalid Sensor	Asset Class	TS - Casual (Performance)	Safe Operating Point	Incidents	Predict-It Log
Peer Review	ODC Engineer	ProcessBook	Valid Process	Device Risk	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Advertise ODC	ODC Manager	Manuals	Non State	Asset Class	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Defect	Plant/ODC	Drawings	Drift	Asset Class	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Clear	Plant Asset Owner	Performance	Asset Class	Asset Class	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Comment	Plant Manager	Performance	Asset Class	Asset Class	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Change Limit	ODC	Performance	Asset Class	Asset Class	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Adapt Model	Reliability Committee	Performance	Asset Class	Asset Class	TS - Valid (Normal Range)	W/D Generated	Invalid Sensor	Model Register
Retrain								
Plant Disabled								
Reset								

Everybody has an opinion



Communications – Stepped Approach

Initial direct communications with site engineer



ODC email address



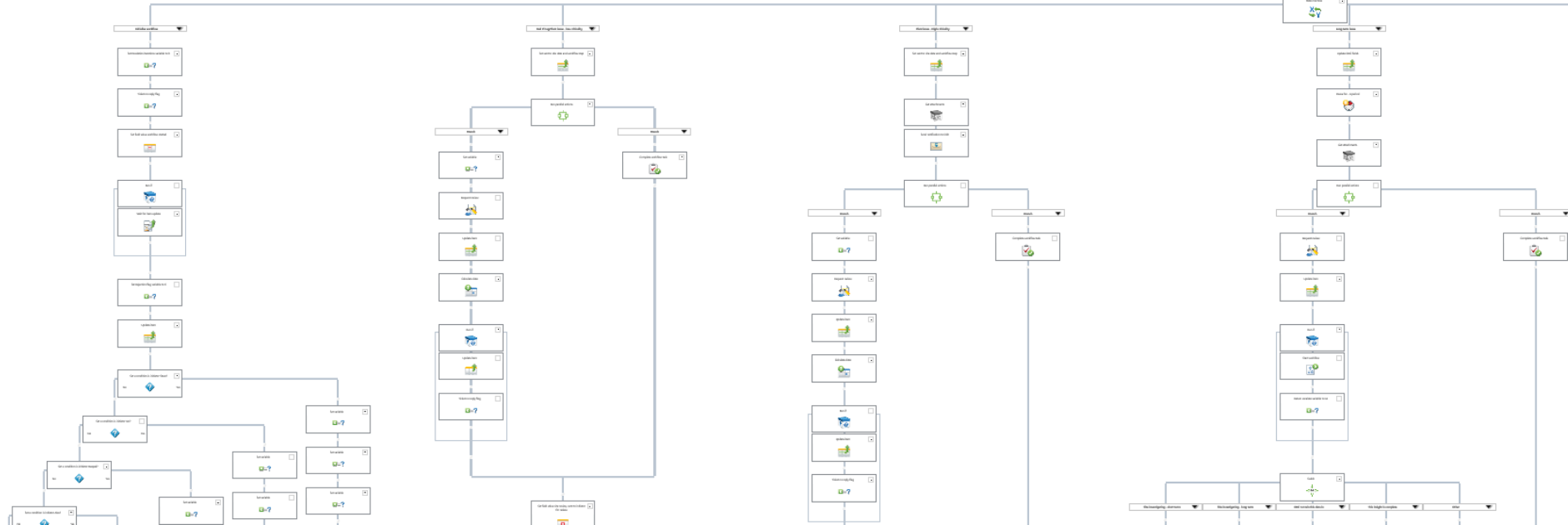
Nintex Ticket system – Plant Insights

- Easily accessible
- Work flow
- History



Nintex - Work Flow

ODC APR Ticket workflow
ODC APR Tickets
Version 238.0



Nintex - Ticketing

Ticket Header information

Free text information

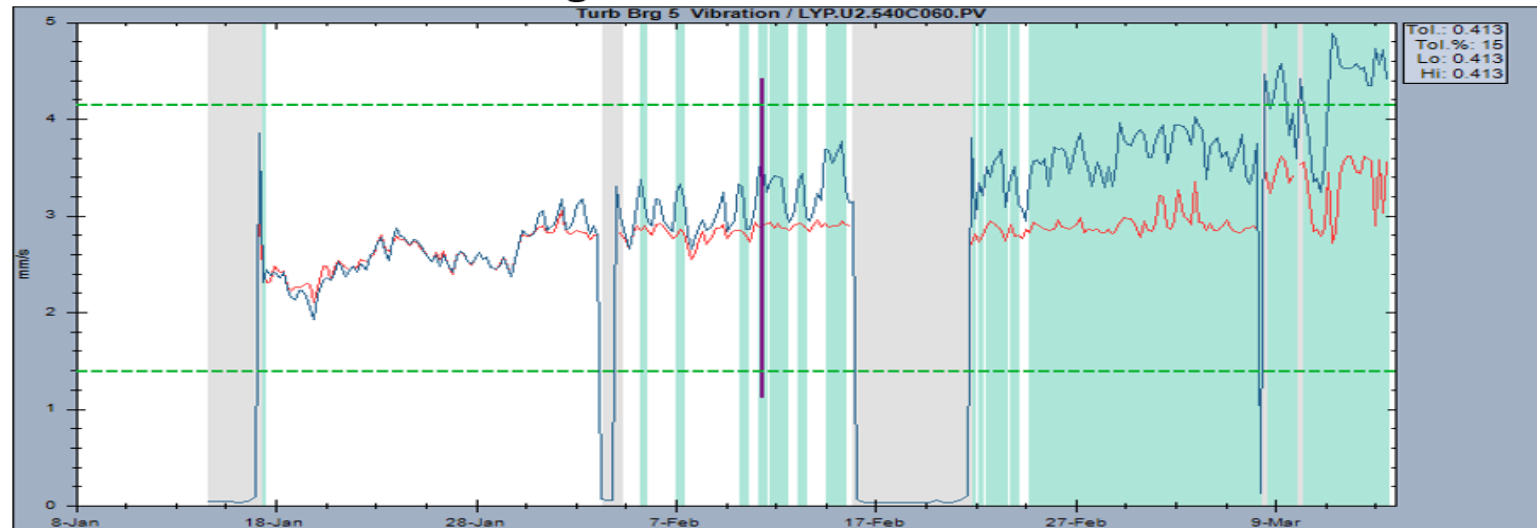
Attached supporting documentation

ODC Plant Insight - Details			
Insight ID	225	Title *	LY Unit 2 Turbine Bearing 5 vibration step change
Site	Loy Yang Station	Tag name *	LYP.U2.540C060.PV
Unit Select *	Unit 2		
Insight Type *	Pi Tag	Tag description *	Turb Brg 5 Vibration
Severity *	2		
APR Model No	249	Tag value *	4.4 mm/sec
WO No.			
		Expected value *	3.6 mm/sec
		Average peer value *	Normally below 3 mm/sec
		Alert Date *	14/03/2018
Plant Insight Details			
<p>Deepak Patel (19/03/2018 3:44 PM):</p> <p>Reply received from Neil Griffiths:</p> <p>Hi Ken,</p> <p>I haven't yet been able to find anything abnormal that might explain the recent increase in bearing 5 & 7 vibrations. All electrical, seal oil, stator water, etc readings appear to be normal.</p> <p>I noticed that the bearing 5 & 7 vibration levels also did an upward step change when the unit came back to service after the trip on 8/3/18.</p> <p>One possible explanation could be shorted turns within the rotor winding. These can show up as increased bearing vibrations and can develop during winding contraction/expansion, eg, unit trips.