

# Centralized Data Strategies for Modern Operations – Why Are They so Important?

*Perry Zalevsky - Senior Director, Industry*

*November 19, 2019*

# Data Infrastructure: from Sensors to Community



# The Experts Say the World is Changing...

Cloud†

\$94B

2017

\$203B

By 2021

IoT\*

\$745B

2019

\$1T

By 2022

AI‡

\$35B

2019

\$79B

By 2022

† Gartner Press Release, Gartner Forecasts Worldwide Public Cloud Revenue to Grow 17.3 Percent in 2019, Sep, 2018.

\* IDC Press Release, IDC Forecasts Worldwide Spending on the Internet of Things to Reach \$745 Billion in 2019, Led by the Manufacturing, Consumer, Transportation, and Utilities Sectors, Jan 2019.

‡ IDC Press Release, Worldwide Spending on Artificial Intelligence Systems Will Grow to Nearly \$35.8 Billion in 2019, According to New IDC Spending Guide, Mar, 2019.

# Translating the Megatrends for IT and OT

**Cloud**

**Unlimited  
Shared  
Compute  
Platform**

**IoT**

**Increasing  
Scope of  
Operations  
Data**

**AI**

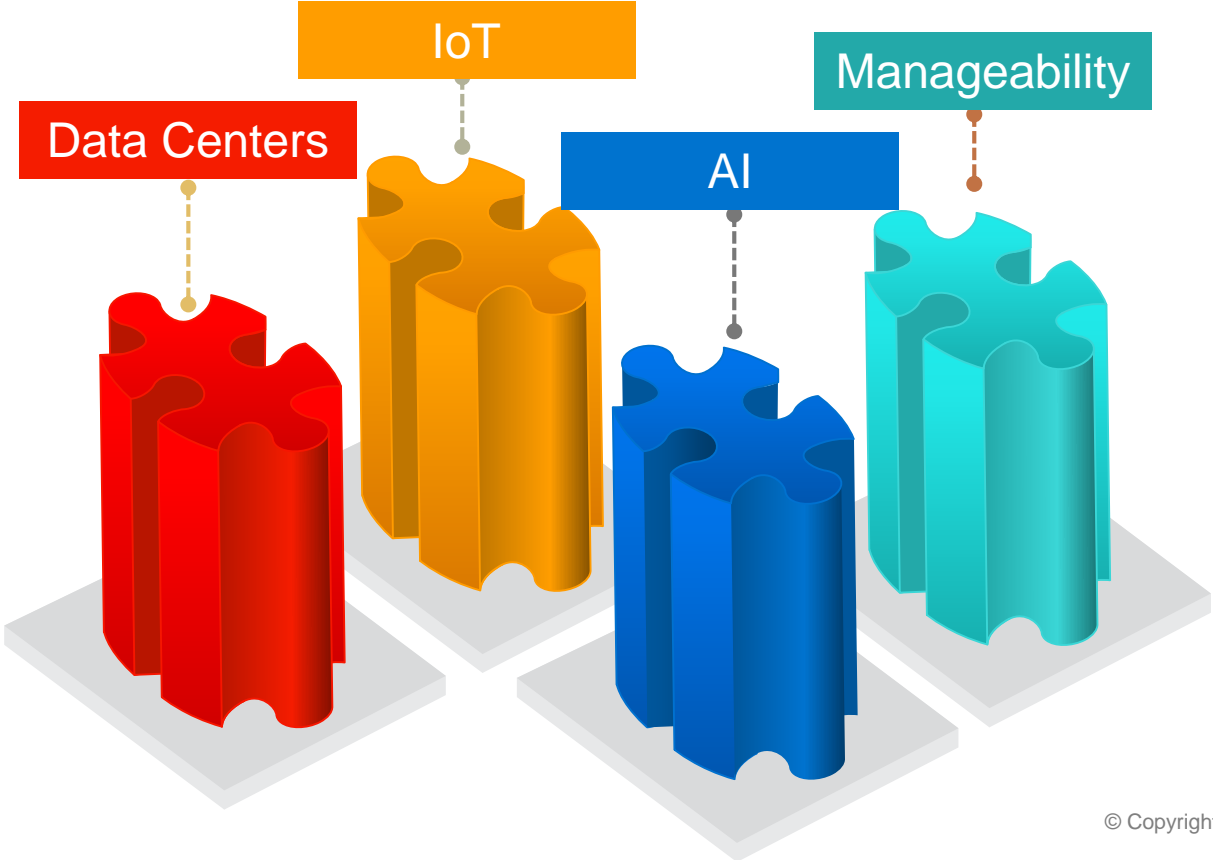
**Changing  
Consumers  
of Data and  
Power**

**38% of Enterprises feel pressured to be 100% Cloud today.**

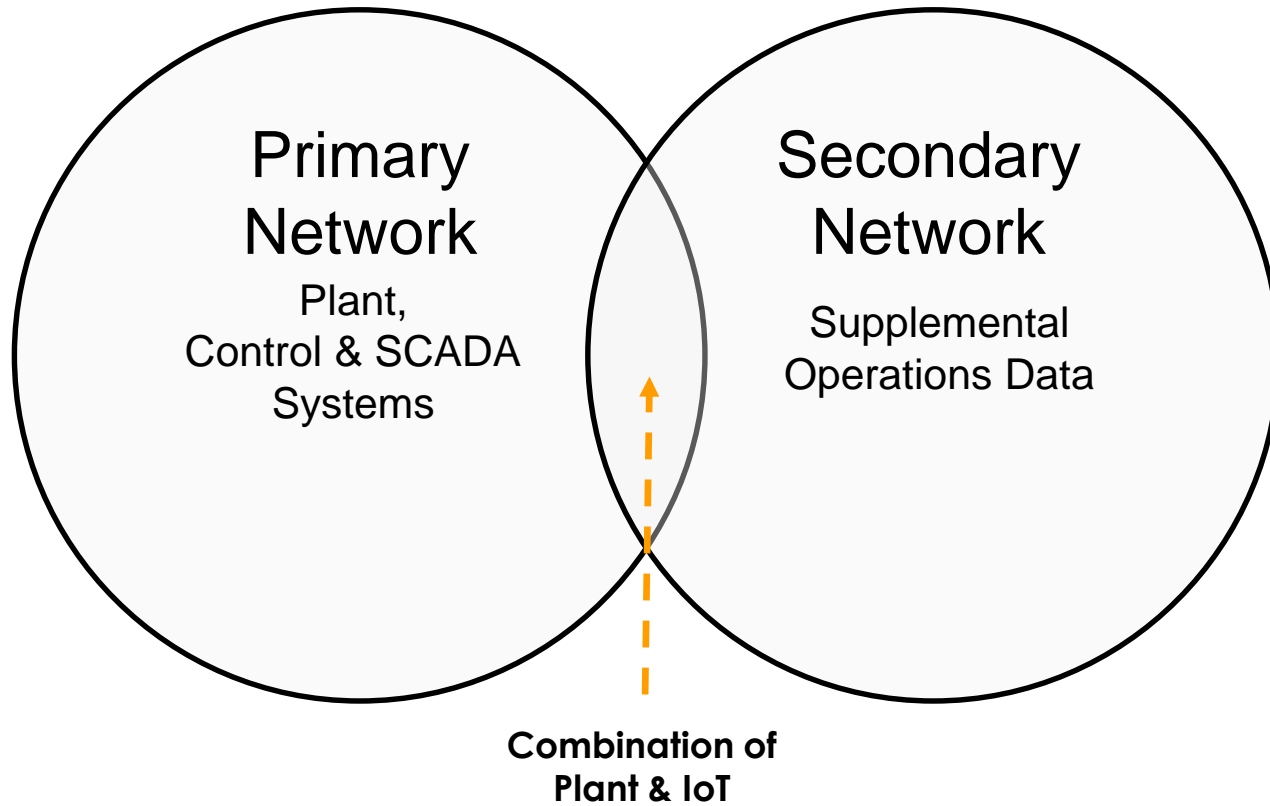
**30% of total IT budget will be allocated to cloud computing within the next year.**

[IDG](#), 2018 Cloud Computing Survey, Aug, 2018.

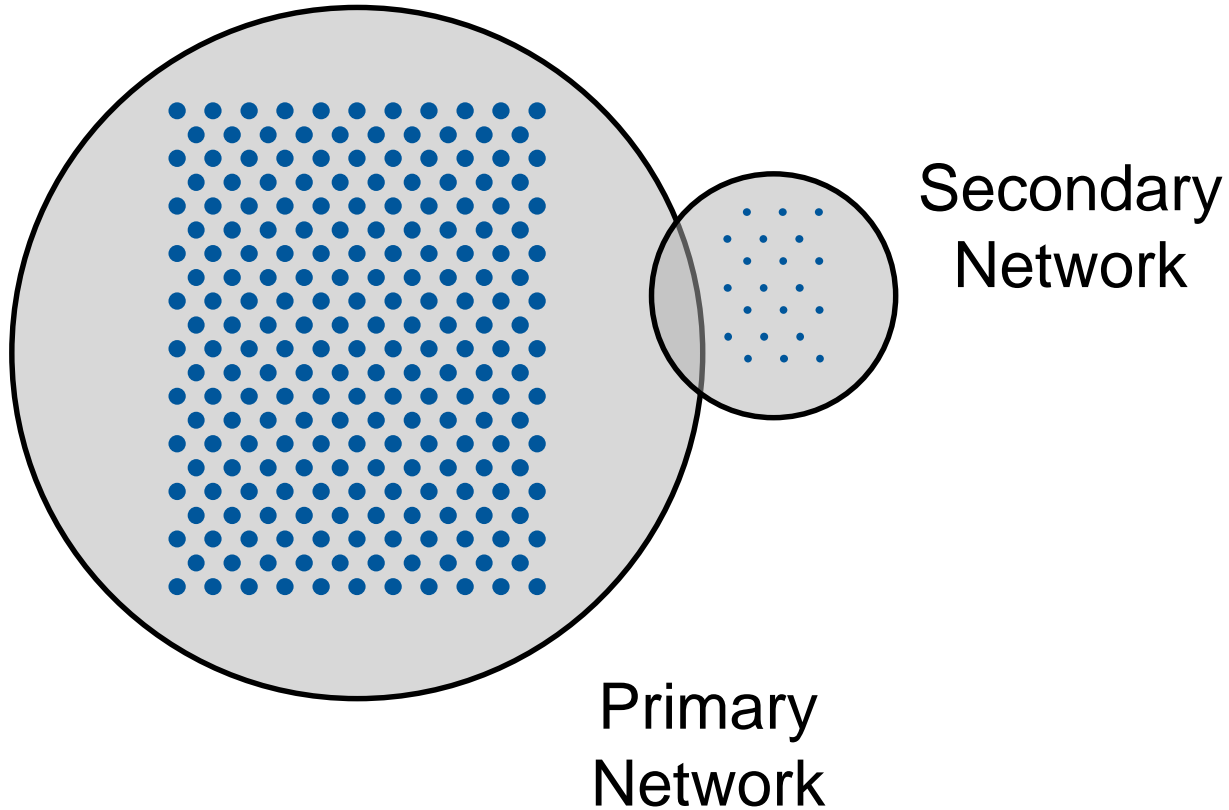
# What is Your Cloud Strategy Today?



