

The background of the entire image is a dark blue gradient. On the left side, there is a faint, stylized image of the San Francisco Bay Bridge. On the right side, there is a faint silhouette of the San Francisco skyline, including the Transamerica Pyramid. The OSIsoft logo is centered at the top in white.

**OSI**soft®

# USERS CONFERENCE 2016

April 4-8, 2016 | San Francisco

**TRANSFORM**  
**YOURWORLD**



# PI System 101: Basics for Beginners

Presented by **Dan Lopez**  
**Stuart Collins**





Petrie

Note: the module is frequently upgraded and moved; please pardon any data interruptions

Yard Weather Sensors and Particle Photon IoT Module



WiFi Strength: -64

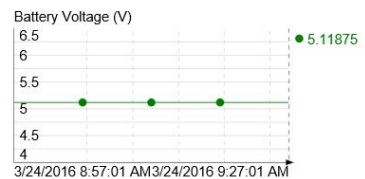
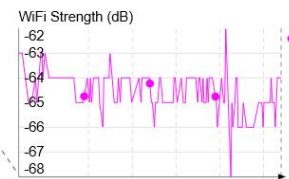
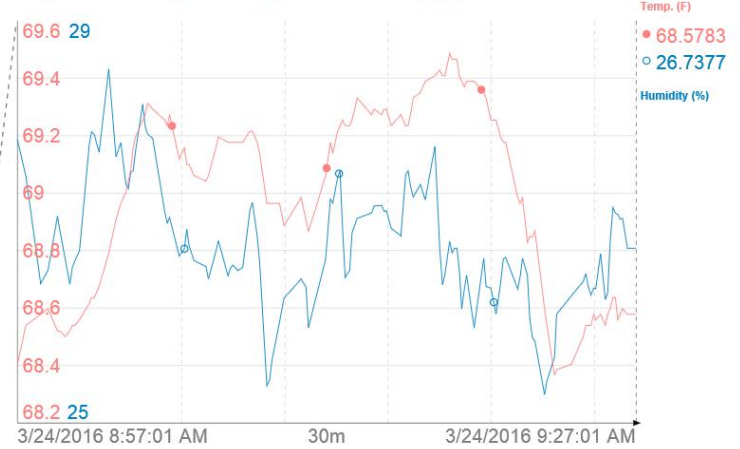
Microsoft Azure Event Hub



OSIsoft PI System



Doghouse Temperature (F) and Humidity (%)



3/24/2016 8:57:01 AM

< 30m >

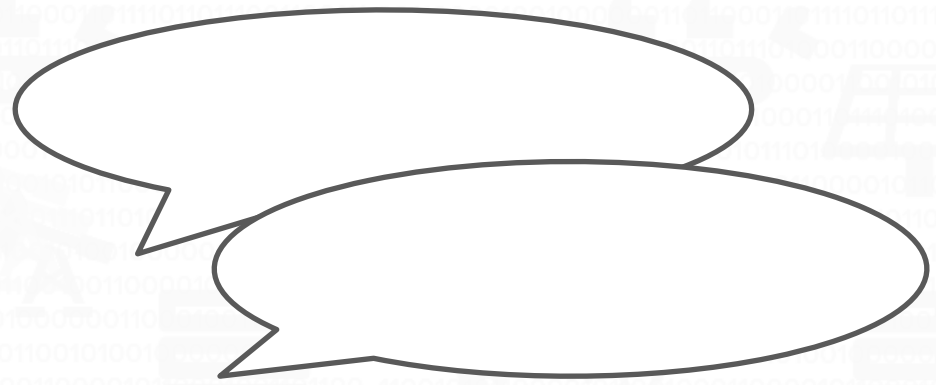
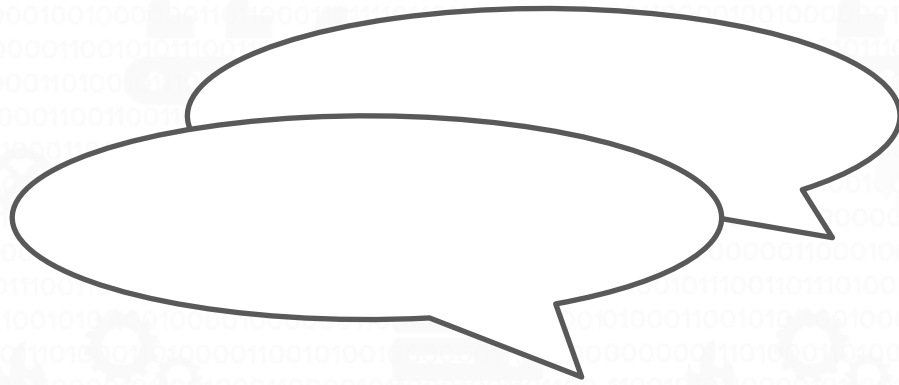
Now