</p> <p>Shorted turns are unlikely to be the cause of the increased vibrations, as the rotor is fairly new (manufactured in 2010 and less than 7 years operation).</p> <p>I will arrange electrical testing during to be done during the U2 minor outage later this year to confirm this.</p> <p>Neil</p> <p>Deepak Patel (15/03/2018 10:16 AM):</p> <p>Reply received from Ken Grove:</p> <p>Hi Griff,</p> <p>Unit 2 Bearing 5 vibration has been gradually increasing over the past couple of months. See trend below.</p> <p><small>It looks like a minor on 17th but a trip due to high vibration which I wasn't aware of until now. The Bantia Macartha data isn't available for that</small></p> <p>LY Unit 2 Turbine Bearing 5 vibration step change_14032018.docx</p>			

Loy Yang Station Unit 2 TG – Turbine Bearing 5 Vibration step change

Tag: LYP.U2.540C060.PV

Chart: LY Unit 2 Turbine Bearing 5 vibrations over last 2 months



For Predict-it trend...

Blue trend = Actual value, Red trend = Predicted value, Green highlighted area = Predict-it alarm,
Gray highlighted area = Model not running

Nintex - Dashboard



Tailored
Dashboards

Business Unit
Overview

Engineering
Reviews

Operational Diagnostics - APR Plant Insights

[Intranet](#) > [Spaces](#) > [Operational Diagnostics - APR Plant Insights](#) > [Loy Yang Station APR Plant Insights](#)

Loy Yang Station APR Plant Insights

Contact and page details

Contacts: Stephen O Callaghan
Date: 15/03/2018 11:00 AM

More information

[ODC Ticket Register Presentation](#)

✓

ID	Title	Unit	Initiator	Site contact
225	LY Unit 2 Turbine Bearing 5 vibration step change	...	Unit 2	Deepak Patel Ken Groves
209	LY Station 2-PFM-8 PFM Door Temperature Very Low	...	Unit 2	Deepak Patel
204	Loy Yang Station Unit 2 RAH Cold End temperature low	...	Unit 2	Deepak Patel Sunil Philips
86	Loy Yang Unit 2 Electric Feed Pump 1, gearbox high speed bearing 7 high temp deviation	...	Unit 2	Deepak Patel Tim Yates

Loy Yang Station ODC APR Plant Insights - Bad Tags

ID	Title	Unit	Initiator	Site contact
215	Loy Yang Station Unit 2 LPH 3B Body Pressure faulty tag	...	Unit 2	Deepak Patel Len Cornwell
198	LY Station U1 SH Tube Faulty Metal Temperature	...	Unit 1	Deepak Patel Len Cornwell
193	Loy Yang Station 2-PFM-8 PFM Door Temperature Very Low	...	Unit 2	Deepak Patel Andy Mackie