# The Promise of IoT

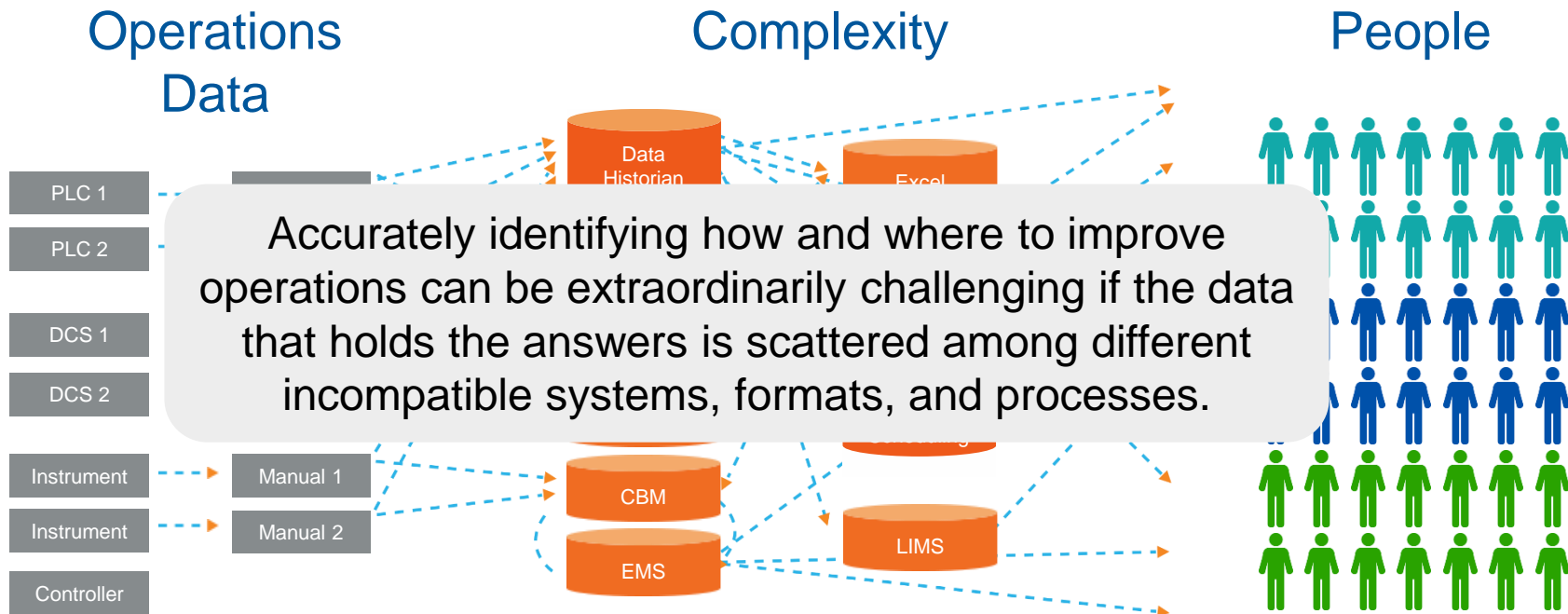


# The Reality of New Sensors Today

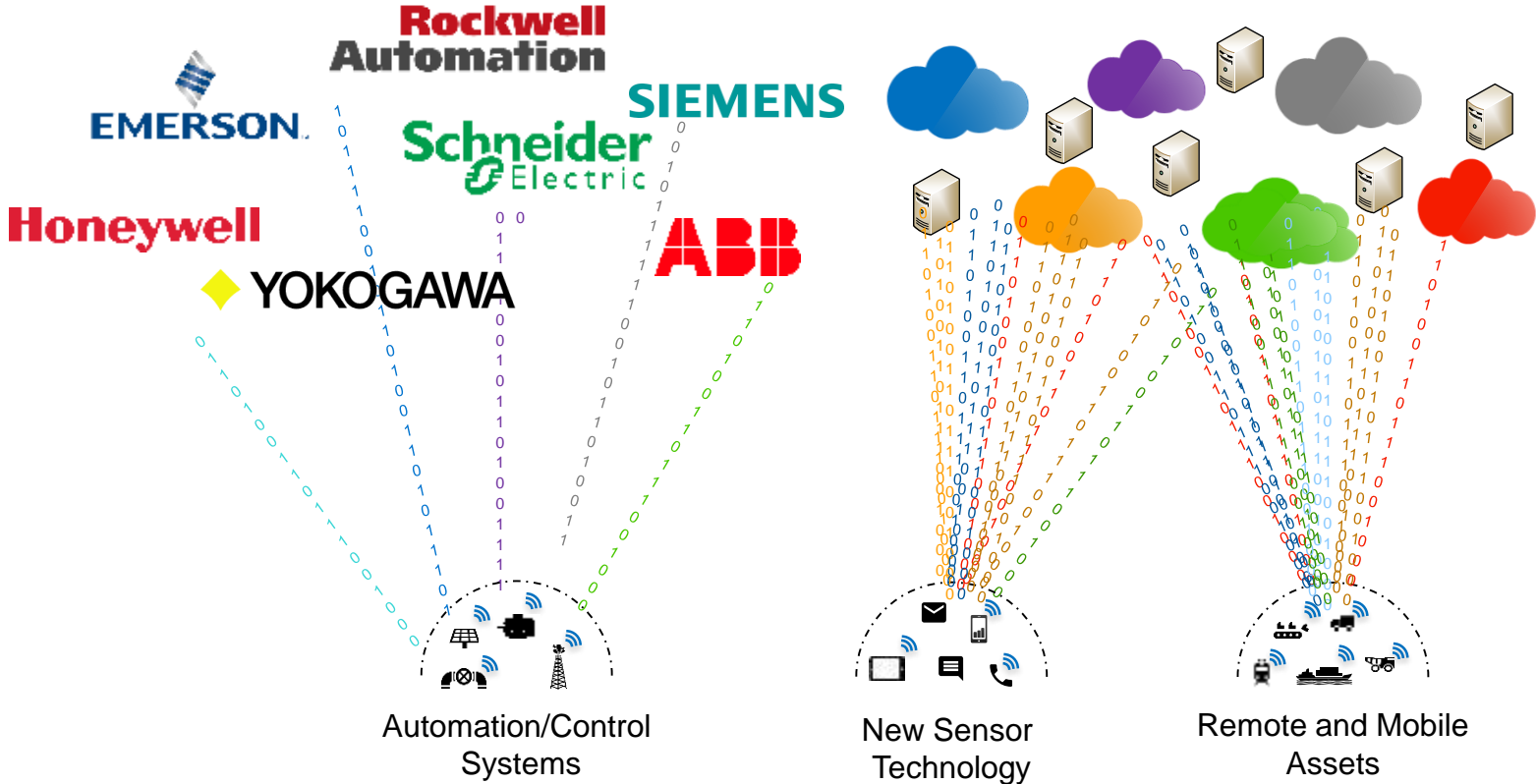




# Operational Data is Complex

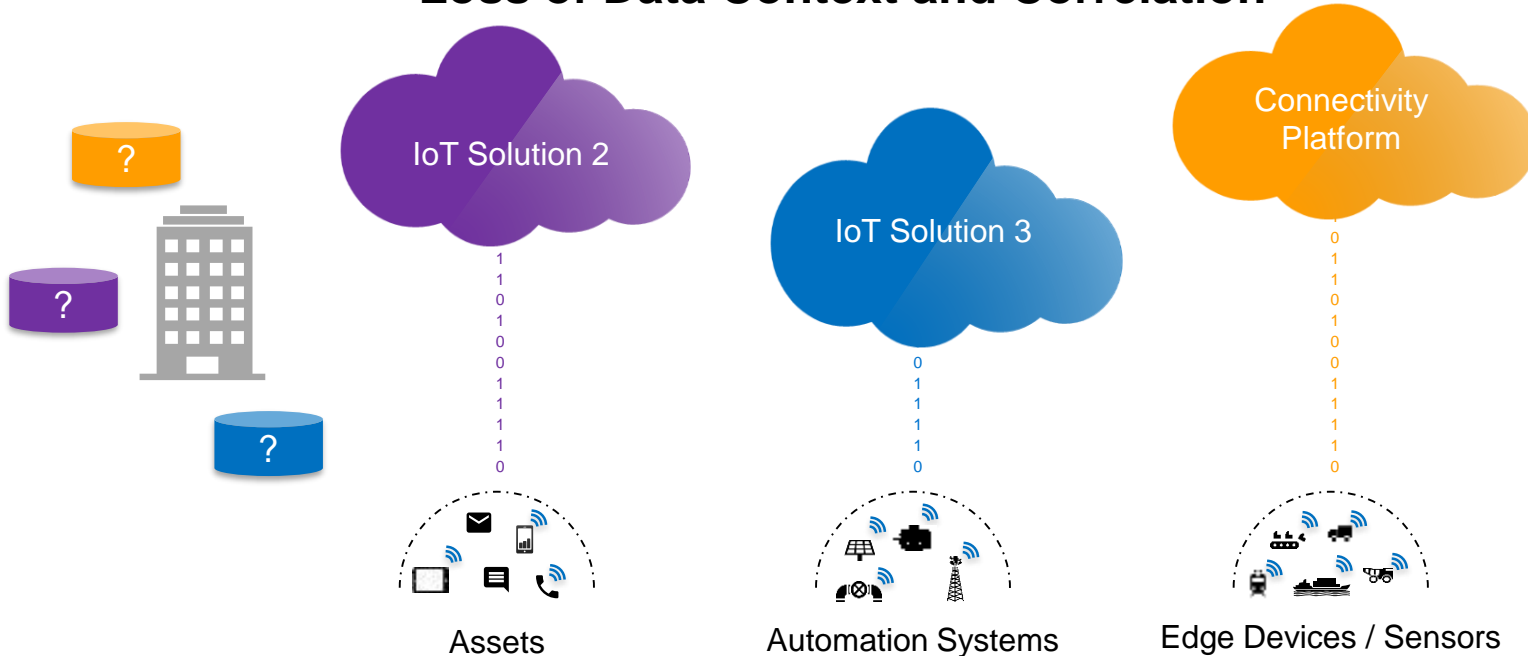


# The IIoT Challenge

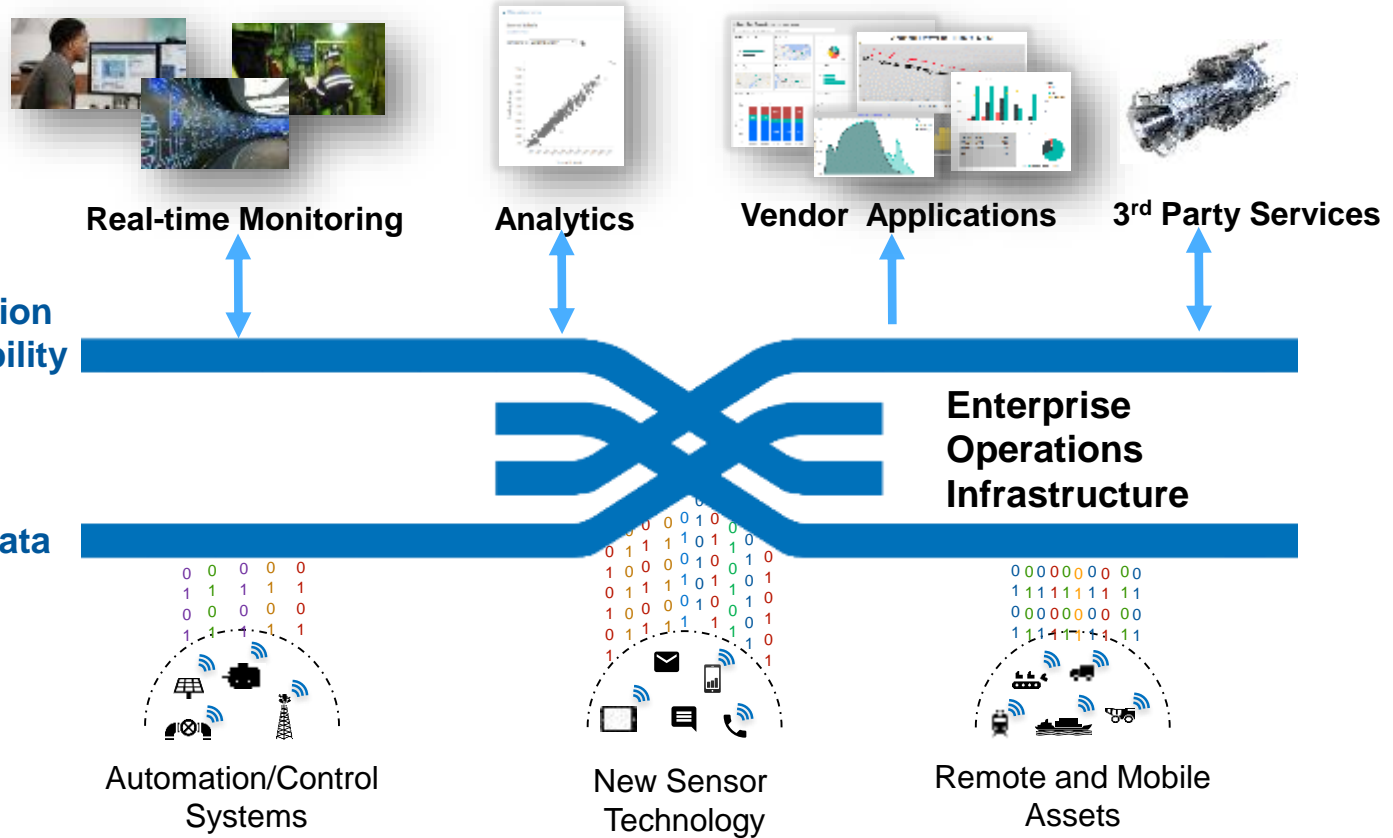


# Inherent Risks of IIoT

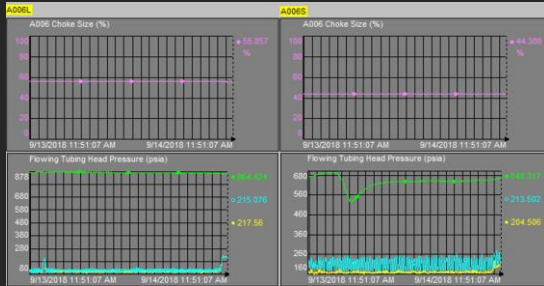
- New Data Silos
- Loss of Data Ownership & Security
- Loss of Data Context and Correlation