3/24/2016 9:27:01 AM

**We're all Here to Share Ideas!**

*Meet the  
people next  
to you!*





*How **do you** use the PI System  
to do your job?*

*How **do your colleagues** use the  
PI System to do their jobs?*





# PI 101: What is the PI System used for?

## Users apply the PI System to **Many Challenges!**

What is the forecast of productivity?

I need to know the moment an asset goes out of tune.

I need to combine data from 3 sources in 1 report.

The equipment is not working! What's the problem?

Plant Manager



COO



Engineer

Maintenance Technician



The PI System is a  
multi-tool for  
“operational” data



# PI 101: Class Outline

“Infrastructure” what is it good for?

See how the PI System **actually works**  
and how the PI system **fits together**

What the **most successful users** use their PI System for





# Leveraging the PI System in Water

## COMPANY

Halifax  
people  
leaks

## CHALLENGE

Non-interoperable systems  
and fractured information  
sharing prevented running  
analytics

- Operators  
relied on  
data to

## CHALLENGE

Non-interoperable systems  
and fractured information  
sharing prevented running  
analytics

- Operators and planners often  
relied on estimates rather than real  
data to do their job

HALIFAX

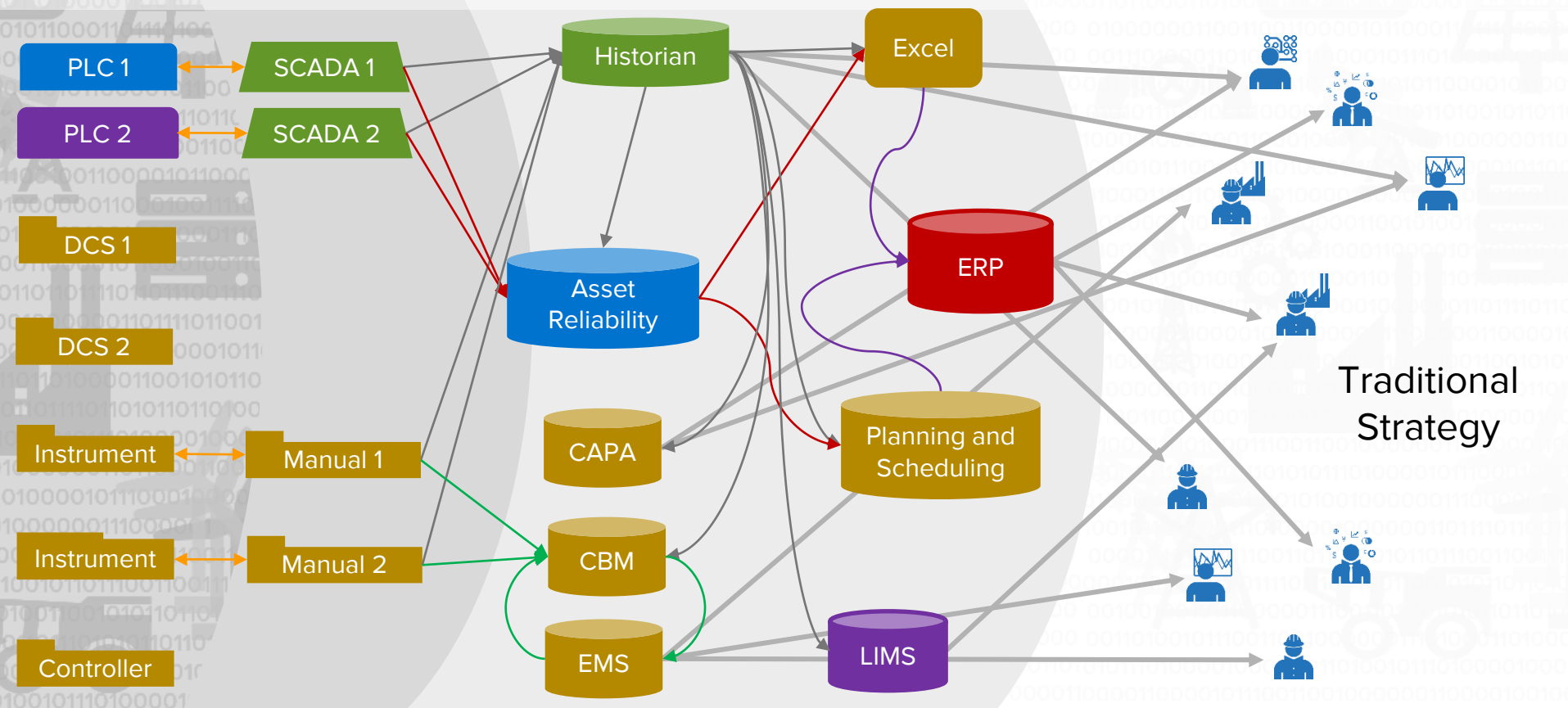


## RESULTS

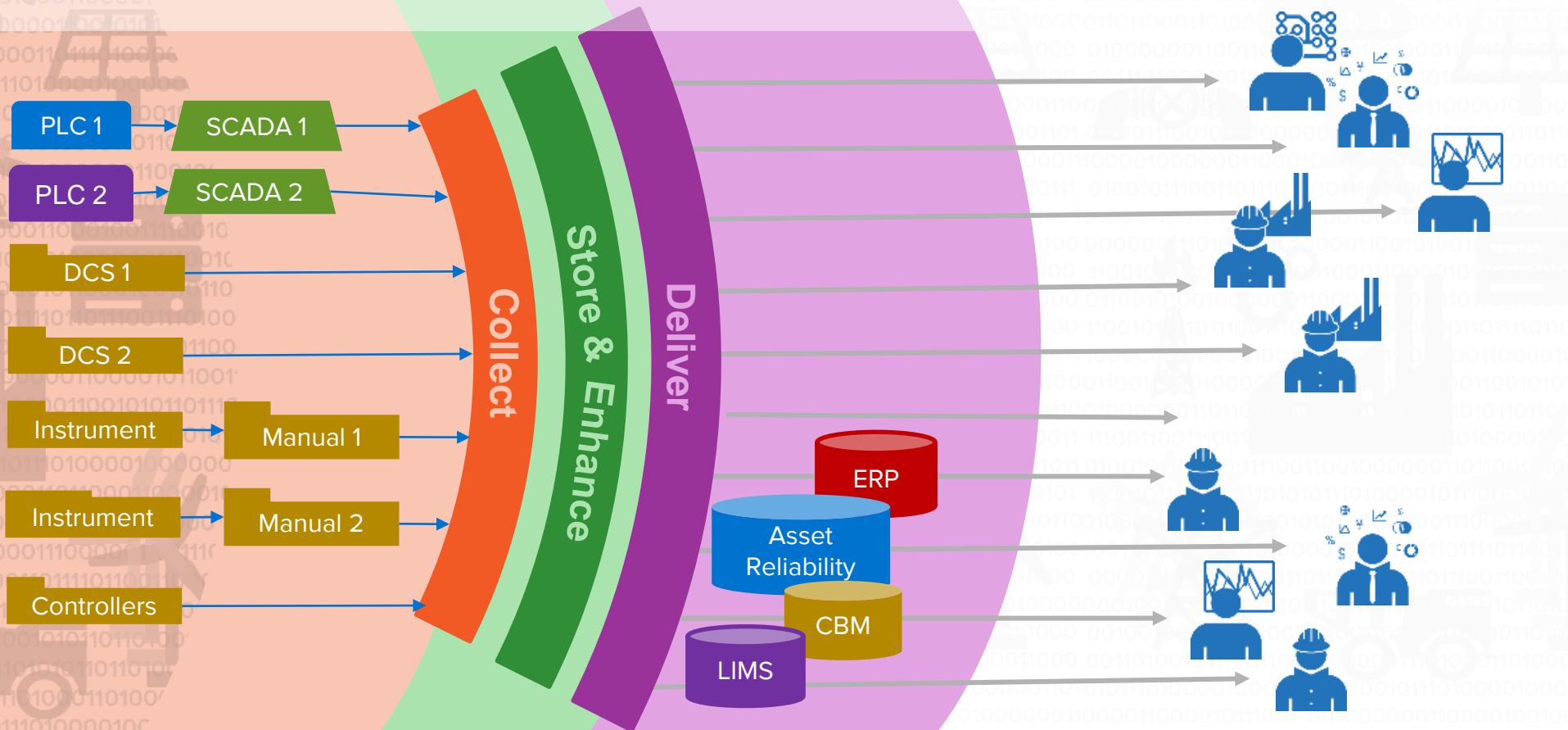
Halifax saved \$800,000  
year by reducing leaks and  
reducing average main  
breaks by as much as 50%