Loy Yang Station ODC APR Plant Insights - History

ID	Title	Unit	Initiator	Site contact
201	LY Unit 2 Generator Transformer HV Winding Temperature High	...	Unit 2	Deepak Patel Nick Iles
200	LY Station 3-PFM-5 Door Temperature Very Low	...	Unit 3	Deepak Patel Andy Mackie
191	Loy Yang Station 1-PFM-1 Mill Inlet Temp probe faulty	...	Unit 1	Deepak Patel Andy Mackie

Predict.it

Login

Username:

Password:

Domain:

Predict It So It Do

Remember Me:

☐

Login

OSIsoft
PI World SAN FRANCISCO 2018

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Value Realisation

- VR a must to stay in Business
- Monthly Reporting
- VR to Date: \$18.7M

Drive Line Monitoring										
A	B	G	H	I	J	K	L	M	N	
1	AGL Energy									
2	ODC (Operational Diagnostics Centre), Melbourne									
3										
4										
5	1. PLANT SAVINGS	confirmed/finalised.	Raw Savings		Includes likelihood factor	Value Realisation	ROI (%)			
6	Direct involvement in plant diagnostic and fault investigations resulting in identified by end of month.		\$ 1,538,792,314.96			\$ 18,709,566.85	1765%			
7	plant faults and/or resulting in significant savings to the business (calculated)									
8										
9	DATE	DETAILS OF PLANT FAULT & ACTIONS	OTHER SAVINGS (lab, parts etc.)	Raw Savings	Likelihood	Value Realisation Savings	PRIMARY CM TECH TYPE	SECONDARY CM TECH TYPE	Proactive OR Predictive?	DETECTED BY
10										
11	Mar-15	Loy Yang 1-EFP-1 Pump increase in vibration	\$ 20,000.00	\$ 90,000.00	5%	\$ 4,500.00	Predict IT	Performance	Predictive	D Patel
12	Apr-15	Loy Yang 4-IDF-2 DE & NDE Bearing temp. High	\$ -	\$ 24,000.00	90%	\$ 21,600.00	Predict-it	Drive Line Monitoring	Predictive	D Patel
13	May-15	Loy Yang 4-IDF-1 NDE Bearing Vibrations High	\$ 5,000.00	\$ 53,000.00	5%	\$ 2,650.00	Predict-it	Drive Line Monitoring	Predictive	D Patel
14	May-15	Loy Yang 4-EFP-1 Main Pump Oil Pressure High	\$ 10,000.00	\$ 30,000.00	100%	\$ 30,000.00	Predict-it	Performance	Predictive	D Patel
15	May-15	Loy Yang 4-PFM-3 Mill Motor Current High	\$ 5,000.00	\$ 55,000.00	10%	\$ 5,500.00	Predict-it	Mill Performance	Predictive	D Patel
16	Jun-15	Loy Yang 1-CEP-1 Motor DE Bearing Temperature High	\$ 15,000.00	\$ 15,000.00	50%	\$ 7,500.00	Predict-it	Pump performance	Predictive	D Patel
17	Jun-15	Loy Yang Unit 1 CEP performance (Difference in Amps)	\$ -	\$ -		\$ -	Predict-it	Pump performance	Predictive	D Patel
18	Jul-15	Loy Yang 2-EFP-2 Main Pump Thrust Bearing Temp 1 High	\$ 20,000.00	\$ 20,000.00	100%	\$ 20,000.00	Predict-it	Pump performance	Predictive	D Patel
19	Jun-15	Loy Yang 2-BCP-1 LP Cooling Water Diff. Temp. High	\$ 10,000.00	\$ 41,200.00	75%	\$ 30,900.00	Predict-it	Pump performance	Predictive	D Patel