# Strategic Data Infrastructure for IIoT and Automation Data Sources



# Historian



# Data Infrastructure

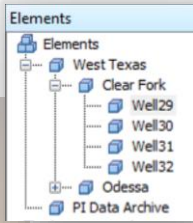


## 7 Key Components

# 1.) Operational Data Model



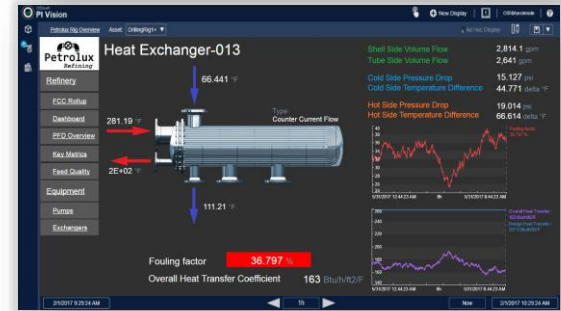
Child Elements	Attributes	Ports	Analyses	Notification Rules	Version
Excluded attributes are hidden.					
Filter					
1 Name Value					
Category: Calculation					
Load Ratio	0 %				
Category: Location					
Latitude	0				
Longitude	0				
Category: Power Consumption					
Power Consumption	76.6881035951376 kW				
Category: Pressure					
Bottom hole pressure	8632.93014263405 psia				
Casing pressure	9.54536437988281 psia				
Line Pressure	1455.05201744617 psia				
Tubing pressure	1462.57281045549 psia				
Category: Production					
Category: Property					
Bore Head	0 in				
Gas Gravity	1.1098313858560761				
Tubing Diameter	0 in				
Well Type	Gas				
Category: Real-time data					
Category: Specification					
Category: Target					
Category: Temperature					
Casing temperature	78.272367947861724				
Tubing temperature	99.338721930672747				
Category: Time tracking					
Avg 30d Downtime	719.959447542832 h				
Status Message	Running				
Total Downtime	425794.85 h				
Total Runtime	0.999303555555556 d				



- ↔ Measured Data
- ↔ Meta Data
- ↔ Calculated Data
- ↔ Data Analysis
- ↔ Predicted Data
- ↔ Geospatial Data
- ↔ Referenced Data

Meaningful, Consistent, Accessible, Structured Data for Everyone!

# 2.) Advanced Real-Time Visualization



Applications & Real-Time Tools for Monitoring & Analysis

### 3.) Real-Time 'Streaming' Calcs & Analytics



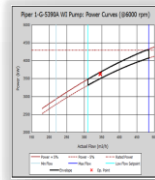
Equipment Status



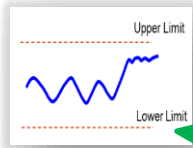
Equipment Usage



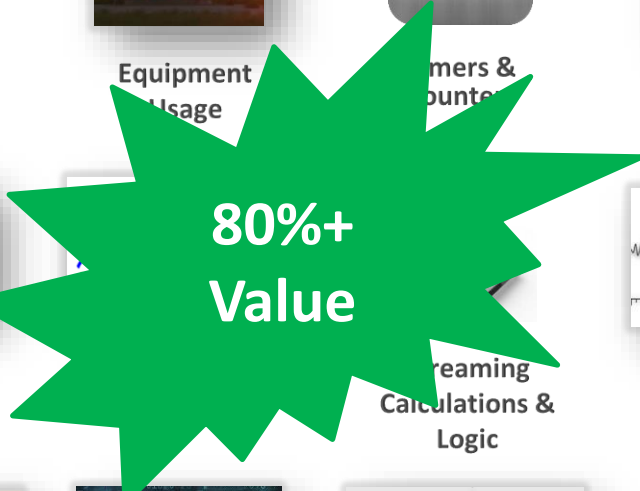
Counters & Tunnels



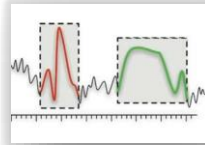
Operating Envelopes



Engineering Limits



Streaming Calculations & Logic



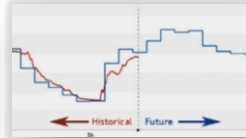
Pattern Recognition

4_00:01:52	Duration	Start Time	End Time
0:01:52	4/5/2015 5:57:03 PM	4/5/2015 5:58...	
0:01:38	4/5/2015 5:57:07 PM	4/5/2015 5:58...	
0:01:17	4/5/2015 5:57:10 PM	4/5/2015 5:58...	
0:00:33	4/5/2015 5:57:13 PM	4/5/2015 5:57...	
0:00:33	4/5/2015 5:57:50 PM	4/5/2015 5:58...	
0:00:14	4/5/2015 5:58:03 PM	4/5/2015 5:58...	
0:00:09	4/5/2015 5:58:36 PM	4/5/2015 5:58...	

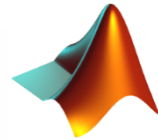
Operational Events



Data Quality

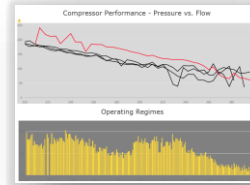


Predictions vs Actual



3rd Party Processing

### 4.) Data Science & Advanced Analytics



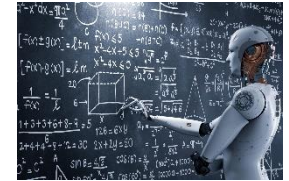
Multi Dimensional Analysis



Machine Learning



Complex Statistical Analysis



Artificial Intelligence

# 5.) Event/Exception Based Surveillance

Event Frame Search 1

Name	Duration	Start Time	End Time
TopLevel_EventFrame	0:01:52	4/5/2015 5:57:03 PM	4/5/2015 5:58...
UnitProcedure_EventFrame	0:01:38	4/5/2015 5:57:07 PM	4/5/2015 5:58...
Operation_EventFrame	0:01:17	4/5/2015 5:57:10 PM	4/5/2015 5:58...
Phase_EventFrame	0:00:33	4/5/2015 5:57:13 PM	4/5/2015 5:57...
Phase_EventFrame	0:00:33	4/5/2015 5:57:50 PM	4/5/2015 5:58...
Operation_EventFrame	0:00:14	4/5/2015 5:58:31 PM	4/5/2015 5:58...
Phase_EventFrame	0:00:09	4/5/2015 5:58:36 PM	4/5/2015 5:58...

- ← Operational events
- ← Erroneous conditions
- ← Predefined patterns
- ← Impossible combinations of data
- ← Event prioritisation

## EVENT FRAMES



## NOTIFICATIONS & ALERTS

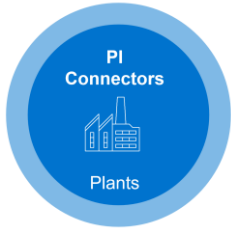


- ← Notifications & Alerts
- ← Event Analytics
- ← Automated Workflows

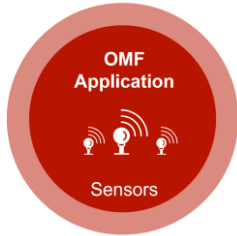


## 6.) Edge & IoT

### Pervasive Data Collection



- Ready Off-The-Shelf
- High Performance
- Auto-Discovery



- Developer Flexibility
- Lightweight Footprint
- Agnostic to Environment



- Persistent Storage
- Self-Healing Capabilities
- Analytics & Application Ready

## 7.) 3<sup>rd</sup> Party Data Sharing



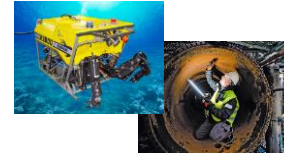
**Equipment  
Manufacturers**



**Engineering  
Companies**



**Maintenance  
Contractors**



**Support &  
Inspection**



**Analytics  
Specialists**



**Material Suppliers**



**Oil & Gas Services**



**Real-Time Drilling**



**Logistics**

## 3rd PARTY REAL-TIME SERVICES

Equipment Specific Monitoring & Condition Based Maintenance  
Specialist Data Driven Services



## ENTERPRISE REPORTING

'Live' Management Dashboards & Reports  
Business Analytics  
Business Process Management



## DATA SCIENCE

Advanced Analytics  
Data Driven Analytics & Models  
Machine Learning & A.I.  
Predictive & Prescriptive Analytics



## REAL-TIME APPLICATIONS & ANALYTICS

'BUILT BY YOU'

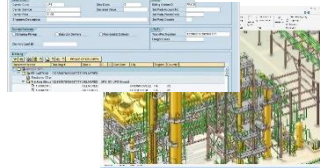
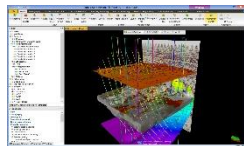
Real-Time Monitoring & Optimisation  
Condition Based Maintenance  
'Live' Operational Integrated Dashboards & Reports  
Exception Based Surveillance  
Alerts & Alarms



## SPECIALIST APPLICATIONS

'PURCHASED'

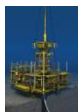
Production Surveillance  
Production Allocation  
Production Optimisation  
Flow Assurance  
Production Forecasting



## OTHER CRITICAL BUSINESS SYSTEMS



Topsides



Wells



Pipelines & Risers



Sensors



Controllers



Safety

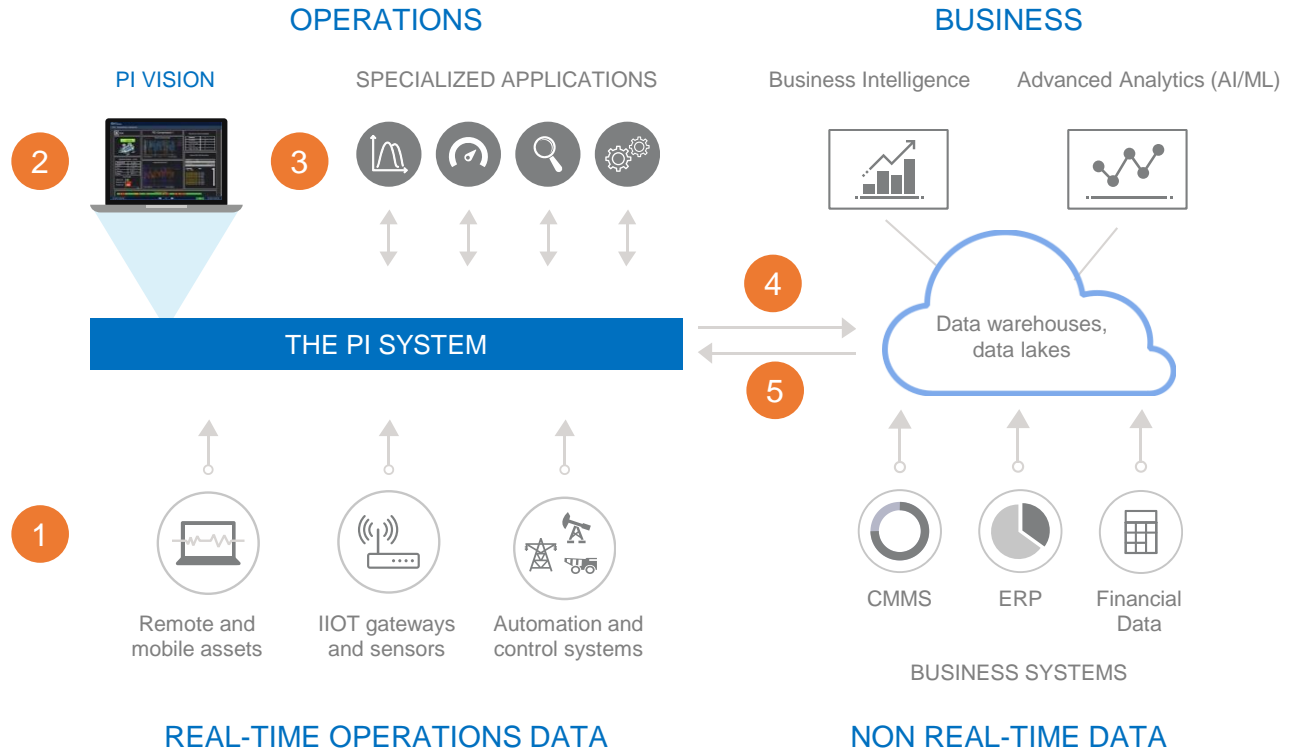


Edge



# How to Proceed?

- 1 Consolidate Operational Data
- 2 Create Real-time Dashboards
- 3 Layer Specialized Applications
- 4 Integrate OT Data to Enterprise
- 5 Validate & Operationalize Insights