- Halifax detected and addressed a  
big leak of 700 gallons per minute  
that had been running for 8 hours
- The company's infrastructure  
Leakage Index (L.I.) improved from  
8 to 2.5

# We've All Been Here...



# ... And You've Made It This Far...



The PI System handles  
operational data  
from sensor  
to destination

## Collect

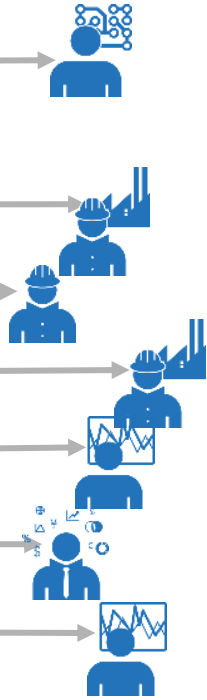
data using  
PI Interfaces

## Manage & Enhance

data within the  
PI Server

## Deliver

data via  
PI Client Tools



# PI 101: What does the PI System “DO”?

Wherever your data starts

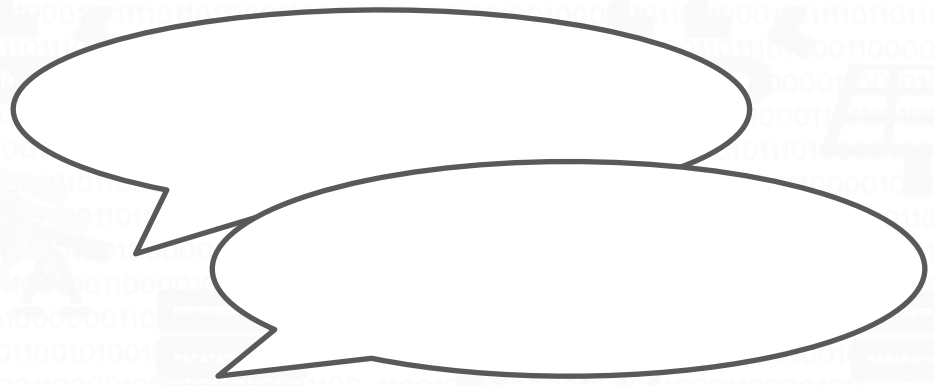
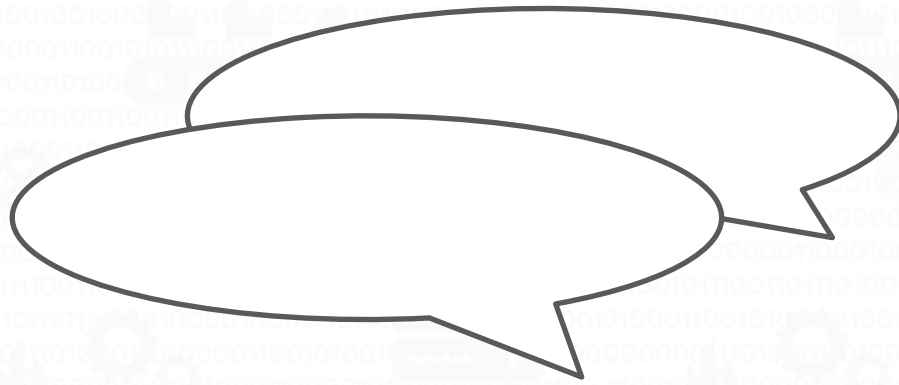
to wherever your data needs to go

The **PI System Infrastructure**

is everything in between



After today, we hope  
you're equipped to  
think up **new goals!**



*Before our demonstration...*

***What sensors, devices, or assets  
matter to you or your industry?***

*We'll show one example; see how your case  
might be similar*





# PI 101: Class Outline

“Infrastructure” what is it good for?

See how the PI System **actually works**  
and how the PI system **fits together**

What the **most successful users** use their PI System for



# PI 101: PI System Demonstration

## Our Scenario: an Industrial Campus

- An industrial campus with large annual utilities usage
  - Utility costs are very important for our budget!
- We are concerned about the campus electrical grid
  - We maintain and manage our own internal generation, grid, and distribution networks!