1-EFP-1

- 1-EFP-1 Alarm raised
- Initial Investigation

Current Models

Auto Refresh - 2 Minutes

New

Ack

Normal

Low

High

Hide Snoozed

Models

Alarms

Limits

Logs

Output Tags

Snooze

Folders

AGL

Loy Yang Station

Tomens Island

Hydro

Loy Yang Mine

Wind

Z_Test

Created	Model	Description	Tagname	Snoozed	Actual	Expected	Normal For	Duration%	Severity Number
30/09/2015 08:15:27 AM	AGL \ Tomens Island \ TIPS B \ Unit TB2 \ Chemical	FW Cond LP3 Hr	TIPS.B2LA004.PV		637.2	542.9	0min	6.4	1
30/09/2015 06:20:22 AM	AGL \ Tomens Island \ TIPS A \ Unit TA4 \ Turbine	T/G OIL BEARING 2 HP CYLINDER END	TIPS.A4TT044.PNT		47.49	44.78	0min	12.7	1
30/09/2015 05:20:25 AM	AGL \ Tomens Island \ TIPS B \ Unit TB2 \ Flue Gas	Flue Gas O2 Econ Out B	TIPS.B2A0T012B.PV		1.505	2.207	2.6 hr	15.6	0
30/09/2015 01:15:25 AM	AGL \ Loy Yang Station \ Unit LYA1 \ EFP \ 1-EFP-3	EFP Main Pump Drive End Sealing Cooler	LYP.U1.231T013.PV		58.63	55.18	6.73 hr	13.2	0
29/09/2015 21:05:21 PM	AGL \ Tomens Island \ TIPS A \ Unit TA4 \ Turbine	T/G HP SHAFT POS	TIPS.A4ZT901_AIN.PNT		0.0696	0.1113	1.35 hr	26.4	0
29/09/2015 19:35:28 PM	AGL \ Tomens Island \ TIPS B \ Unit TB2 \ Generator	Stat Slot 2 10 TE Core	TIPS.B2GT077.PV		45.55	32.37	0min	99.4	3
29/09/2015 19:10:28 PM	AGL \ Loy Yang Station \ Unit LYA3 \ Boiler FW and	Ming Ves Outlet Temp	LYP.U3.190T014.PV		331.5	335.9	0min	46.8	1
29/09/2015 18:55:26 PM	AGL \ Tomens Island \ TIPS A \ Unit TA4 \ Flue Gas	FLUE GAS O2 RSP CALC	TIPS.A4FLUEO2GSCAL.RIO3		-0.44	-0.4564	8.58 hr	14.9	0
29/09/2015 10:45:50 AM	AGL \ Tomens Island \ TIPS B \ Unit TB2 \ Chemical	Polisher Out Acid Cond	TIPS.B2KA007.PV		2.520	1.097	0min	99.7	4
28/09/2015 22:20:18 PM	AGL \ Tomens Island \ TIPS A \ Unit TA1 \ Turbine	TURBINE MAIN ESV NTH POS	TIPS.A1ZT001MDACT.MEASMD		102.1	101.3	0min	80.6	1
28/09/2015 22:10:18 PM	AGL \ Tomens Island \ TIPS A \ Unit TA1 \ Turbine	TURBINE MAIN ESV STH POS	TIPS.A1ZT002MDACT.MEASMD			102	17.1 hr	46.2	0
28/09/2015 13:25:17 PM	AGL \ Tomens Island \ TIPS B \ Unit TB2 \ Condense	Crude Est Pump Vlb	TIPS.B2KV018.PV		0.1713	0.9115	0min	99.3	4
28/09/2015 13:15:22 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Turbine	TURBINE GOVERNOR V/V POS	TIPS.A3Z4790UT.OUT		39.65	33.84	4.27 hr	80.9	0
28/09/2015 13:10:21 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Turbine	IP TURBINE NTH AND STH INTERCEPT	TIPS.A3RHPR_CTRL0UT		102	101.4	1.77 hr	46.9	0
26/09/2015 20:50:34 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Turbine	T/G BEARING NO2 VIBRATION Y	TIPS.A3V011Y_AIN.PNT		41.94	31.52	1 min	81	0
26/09/2015 19:50:29 PM	AGL \ Tomens Island \ TIPS A \ Unit TA1 \ Turbine	T/G MAIN OIL PUMP DISCH PRESS	TIPS.A1PT012.PNT		656.4	655.8	1.67 day	0	0
26/09/2015 19:00:34 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Turbine	SEAL OIL/H2 DIFF TURBINE END	TIPS.A3PT04BA_ALARM.MEAS		41.82	47.54	0min	60.9	1
26/09/2015 18:40:32 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Turbine	SEAL OIL PRESSURE TURBINE END	TIPS.A3PT04BA.PNT		239.3	251.4	0 min	100	2