# Operations Data is an Asset That Everyone Can Use in Real Time



**Process Engineer**  
“Can we increase the overall yield?”



**Control Room Tech**  
“The process is like a baby – you have to watch it.”



**Production Manager**  
“What is the forecast of productivity?”



**Data Scientist**  
“Can we find new savings with machine learning?”



**Reporting Analyst**  
“I need to combine data from 3 sources in 1 report.”



**Maintenance Engineer**  
“I need to know the moment it goes out of tune.”

# The Opportunity for Operations Excellence

Asset  
Health



Energy  
Efficiency



Process  
Optimization



Quality  
Tracking



Regulatory  
Compliance



Safety



DCP  
Midstream

\$20-25 million  
cost savings in  
first year [↗](#)

Air Liquide

10x ROI from  
operational  
savings in first  
8 months [↗](#)

ArcelorMittal

Shipped  
additional 26M  
tons for \$120  
million in added  
revenue [↗](#)

Deschutes

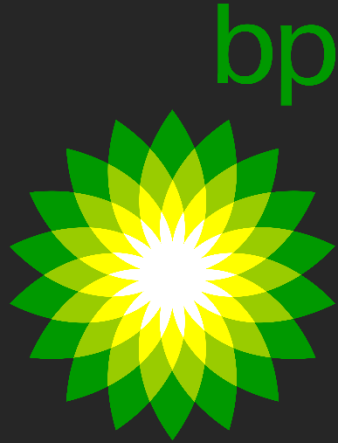
Postponed \$8  
million capital  
upgrade [↗](#)

TasWater

Reduced  
response time  
by 13 hours  
(and saved local  
oysters) [↗](#)

Qatar Power

Over 3,452  
days without  
lost-time  
accidents [↗](#)



**47 Operated Upstream Assets**  
**11 Refineries**  
**15 Petrochemical Plants**  
**15,000km Pipelines**



### **PI World SFO 2019**

The Digital Transformation Journey in BP Upstream [↗](#)



### **PI World EMEA 2018**

Using Analytics in PI AF to Improve Operating Performance [↗](#)

# The Challenges That Started BP On Their Recent PI Journey



- **Need for a step-change improvement in Process Safety** and to **improve competitiveness**
- Massive amounts of data, **disconnected from other related data** and from end users/consumers
- Much of the business **value comes from relating the data to other data** in different databases (equipment work orders to plant conditions)
- Recognition by Executive Team that it was **hard for people to access information and this was driving suboptimal decision making**
  - Many SME's working in Single Databases focused on their expertise (Inspection, Maintenance etc.)
  - **Engineers spending 80% of their time finding information**, 20% of time troubleshooting
  - No central repositories, single owners or commonality of tools

# The BP Journey with PI

Data access via historians is now considered to be “business critical”



Migration of data to data lake to facilitate “Big Data” projects

2014



1996

First use of OSIsoft PI

2005\*

‘Field of the Future’

Palantir

BAKER HUGHES  
a GE company



2016

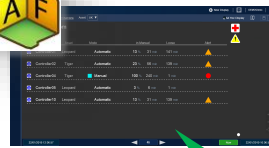
“Plant Operations Advisor”

Problem – align Real Time (PI) tags to common hierarchy to feed to BP Data Lake

Completed first asset ~17,000 tags, fed from our PI Historians took 6+ months to map and align with 5 FTE resources including documenting the process



PI Vision Analytics



ELEMENT ANALYTICS™

PI AF Data Model

PI Vision Tools

55 assets, taking 4 – 6 weeks per asset with 1 FTE

Federal Data Structure in PI AF

9 PI Vision Analytics Globally Deployed

Alignment of internal data sources across multiple systems in the Data Lake vs attempting to do so in the Core Systems.

Availability of data, combined with live analysis to assist decision making is now tangible.



2019



# 'In House' Real-Time Tools - Analytics

Built with PI AF and PI Vision – BP Controller 'Fit for Service'



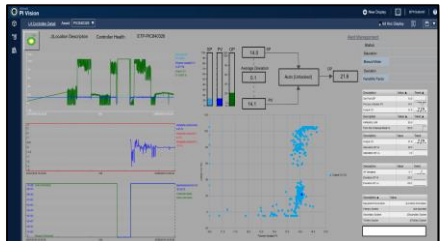
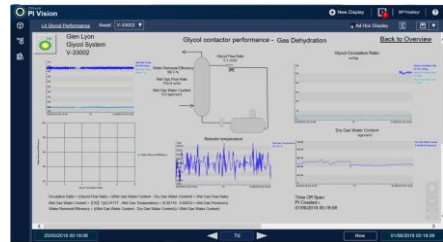
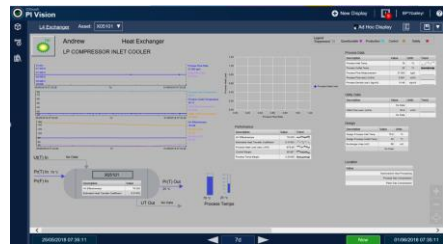
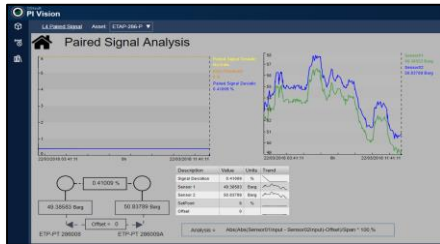
The image displays a collection of overlapping screenshots from the PI Vision and Power BI Desktop dashboards. The screenshots show various data visualizations and controls:

- PI Vision Screenshots:** Multiple instances of the 'Controller Health - Alert' dashboard, showing event logs with columns for Event Name, Time, and Location. One instance shows a map of North America with a yellow triangle marker.
- Power BI Desktop Screenshot:** A dashboard titled 'Controller Health Dashboard - Power BI Desktop' showing a world map with red circles indicating alert locations. Below the map are several charts:
  - A bar chart titled 'Controllers - Alert - Amber Count and Controllers - Alert - Red Count by Asset Facility' showing counts for Bear, Dolphin, Eagle, Tiger, Leopard, and Hawk.
  - A pie chart titled 'Controllers - Alert - Red Count by Day and Asset Facility' showing counts for Bear, Dolphin, Eagle, Hawk, and Tiger.
  - A line chart titled 'Controllers - Alert - Red Count by Day and Asset Facility' showing trends over time for the same asset facilities.

# Global Templates for PI Vision Analytics

Requested Analytic	Hopper	Backlog/Dev	Deployed
Paired Signal			X
Heat Exchanger			X
Controller Health			X
Glycol System Performance			X
Filter DP			X
Dry Gas Seal			X
Operating Envelopes			X
Pump Performance Monitoring			X
Progressive Cavity Pump Monitoring			X
Compressor Performance	X		
Controller Valve Position	X		
Deviation Indicator Analytics - Normalisation		X	
Predictive analysis – future tags		X	
Gas Flow Analytics		X	
Level Inventory Monitoring Analytics	X		
Nitrogen system Analytics - Yevgeniy & Team	X		
Predictive facility trouble-shooter	X		
Produced water monitoring Analytics		X	
Product Quality Analytics	X		
Production Chemistry - Excursion Analytics		X	
Production Chemistry limit / like SDL, SOL	X		
Seperator - Density profiler Analytics		X	
Water injection system Analytics - Yevgeniy & Team	X		
Pipeline Stability	X		
Gas Turbines	X		
Lube oil & Utilities	X		
Choke Monitoring	X		

**Evolving list – user input growing**

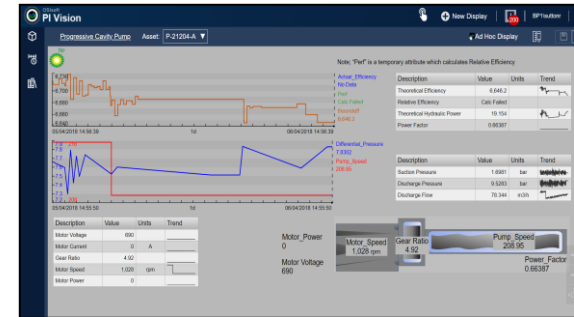


# Remote Operations Pump Analytic delivered to Glen Lyon for Critical Pump Start-Up



## PI AF Vision – One Team delivers solution in 3 days!

- During the PI AF roll out workshop in the North Sea, the Glen Lyon(GL) Team presented a business problem with produced water Progressive Cavity Pumps which were significantly impacting production. The pumps supported a 20,000 boed production improvement opportunity. **(Approx \$400m/yr)**
- The Analysis provides absolute and theoretical values of motor and hydraulic power and efficiency and is in the process of being extended to show leakage flows (also known as slip) and power offset relative to the Manufacturer's curves for the pumps. The data is visualised to create a clear insights into any potential deteriorating performance. Work is already underway to develop the Analysis even further.
- The PI AF monitoring capability is part of a suite of Analytics and Dashboards to be deployed to additional regions over the coming months.





**Steve Beamer**

VP Continuous Improvement,  
Transformation, System  
*BP*



- No need to change core systems – modern architecture and connectivity are extremely important for the future. **VALUE CONNECTIVITY OVER FEATURES** in selecting tools in the future.
- **Data Lake is the beginning not the end.** By itself, it does not solve any problems. Data Lake is one enabler not the complete answer.
- **Build useful data templates in PI AF** by equipment class for multiple use cases vs a use case per application.
- **PI AF helps to deploy at pace** and enabled other initiatives as they materialized.
- **Use cases we did not anticipate** at the time are **leveraging the same data models** to move more quickly.
- **Enable the data owners** to curate and maintain the models in order to democratize the data.