# Data Delivery: to the Right People at the Right Time

## PI Interface

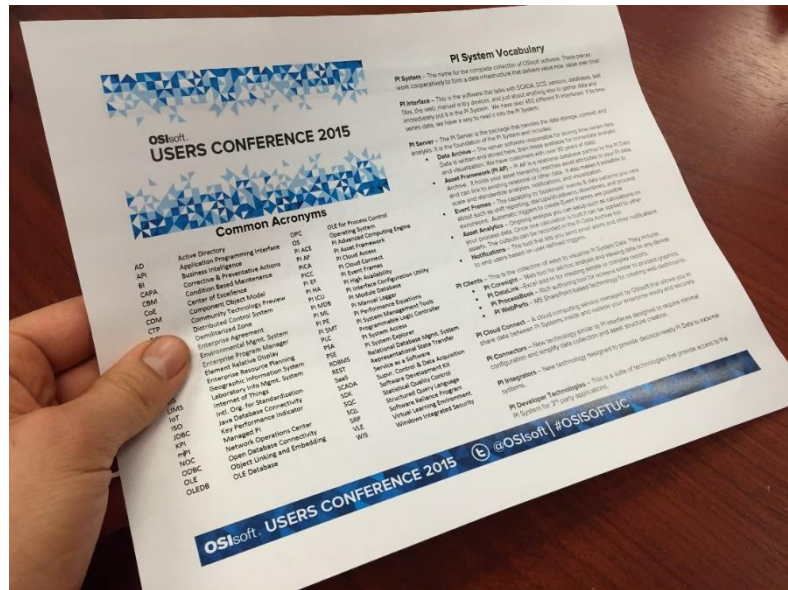
Talks with SCADA, DCS, sensors, databases, text files, the web, manual entry devices, and just about anything else to gather data and immediately put it in the PI System.

## PI ProcessBook

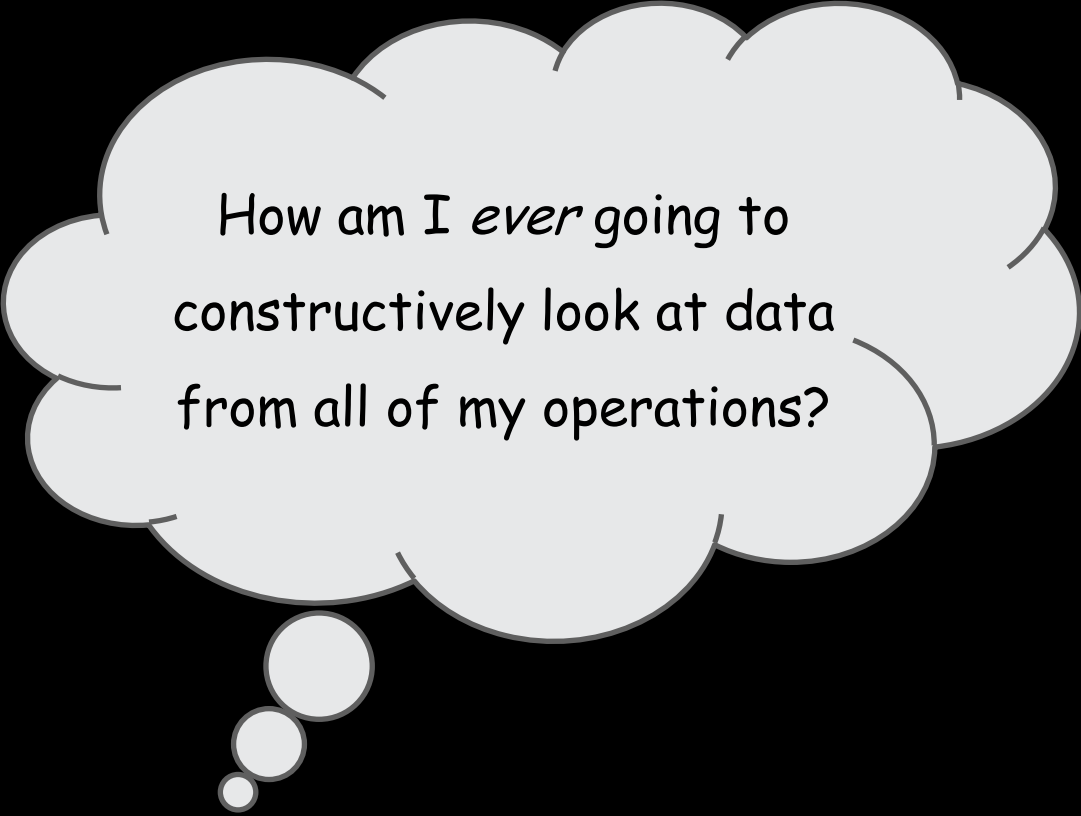
Rich authoring tool for screens similar to process graphics.