26/09/2015 14:35:08 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Flue Gas	Fuel Gas AR PRV Temp	TIPS.B1Q1TT151.PV		13.97	13.42	1.18 hr	89.2	0
25/09/2015 20:15:05 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	Seal Oil EE to Hyd DP	TIPS.B1GPT122.PV		62.15	60.49	0min	99.8	2
25/09/2015 20:05:08 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	Stat Coolant Conductiv	TIPS.B1GAT028.PV		42.27	36.65	0min	99.8	2
25/09/2015 15:15:36 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	Stat Coolant Wire Rk DP	TIPS.B1GPT141.PV		11.15	11.57	0min	93.2	1
25/09/2015 15:15:36 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	Stat Coolant Flow	TIPS.B1GPT041.PV		15.44	15.89	0min	99.8	4
25/09/2015 15:15:31 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	Stat Coolant Gen DP	TIPS.B1GPT143.PV		121.4	129	0min	99.8	4
25/09/2015 03:00:34 AM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Chemical	FW Conductivity LP3 Hr	TIPS.B1LA004.PV		588.8	536.7	0min	89.1	2
15/09/2015 08:45:20 AM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Chemical	Polisher Out Acid Conductivity	TIPS.B1KA007.PV		214.7	90.49	0min	73	1
10/09/2015 14:45:18 PM	AGL \ Tomens Island \ TIPS B \ Unit TB4 \ Turbine	Feed Trip Rise Across HP7	TIPS.B4HTC100.PV		-1.279	4.335	0min	100	1
6/09/2015 21:15:18 PM	AGL \ Tomens Island \ TIPS B \ Unit TB4 \ BFP \ TIP	BFP Thr L/B Mi Temp	TIPS.B4FTT228.PV		46.13	56.6	0min	100	2
4/09/2015 18:25:08 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Generator	HYDROGEN BEARING METAL SEAL ST...	TIPS.A3TT067.PNT		58.78	54.6	0min	100	2
4/09/2015 17:10:12 PM	AGL \ Tomens Island \ TIPS A \ Unit TA3 \ Generator	HYDROGEN BEARING METAL SEAL NT...	TIPS.A3TT069.PNT		72.33	69.73	0min	100	2
4/09/2015 08:00:03 AM	AGL \ Tomens Island \ TIPS B \ Unit TB3 \ Air Heater	A/H Big East Mi Temp	TIPS.B3ATT285.PV		34.48	48.28	0min	100	2
3/09/2015 15:01:16 PM	AGL \ Loy Yang Station \ Unit LYA4 \ TG \ 4-Generat	Stator Slot 5 EE Temp	LYP.U4.403T212.PV		27.68	70.02	0min	100	4
25/08/2015 20:15:23 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	DW Coolers DW Out Temp	TIPS.B1GTT073.PV		18.36	21.93	0min	81	2
25/08/2015 17:10:26 PM	AGL \ Tomens Island \ TIPS B \ Unit TB4 \ Turbine	HP7 Bld Steam Press	TIPS.B4HP010P.PV		0.3867	0.8893	0min	100	1
25/08/2015 14:55:22 PM	AGL \ Tomens Island \ TIPS B \ Unit TB1 \ Generator	H2 Purty	TIPS.B1GAT001.PV		87.85	94.09	0min	99.8	4
19/08/2015 16:20:24 PM	AGL \ Tomens Island \ TIPS B \ Unit TB4 \ BFP \ TIP	BFP Big O/B Mi Temp	TIPS.B4FTT220.PV		55.12	44.75	0min	100	3
19/08/2015 14:50:21 PM	AGL \ Tomens Island \ TIPS B \ Unit TB4 \ BFP \ TIP	BFP Thr O/B Mi Temp	TIPS.B4FTT219.PV		59.07	45.03	0min	100	4
17/08/2015 18:30:24 PM	AGL \ Loy Yang Station \ Unit LYA4 \ SHS \ SH4 Tu	SH4 Tube Met In Leg 1	LYP.U4.154T001.PV		26.88	513.3	0min	99.8	4
3/08/2015 23:35:26 PM	AGL \ Loy Yang Station \ Unit LYA4 \ TG \ 4-Turbine	Temp LPB-3/4 Above Tsat	LYP.U4.270T920.PV		285.3	439.3	0min	100	4
10/07/2015 05:50:10 AM	AGL \ Loy Yang Station \ Unit LYA4 \ PFM \ 4-PFM-5	PFM Door Temperature	LYP.U4.091T023.PV		244	312.8	0min	100	2