# AGL's Real-Time Data Journey (Australia Gas & Light)

David Bartolo (Head of Asset Performance)

# The AGL Generation Fleet

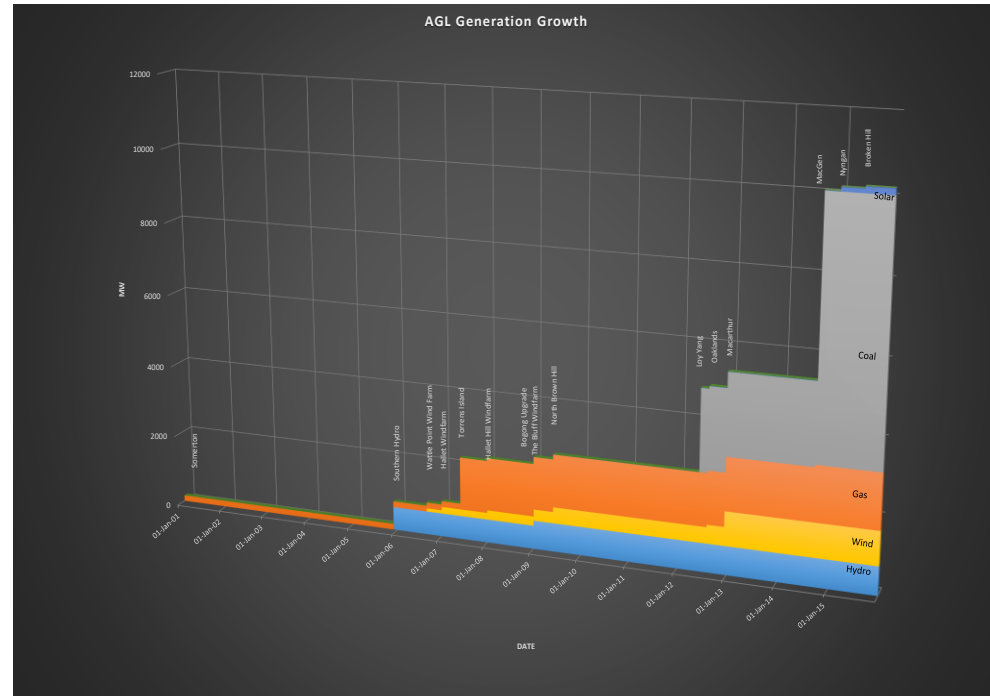
300-10,000+ MW in 9 Years!

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)



# Data Landscape Early 2012

## Data issues facing AGL

Live “Read Only” SCADA screens being used for real time visualization

Data skill set not transferable

High reliance on human data champions at each site to provide data

Data precision and tractability poor

Many data collection processes still manual

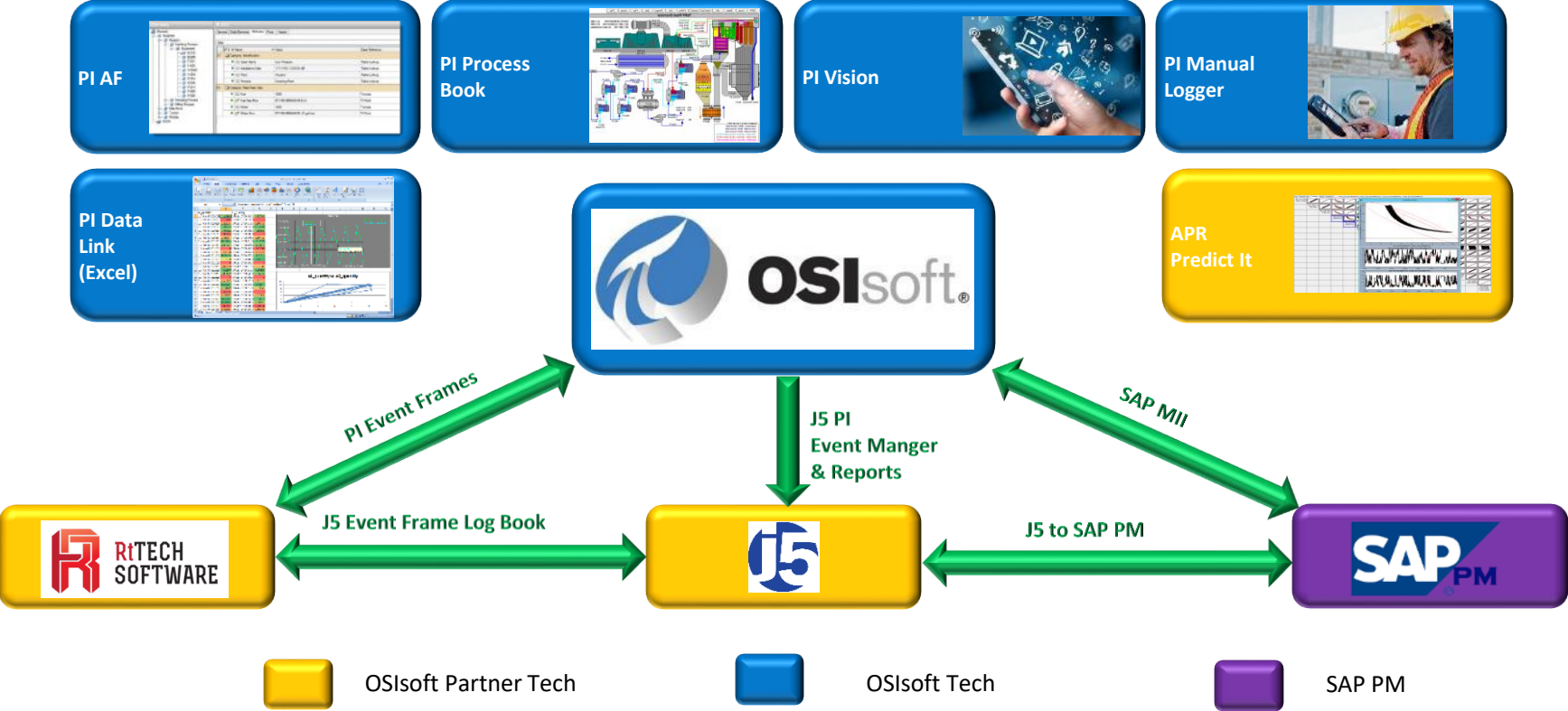
Data “black spots” reducing capability to investigate asset performance and incidents effectively

Centralised human resources hampered by poor access to asset data

No capability to efficiently execute any type of Data Analytics across the portfolio

**AGL Generation Fleet was projected to grow to 9000+ MW within 4 years! A data solution that matched our growth strategy was urgently required.....**

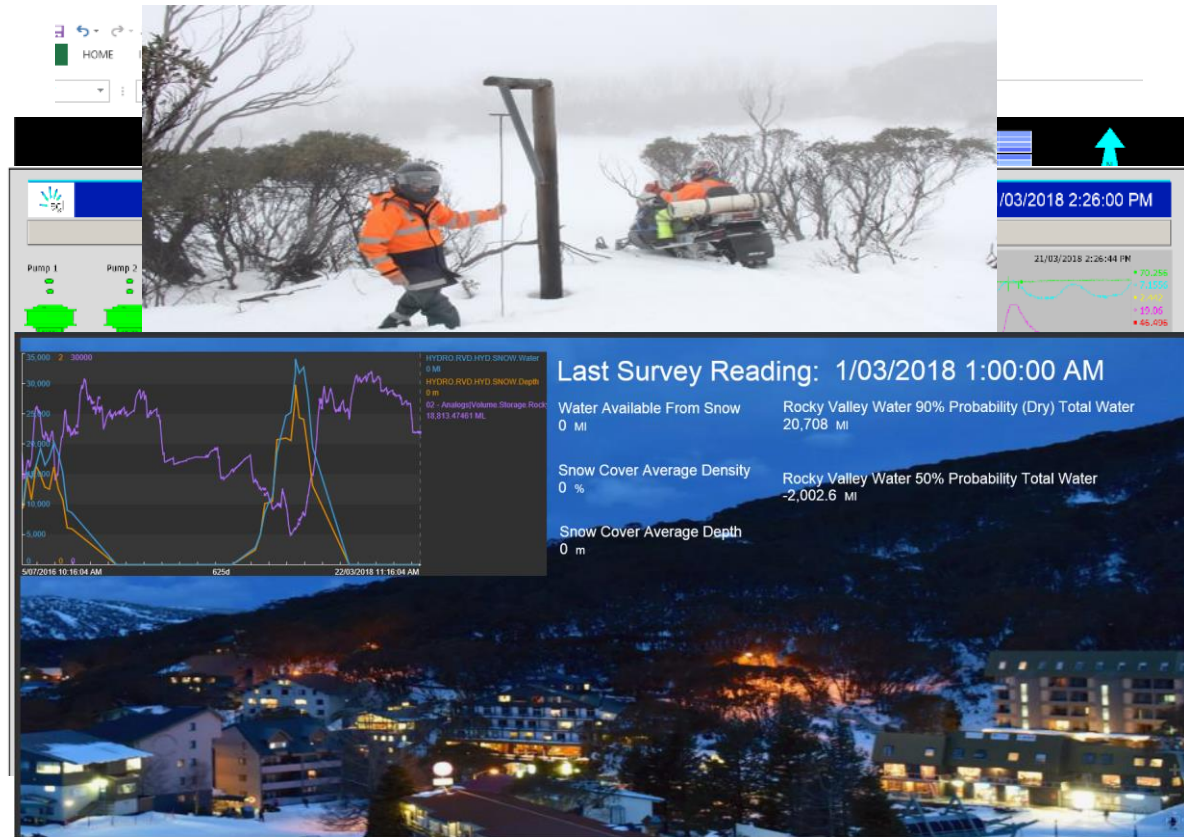
# OSIsoft PI: The heart of our operational technology platform





# AGL People empowered with the PI data system can build value fast

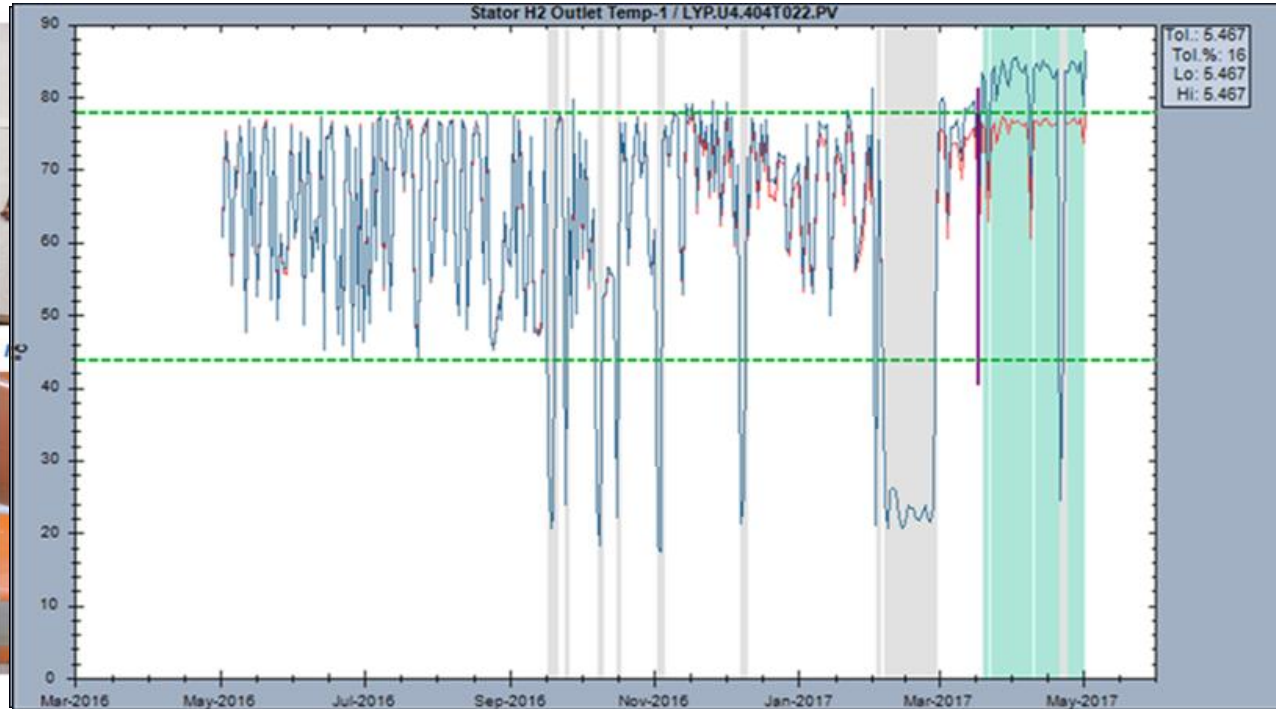
*“OSIsoft PI improves our understanding of our assets and processes and allows our team to achieve better results”*



Generator Temperature Monitoring  
Removal Hydro Generator Monitoring  
Water Capacity Management  
Monitoring

# July 17 ODC: Significant Failure Avoided

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



July 17, 2017

By using our software, we found to be tampered and checked the BEGIC above. It predicted it calculated expectation. It calculated expectation. Unit repaired in situ 4.5 weeks. As a result, the total time for fault (estimated 12-14 weeks) was avoided. Unit placed under close monitoring. \$500,000 of service and comprehensive inspection actioned.

# Operational Diagnostics Centre



Reduce unplanned generation losses across a mixed technology portfolio of > 10,000 MW



## CHALLENGE

Improve capability to sense active failure modes at the earliest possible opportunity and take actions to avoid loss

- Data isolated and scattered
- Multiple SCADA technologies in play
- No access to real time data

## SOLUTION

Phase #1: Centralise all real time data via OSIsoft PI

Phase #2: Install and commission Advanced Pattern Recognition Technology

- Predict It (APR) technology was fast to install and did not require a large data base (it uses Pi directly)
- A Centralised Operational Diagnostics Centre (ODC) reduced the number of recourses required and increased the level of skills
- ODC also uses PI system for deep dive investigations

## RESULTS

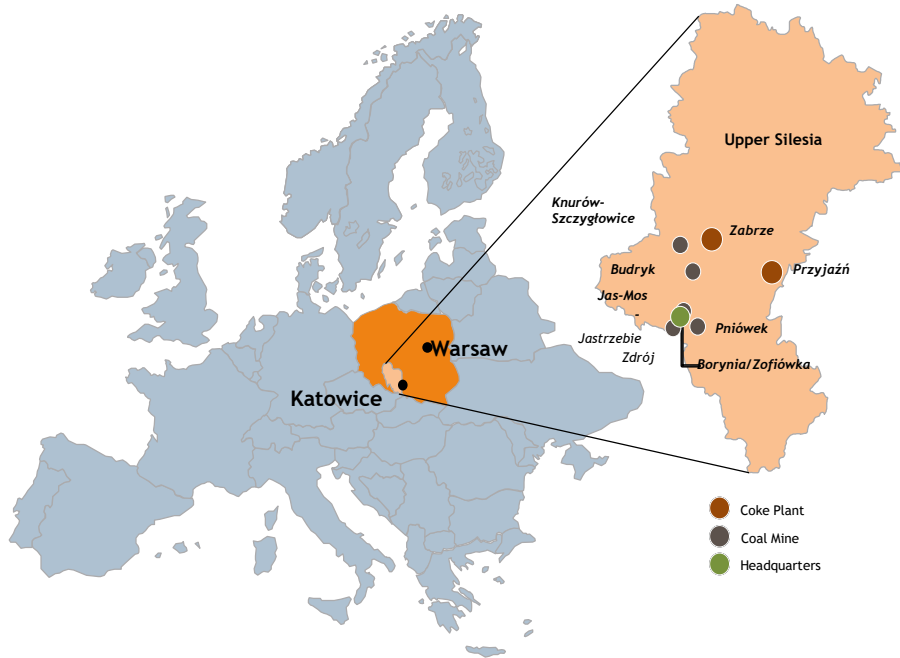
\$18.7M of avoided losses in 3 years (from a standing start)  
\$8.5M of savings last financial year

- ODC delivers significant tangible benefits
- OSIsoft PI enables data transformation and the pursuit many other business improvements
- ODC technology now focusing on process safety uplift

# The role of PI System in the machinery efficiency improvement program in JSW

Jacek Kwaśnica

# Jastrzębska Spółka Węglowa – Capital Group



## Located in the industrial heartland of Europe

- 4 coal mines
- 3 coking plants
- headquartered in Jastrzębie-Zdrój, Poland

## Coking coal focused

- Holds 14% of the global coke trade market

## Long mine life

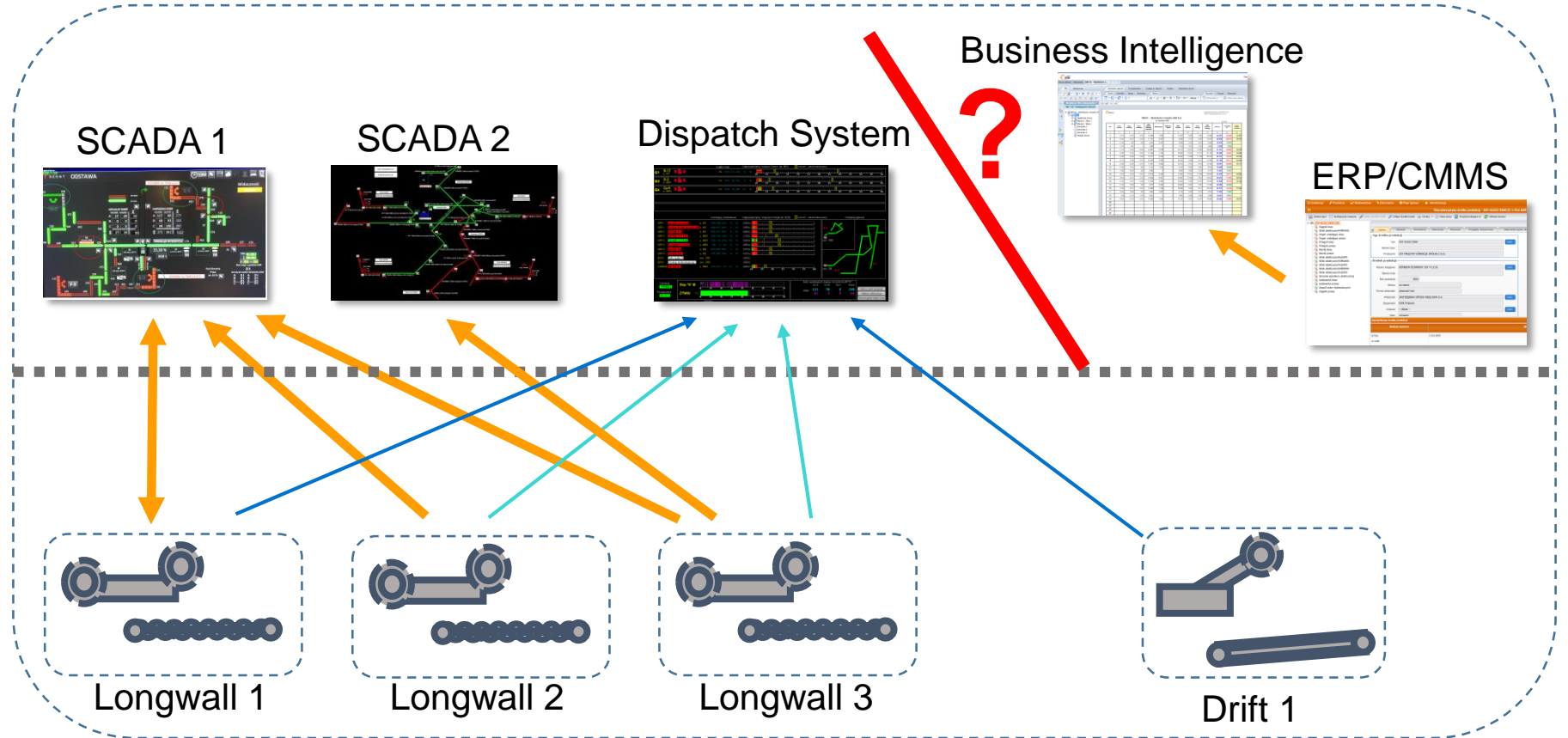
- 30–40 years expected life of mines

## Solid total resources and reserves

- Total resources of approx. 5.497 billion tonnes
- Reserves of 0.952 billion tonnes

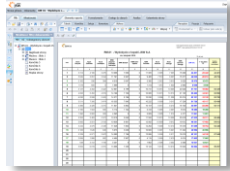
# JSW challenges

JSW typical mine

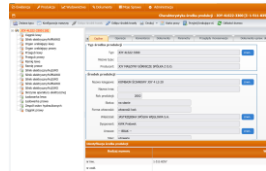


# Solution -> Central Technology Data Server

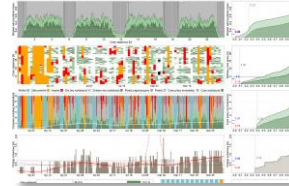
Business Intelligence



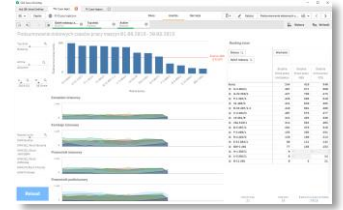
CMMS



Longwall Reporting System

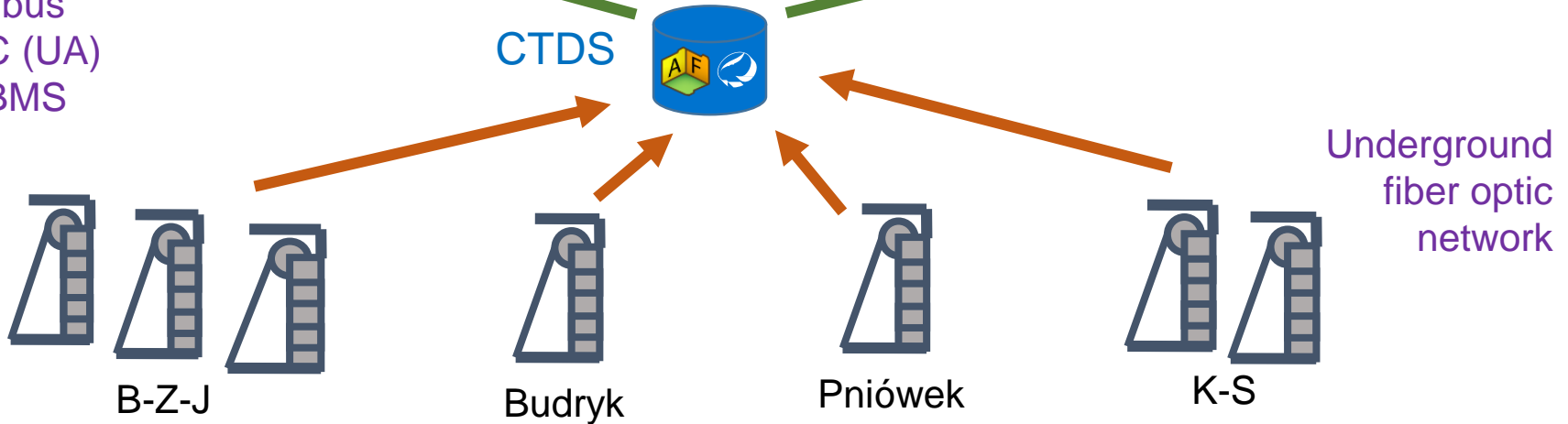


Analytics



## Interfaces

- Modbus
- OPC (UA)
- RDBMS
- UFL

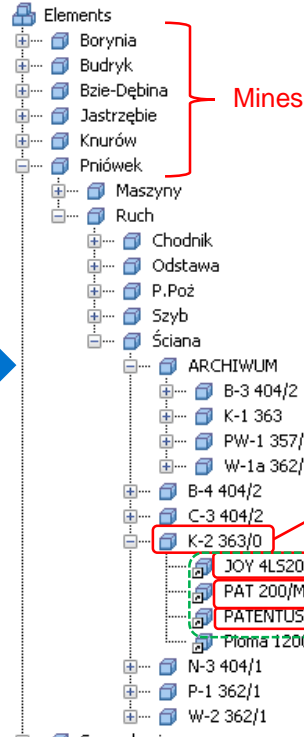
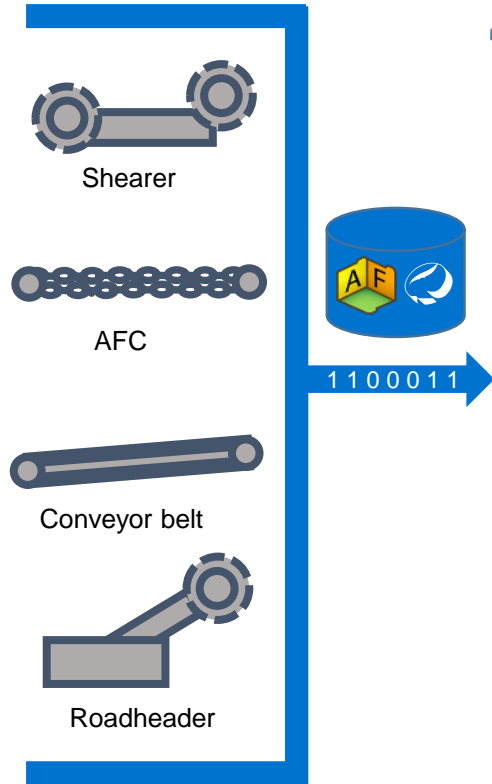