Refresh

Acknowledge

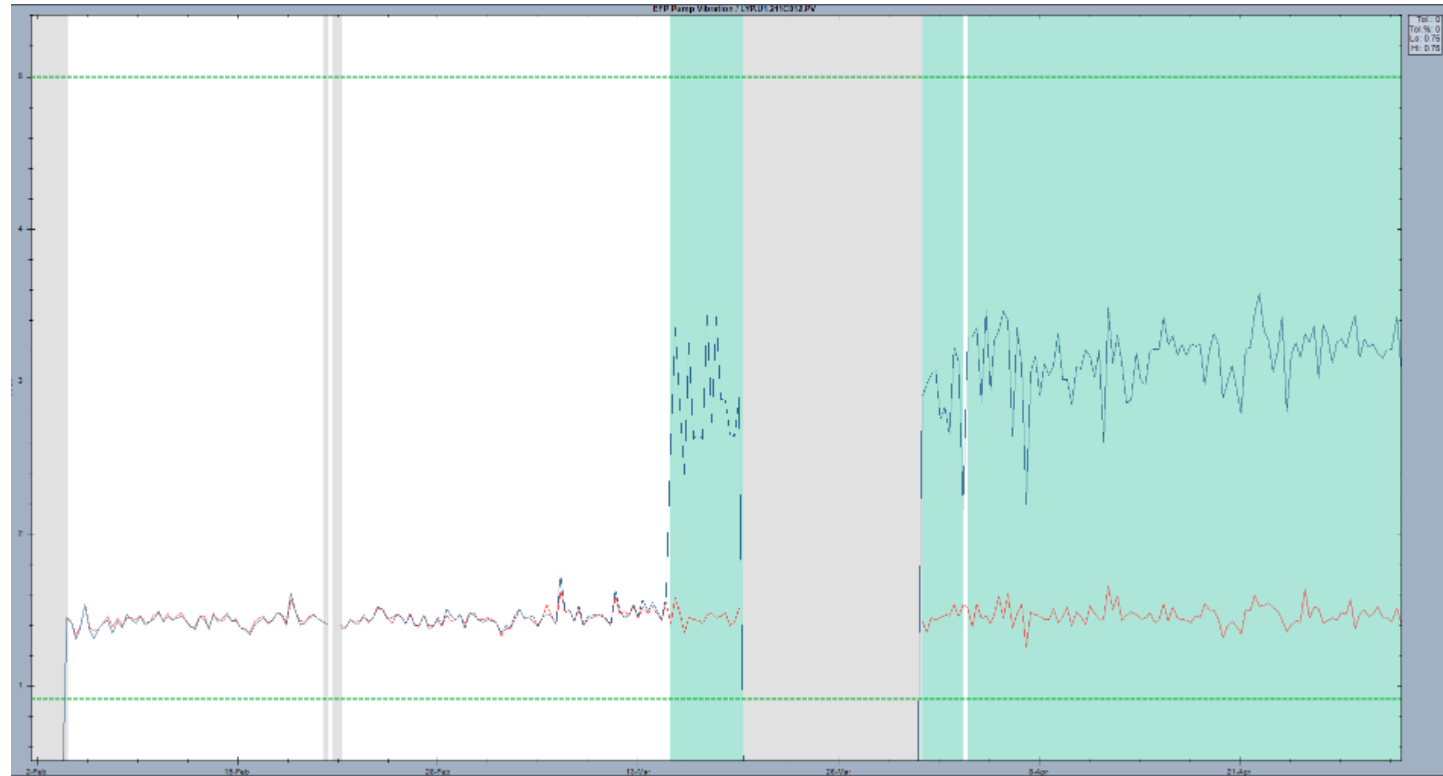
Clear

Comment

Snooze

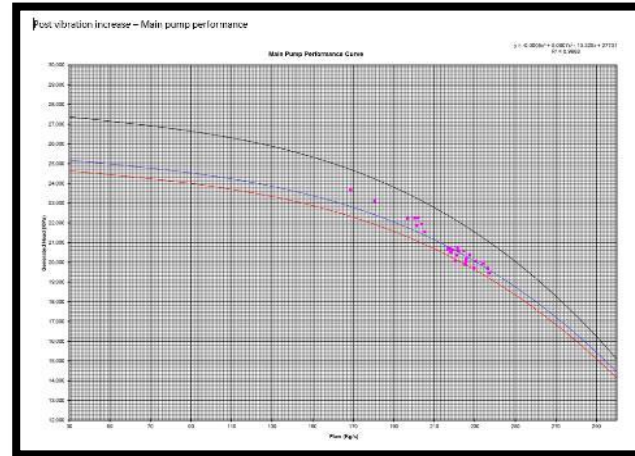
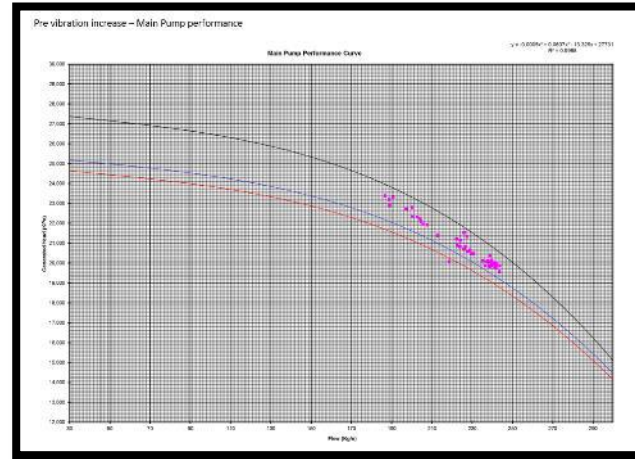
1-EFP-1

- 1-EFP-1 Alarm raised
- Initial Investigation



1-EFP-1

- 1-EFP-1 Alarm raised
- Initial Investigation
- Performance Monitoring via PI system
- Vibration increase and Performance loss confirmed



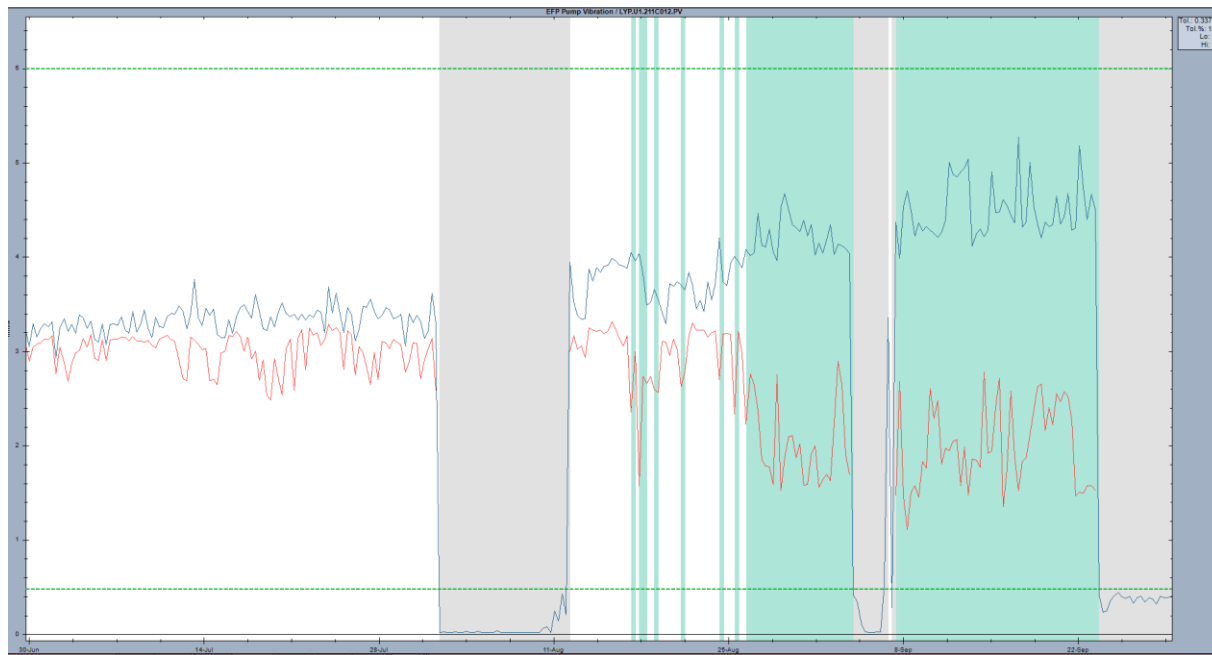
1-EFP-1

- 1-EFP-1 Alarm raised
- Initial Investigation
- Performance Monitoring via PI system
- Vibration increase and Performance loss confirmed
- Communication with site Engineer and Condition Monitoring Team
- Formal Communications with agreed actions

AGL Energy in action.		Ticket: ODC0001 / Loy Yang Station 1-EFP-1 High Vibrations		PREDICT ^{it} Predictive Modeling for Process Data	
Plant:	1-Electric Feed Pump-1 1-EFP-1	Model: Tag:	Loy Yang\Unit1\1-EFP-1_Mech LYP.U1.211C012.PV		
Date Alarmed:	14/3/2015	Notification Date:	7/4/2015		
Alarm Description:	<p>1-EFP-1: Main pump experienced a step change in vibrations of approx. 1.5 mm/sec, with the pump now operating at 3mm/s. Previous to the step change vibrations had been steady at 1.5 mm/s.</p> <p>This step change and alarm within the APR software was noticed during the model build for the feed pump.</p> <p>The pump was taken out of service within 3 days of the step change and returned to service on the 31st April with the increased levels.</p> <p>A step change in main pump performance was also noticed at the time of the step change in vibrations. Drop in performance of 2.5%.</p>				
Alarm Deviation:	<p>Expected Value:</p> <p>Actual Value:</p> <p>Deviation:</p>				
Actions:	<p>ODC to increase the vibration limit to 4 mm/s and the ODC to continue to monitor.</p> <p>Business Unit to schedule a rebuild of the pump.</p>				
<p>Further Information:</p> <p>2/4/15: Tim Yates/Peter Fanning</p> <p>Meeting with Tim and Peter to communicate APR alarm. Please see attached alarm and performance data.</p> <p>Tim to investigate reason for step change, indication at present is that the pump internal seals have wiped, increasing internal clearances and reducing pump performance.</p>					
<p>Support Documentation:</p>					

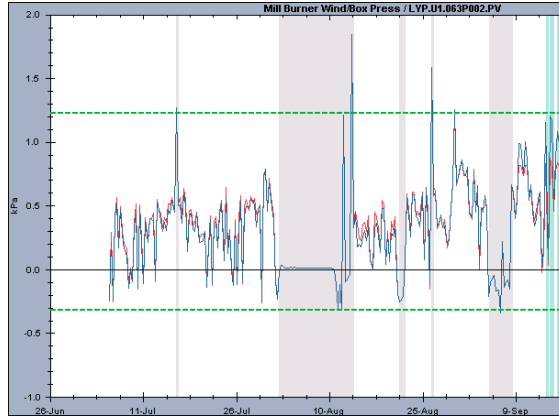
1-EFP-1

- 1-EFP-1 Alarm raised
- Initial Investigation
- Performance Monitoring via PI system
- Vibration increase and Performance loss confirmed
- Communication with site Engineer and Condition Monitoring Team
- Formal Communications with agreed actions
- ODC conducts further monitoring as agreed
- Site programs pump overhaul for next available maintenance opportunity

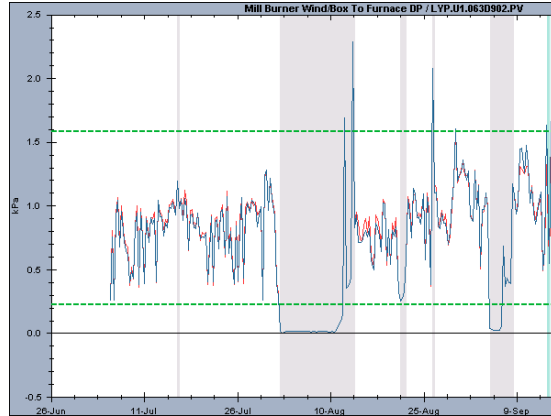


1-PFM-1 Expansion Joint Alarm

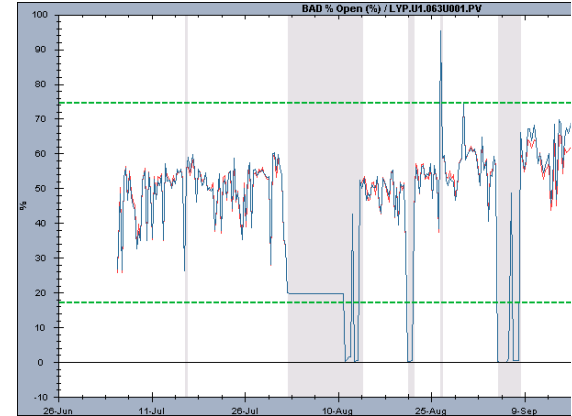
Alarm 1: Mill Burner Wind/Box Pressure is trending high (Tag: LYP.U1.063P002.PV)



Alarm 2: Mill Burner Wind/Box To Furnace DP is trending high (Tag: LYP.U1.063D902.PV)



Alarm 3: BAD % Open (%) (Tag: LYP.U1.063U001.PV) is also showing a considerable step change.