# CTDS – integration details

- **Downtimes from PI to CMMS**  
AF analyze PI Point → EF → **PI OLEDB ENT View** → MS SQL Linked server → Pentaho Integration Process → Oracle View (CMMS)
- **Technical machine parameters from CMMS to PI**  
Oracle View (CMMS) → **Linked Table in AF** → Table Lookup in AF
- **Plant calendar from ERP to PI**  
Oracle View (ERP) → **PI RDBMS Interface** → PI Point
- **Aggregated (by shifts) machines work times**  
**PI OLEDB ENT View** → Linked Table in AF → Table Lookup in AF
- **Machine Work Times from PI to SAP Business Objects**  
**PI SQL RTQP View** → Pentaho Integration Process → SAP Business Objects Database



# Case 1 - AF structure reflecting mine topology



Machine technical parameters from CMMS

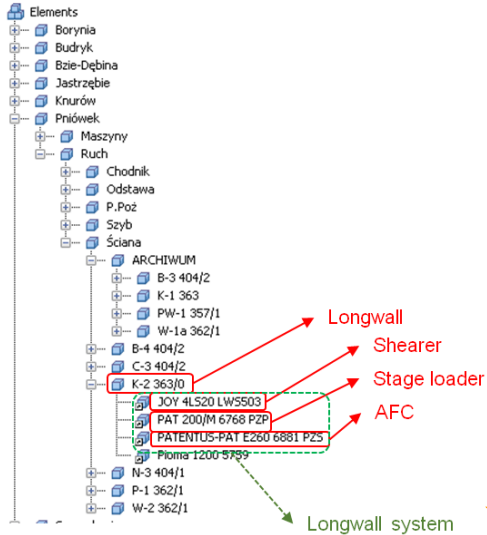
Category: Dane SZYK GŚP		
▣	Typ maszyny	JOY-4LS20-1000
▣	Pracuje od dnia	01.06.2019 00:00:00
▣	Oddział	G-4
▣	Nr inwentarzowy	1-511-6703
▣	Nr fabryczny	LWS503
▣	Nr ewidencyjny	
▣	Faza pracy	praca
✎	AssetID	500003510
▣	Aktualne miejsce pracy	ŚCIANA K-2 POKŁAD [363]

Machine workplace history

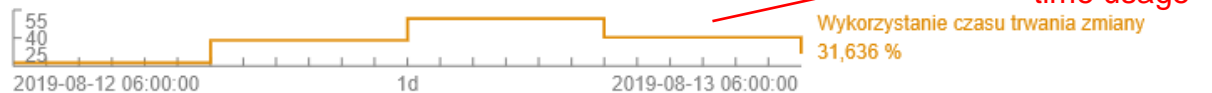
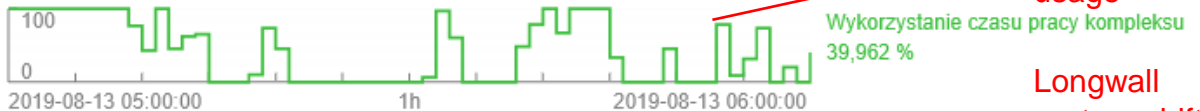
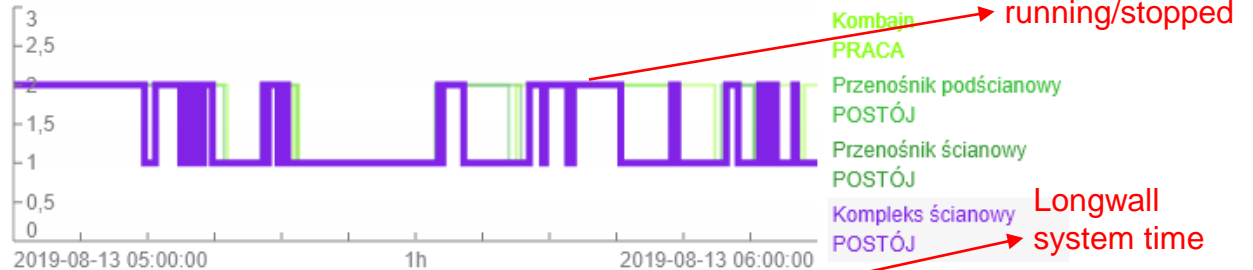
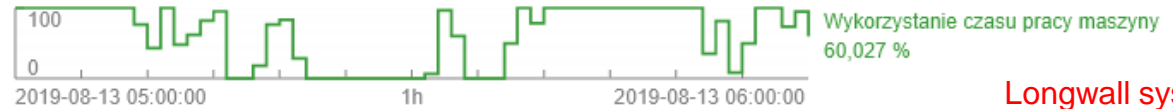
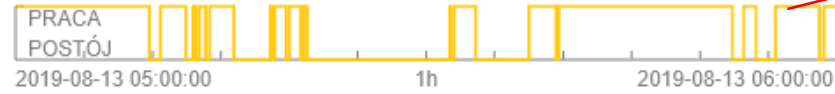
Time Stamp	Value
01.01.1970 00:00:00	No Data
11.12.2017 00:00:00	ŚCIANA K-2 POKŁAD[362/1]LIKWIDACJA
09.01.2018 08:32:00	ŚCIANA N-9 POKŁAD[404/2] EKSPLOATACJA
02.07.2018 07:58:00	ŚCIANA K-1 POKŁAD[363]
10.04.2019 11:42:00	ŚCIANA K-2 POKŁAD [363] ZBROJENIE
17.04.2019 06:28:00	ŚCIANA K-2 POKŁAD [363]
31.12.9999 23:59:59	No Data

# Case 2 - Logical relations between machines

## AF analysis



Complexity ↓



# Case 3 - Rollup calculations – mine, corporate KPI's

- Elements
  - Borynia
  - Budryk
  - Bzie-Dębina
  - Jastrzębie
  - Knurów
  - Pniówek
    - Maszyny
      - Ruch
        - Chodnik
        - Odstawa
        - P.Poż
        - Szyb
        - Ściana
          - ARCHIWUM
          - B-4 404/2
          - C-3 404/2
          - K-2 363/0
          - N-3 404/1
          - P-1 362/1
          - W-2 362/1
  - Szczygłowice
  - Zofiówka

Working time usage (average for all longwall systems) within one mine



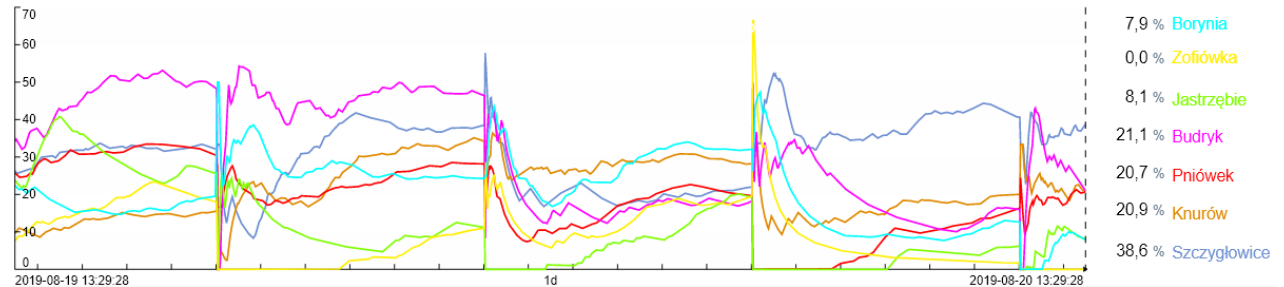
Longwalls

# Case 3 - Rollup calculations – mine, corporate KPI's

- Elements
  - Borynia
  - Budryk
  - Bzie-Dębina
  - Jastrzębie
  - Knurów
  - Pniówek
  - Szczygłowice
  - Zofiówka

Mines

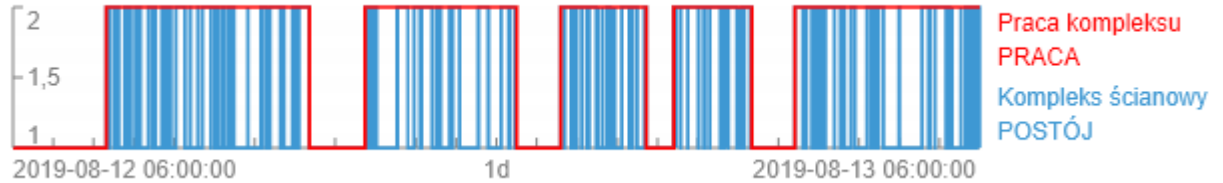
Working time usage (average for all longwall systems) within all mines



# Case 4 - Automatic downtimes recognition

## LS downtimes go to CMMS

Red trend –  
LS downtimes  
longer then 30min



Event frames  
generated

Nazwa zdarzenia	Zasób	▼ Czas początku	▼ Czas końca	▼ Czas trwania	▼ Przyczyna
Postój MP (PN) C-3 404/2 2019-08-13 00:20:390	C-3 404/2	2019-08-13 00:20:39	2019-08-13 01:24:49	1h 4m	
Postój MP (PN) C-3 404/2 2019-08-12 21:43:180	C-3 404/2	2019-08-12 21:43:18	2019-08-12 22:24:08	40m 50s	
Postój MP (PN) C-3 404/2 2019-08-12 18:30:020	C-3 404/2	2019-08-12 18:30:02	2019-08-12 19:35:43	1h 5m	
Postój MP (PN) C-3 404/2 2019-08-12 13:21:330	C-3 404/2	2019-08-12 13:21:33	2019-08-12 14:44:39	1h 23m	
Postój MP (PN) C-3 404/2 2019-08-12 06:00:000	C-3 404/2	2019-08-12 06:00:00	2019-08-12 08:19:05	2h 19m	

Event log in  
CMMS  
(integration  
example)

Nr MP maszyny	Miejsce pracy maszyny	Typ maszyny (nr inw./ewid./fab.)	Rodz. masz.	Data od	Data do	Nr MP postoju	Miejsce postoju	Przyczyna
	C-3							
157	ŚCIANA C-3 POKŁAD  404/2	JOY-4LS22-3300 (7539)	KBS	2019-08-13 00:20	2019-08-13 01:24	157	ściana C-3 (404/2)	Międzyzmianna
157	ŚCIANA C-3 POKŁAD  404/2	JOY-4LS22-3300 (7539)	KBS	2019-08-12 21:43	2019-08-12 22:24	157	ściana C-3 (404/2)	Przekładka dolnego napędu + budowa wneki
157	ŚCIANA C-3 POKŁAD  404/2	JOY-4LS22-3300 (7539)	KBS	2019-08-12 18:30	2019-08-12 19:35	157	ściana C-3 (404/2)	Międzyzmianna
157	ŚCIANA C-3 POKŁAD  404/2	JOY-4LS22-3300 (7539)	KBS	2019-08-12 13:21	2019-08-12 14:44	157	ściana C-3 (404/2)	przekładka górnego napędu PZS
157	ŚCIANA C-3 POKŁAD  404/2	JOY-4LS22-3300 (7539)	KBS	2019-08-12 06:00	2019-08-12 08:19	157	ściana C-3 (404/2)	Międzyzmianna

# Case 5 - Haulage system optimization

## Events based on relations between machines

1'st Conveyor belt

Longwall system



# Case 5 - Haulage system optimization

## Events based on relations between machines



### Event 1: Overloading 1'st conveyor belt

Nazwa zdarzenia	Zasób	▲ Czas początku	▼ Czas końca	▼ Czas trwania
Zasypywanie PT D-2 358/1 2019-08-07 14:53:47	D-2 358/1	2019-08-07 14:53:47	2019-08-07 14:54:37	49,985s
Zasypywanie PT D-2 358/1 2019-08-08 09:59:37	D-2 358/1	2019-08-08 09:59:37	2019-08-08 10:00:43	1m 5s
Zasypywanie PT D-2 358/1 2019-08-08 10:09:59	D-2 358/1	2019-08-08 10:09:59	2019-08-08 10:11:23	1m 24s
Zasypywanie PT D-2 358/1 2019-08-08 14:17:03	D-2 358/1	2019-08-08 14:17:03	2019-08-08 14:17:57	54,048s
Zasypywanie PT D-2 358/1 2019-08-08 14:18:03	D-2 358/1	2019-08-08 14:18:03	2019-08-08 14:19:03	59,997s

### Event 2: Running empty on 1'st conveyor belt

Nazwa zdarzenia	Zasób	▲ Czas początku	▼ Czas końca	▼ Czas trwania
Praca nieefektywna PT D-2 358/1 2019-08-07 17:47:11	D-2 358/1	2019-08-07 17:47:11	2019-08-07 18:07:27	20m 16s
Praca nieefektywna PT D-2 358/1 2019-08-08 11:30:43	D-2 358/1	2019-08-08 11:30:43	2019-08-08 11:49:13	18m 29s

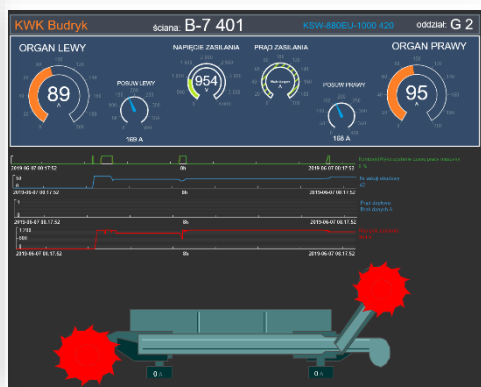
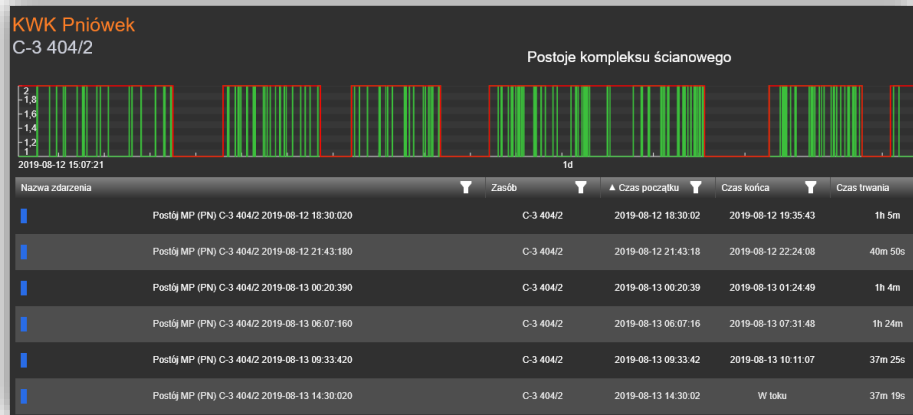
### BO reports for mine

KWK Budryk

staff Data wygenerowania: 2019-08-11

Ściana	Data	Praca nieefektywna PT		Zasypywanie PT	
		Czas	Ilość	Czas	Ilość
CZ-5 364/2		10:33:27	27	0:01:58	0
	2019-07-10 23:25:22	0:15:30	1		
	2019-07-11 05:10:14	0:24:30	1		
	2019-07-11 11:20:19	0:16:24	1		
	2019-07-17 03:16:44	0:16:12	1		
	2019-07-19 22:05:13	0:17:30	1		
	2019-07-20 08:43:53	0:38:46	1		
	2019-07-22 05:17:07	0:26:32	1		
	2019-07-22 13:43:02	0:26:41	1		
	2019-07-23 10:30:30	0:33:19	1		
	2019-07-23 20:49:07	0:24:02	1		
	2019-07-24 23:11:31	0:19:26	1		
	2019-07-26 15:51:19	0:18:54	1		
	2019-07-29 22:27:45	0:30:36	1		
	2019-07-30 20:21:15	0:19:14	1		

# CTDS – operational level dashboards



Odstawa Główna

Praca	Internet 1400	Internet 1400	Pioma 1400	Pioma 1400	Pioma 1400	Internet 1200	Pioma 1400 W-Pioma 1400 W	GWarek 1400	GWarek 1400	GWarek 1200	GWarek 1200	GWarek 1200	GWarek 1200	Pioma 1400 N	Pioma 1400 N	Pioma 1200 N	
Pracownik	PP-2	PP-1	PW-1	PW-2	PJ-A	PJ-B	SA1	SA2	PZ-1	PZ-2	PZ-3	Z-6A	GW-2	10 R1	10 R2	10 R3	
0:00	0:41:58	1:00:00	0:58:41	0:45:43	0:44:59	0:40:01	0:41:35	0:41:28	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00
7:00	0:00:00	0:40:27	0:29:23	0:06:56	0:00:21	0:00:00	0:00:53	0:04:21	0:29:07	0:28:54	0:00:00	0:00:00	0:00:00	0:33:05	0:37:41	0:16:34	0:16:38
8:00	0:00:00	1:00:00	1:00:00	0:57:31	0:00:00	0:49:16	0:57:01	0:51:18	1:00:00	1:00:00	0:38:38	0:00:00	0:00:00	1:00:00	1:00:00	0:59:01	0:51:41
9:00	0:00:00	1:00:00	0:59:16	0:59:07	0:11:16	0:30:09	0:58:53	0:58:49	1:00:00	1:00:00	0:22:42	0:00:00	0:00:00	1:00:00	0:58:29	0:58:20	0:57:47
10:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:34:50	0:00:00	0:00:00	1:00:00	0:49:00	0:46:45	0:46:05
11:00	0:00:00	1:00:00	0:58:53	0:58:46	0:58:43	0:58:36	0:58:30	0:56:55	0:57:48	0:57:37	0:00:00	0:00:00	0:00:00	0:56:08	0:55:41	0:55:25	0:53:52
12:00	0:00:00	1:00:00	0:59:35	0:59:29	0:59:27	0:59:19	0:58:12	0:56:22	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00
13:00	0:00:00	1:00:00	0:57:54	0:57:41	0:57:38	0:55:05	0:46:24	0:35:25	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00
14:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:54:30	1:00:00	1:00:00	1:00:00	1:00:00	0:28:45	0:15:16	0:00:00	0:28:49	0:28:37	0:29:29	0:22:49
15:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:49:20	0:41:08	0:40:00	1:00:00	1:00:00	0:58:13	0:35:39	0:00:00	0:58:04	0:57:51	0:57:42	0:57:40
16:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:55:58	1:00:00	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	0:44:49	0:47:45	0:44:38	0:44:35
17:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:49:20	0:41:08	0:40:00	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	0:51:28	0:51:17	0:49:49	0:46:57
18:00	0:00:00	1:00:00	0:57:54	0:57:46	0:57:44	0:57:15	0:00:00	0:00:00	0:54:43	0:54:08	0:00:00	0:00:00	0:00:00	0:53:50	0:53:47	0:53:03	0:53:00
19:00	0:00:00	1:00:00	0:59:30	0:59:23	0:59:21	0:56:45	0:00:53	0:09:35	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00
20:00	0:24:23	0:59:17	0:58:56	0:58:50	0:58:47	0:58:00	0:56:51	0:50:09	0:58:10	0:57:58	0:00:00	0:00:00	0:00:00	0:57:51	0:57:50	0:57:54	0:58:00
21:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:56:43	1:00:00	0:58:31	0:07:20	0:00:00	0:00:00	0:58:29	0:58:16	0:58:08	0:58:03
22:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:57:15	0:57:53	0:57:41	0:00:00	0:00:00	0:00:00	0:00:00	0:57:35	0:57:20	0:57:11	0:57:06
23:00	0:00:00	1:00:00	0:58:59	0:58:55	0:58:52	0:56:51	0:50:09	0:58:10	0:57:58	0:00:00	0:00:00	0:00:00	0:00:00	0:57:51	0:57:50	0:57:54	0:58:00
0:00	0:00:00	1:00:00	0:58:00	0:57:28	0:57:29	0:44:57	0:48:25	0:47:06	0:49:54	0:49:18	0:00:00	0:00:00	0:00:00	0:48:54	0:48:25	0:44:56	0:44:40
1:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00	0:31:28	0:27:38	0:00:00	0:00:00	0:57:06	0:56:42	0:00:00	0:00:00	0:56:34	0:56:23	0:56:15	0:56:12
2:00	0:00:00	1:00:00	1:00:00	1:00:00	0:00:00	0:22:40	0:21:11	1:00:00	1:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:57:51	0:57:50	0:57:54	0:58:00
3:00	0:00:00	1:00:00	1:00:00	1:00:00	0:36:31	0:36:22	1:00:00	1:00:00	0:58:49	0:58:25	0:23:19	0:00:00	0:00:00	0:58:41	0:58:28	0:57:08	0:56:54
4:00	0:00:00	1:00:00	1:00:00	1:00:00	0:58:34	0:48:17	1:00:00	1:00:00	1:00:00	1:00:00	0:01:58	0:00:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00
5:00	0:00:00	1:00:00	0:59:11	0:59:26	0:19:12	0:00:54	0:59:10	0:50:11	1:00:00	1:00:00	0:00:45	0:00:00	0:00:00	1:00:00	1:00:00	1:00:00	1:00:00



# Mining efficiency improvement



## CHALLENGES

- Increase working time at the coal face

## SOLUTION

- AF structure
- RT Analysis
- AF Event Frames
- PI Vision dashboards
- Integration with CMSS
- PI SQL RTQP

## BENEFITS

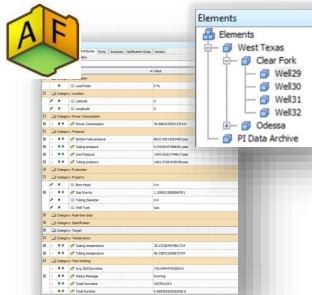
- Improved OEE for mine machines
- Increased awareness of process issues *(about 3 times more downtimes registered and annotated)*
- New options for haulage optimizations
- Shared and transparent technical data
- Reduced report preparation time *(preparation of monthly uptime report was reduced from 1h to 1m)*

“ Our Central Technology Data Server has gave us greater awareness of underground coal mine processes despite their high variability. ”

Jacek Kwaśnica. PI System Coordinator

# Closing Thoughts...

1. The modern Operations company is generating **more Real-Time Data than ever before**
2. There is a growing need to **embrace Emerging Technology Trends and Digital Transformation**
3. There is **significant value** that can be realized by widely **embracing an advanced real-time data infrastructure** within your organisation. **Legacy historians are no longer enough!**
4. Across many Industries, **80%+ of the value of analytics** is coming today from the application of **real-time 'streaming' analytics and automated workflows** within a data infrastructure
5. Structured and contextualized data is a **foundational and critical building block** to successfully implementing Advanced 'Big Data' Analytics, Machine Learning & A.I.



謝謝  
 DZIĘKUJĘ CI  
 NGIYABONGA  
 TEŞEKKÜR EDERİM  
 DANKIE  
 TERIMA KASIH  
 SPASIBO  
 ПРАКМЕТ СИЗГЕ  
 GO RAIBH MAITH AGAT  
 БЛАГОДАРЯ  
 TI БЛАГОДАРАМ  
 TAK DANKE  
 RAHMAT  
 HATUR NUHUN  
 CẢM ƠN BẠN  
 WAZVIITA  
 GRACIES  
 DANKON  
 TANK  
 TAPADH LEAT  
 SALAMAT  
 KEA LEBOHA  
 MISAOTRA ANAO  
 WHAKAWHETAI KOE  
 MATUR NUWUN  
 ХВАЛА ВАМ  
 MULŢUMESC  
 GRAZIE  
 SHUKRA  
 HVALA  
 FAAFETAI  
 ESKERRIK ASKO  
 HVALA  
 TEŞEKKÜR EDERİM  
 OBRIGADO  
 MERCİ  
 DI OU MËSI  
 ĀKIJEM  
 GRAZZI  
 ПРАККА ПĒР  
 АРИГАТӨУГОЗЭЙМАШТА  
 SIPAS JI WERE  
 TERIMA KASIH  
 UA TSAUG RAU KOJ  
 TI БЛАГОДАРАМ  
 СИПОС  
 MAHADSANID  
 DANK JE  
 AČIŪ  
 SALAMAT  
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# THANK YOU

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