- Initial alarm raised in Predict it
- Acknowledged by the ODC
- ODC confirmed alarm with other plant and units
- Ticket raised and business unit notified by email and phone

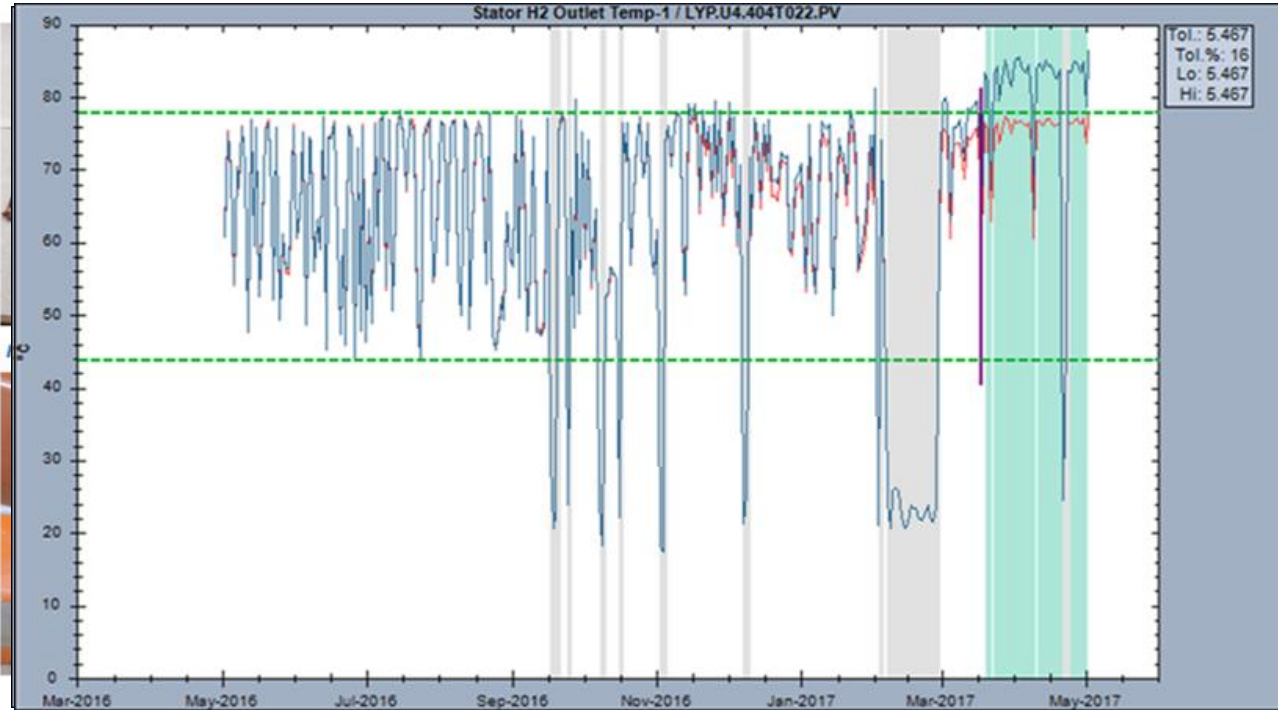
1-PFM-1 Expansion Joint Alarm

- Responsible engineer confirmed the alarm and initiated inspection of the plant.
- Confirmed air leakage from the expansion joint
- Work order for inspection raised by business unit at the upcoming Outage – 3 weeks
- Inspection resulted in repair of expansion joint. Program to be replaced next outage.
- Adverted 2 day forced outage
- Est VR \$417,200.00
- Learnings documented, to be evaluated on other sites



July 17 ODC: Significant Failure Avoided

- Loy Yang Station U4 Generator, 560MW, Hydrogen Cooled Stator



May 2017

Hydrogen Outlet #1 found to be damaged and is being replaced above May. It calculated expectation calculated expectation Unit repaired in situ 4.5 weeks. As a result of the fault estimated 12-14 weeks) Unit placed under close monitoring since and comprehensive inspection actioned

Operational Diagnostic Centre



Set up of Advanced Pattern Recognition across 10,000MW
Centralised Diagnostic Centre to monitor AGL generation
Thermal, Hydro, Solar, Wind and Gas assets.



CHALLENGE

Provide advanced pattern Recognition diagnostics capabilities services to Group Operations BUs.

- Site engagement and buy in
- Model build expectations
- Alarm management

SOLUTION

Priority Model Build and Collaborative approach with site engineering team

- Predict It
- OSI PI
- Face to Face collaboration

RESULTS

Successful deployment of ODC and APR.

Site engineering engagement with engineering team ownership of the models

- Overall savings since installation of 18.7M
- Total set up cost \$1.2M
- Annual running costs \$620k
- Over 2700 models monitoring over 45k critical points every 5 minutes

AGL's Advance Pattern Recognition Implementation Journey



- Mark Faith
- MFaith@agl.com.au
- Manager ODC and Technology
- AGL

Questions

Please wait for the **microphone** before asking your questions

State your **name & company**



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Merci

谢谢

Спасибо

Danke

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado

Optional: Click to add a takeaway you
wish the audience to leave with.