## PI Coresight

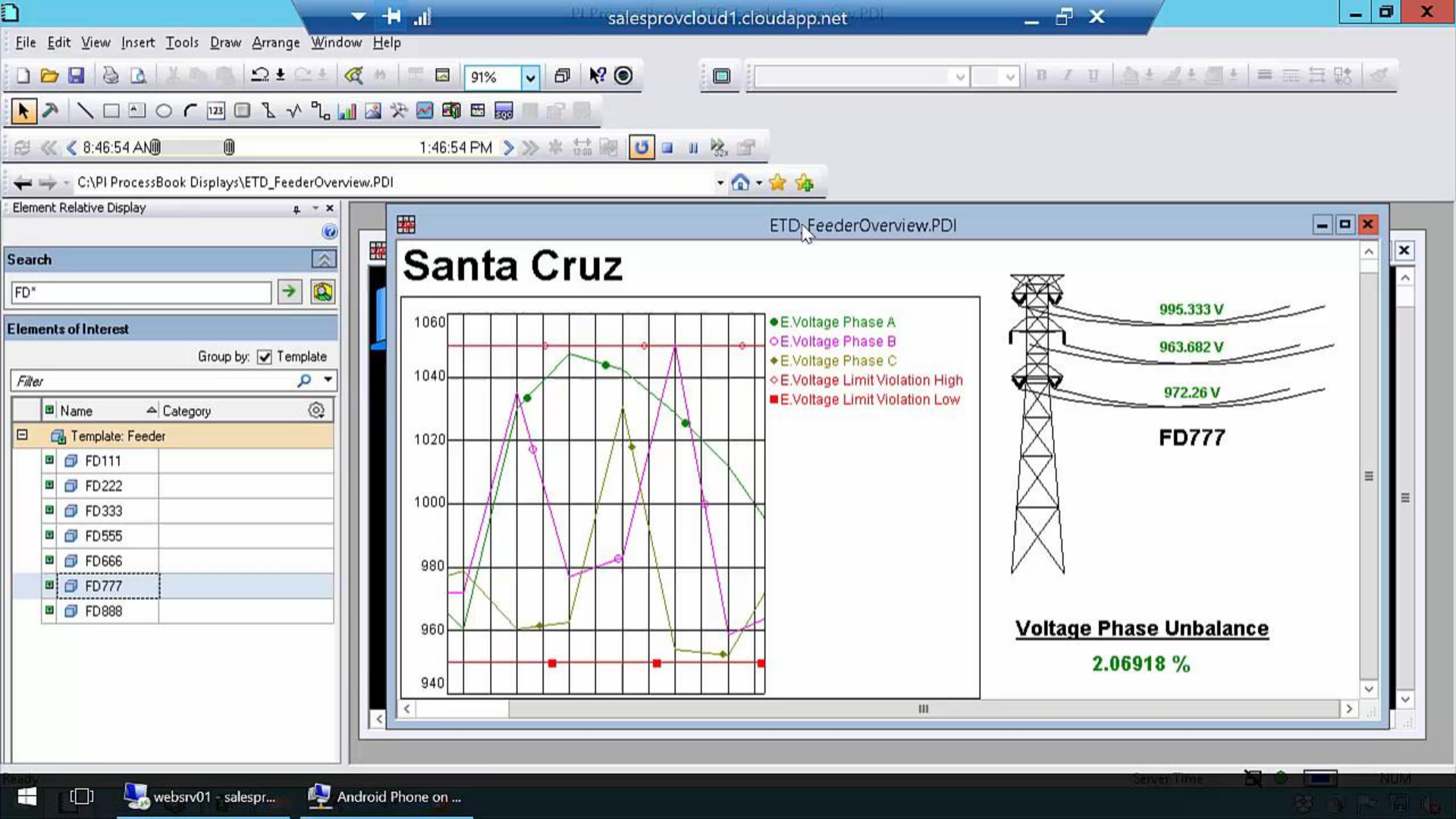
Web tool for charts, numbers, graphics, quick analysis, and viewing data on any device.




*Your handy info sheet!*



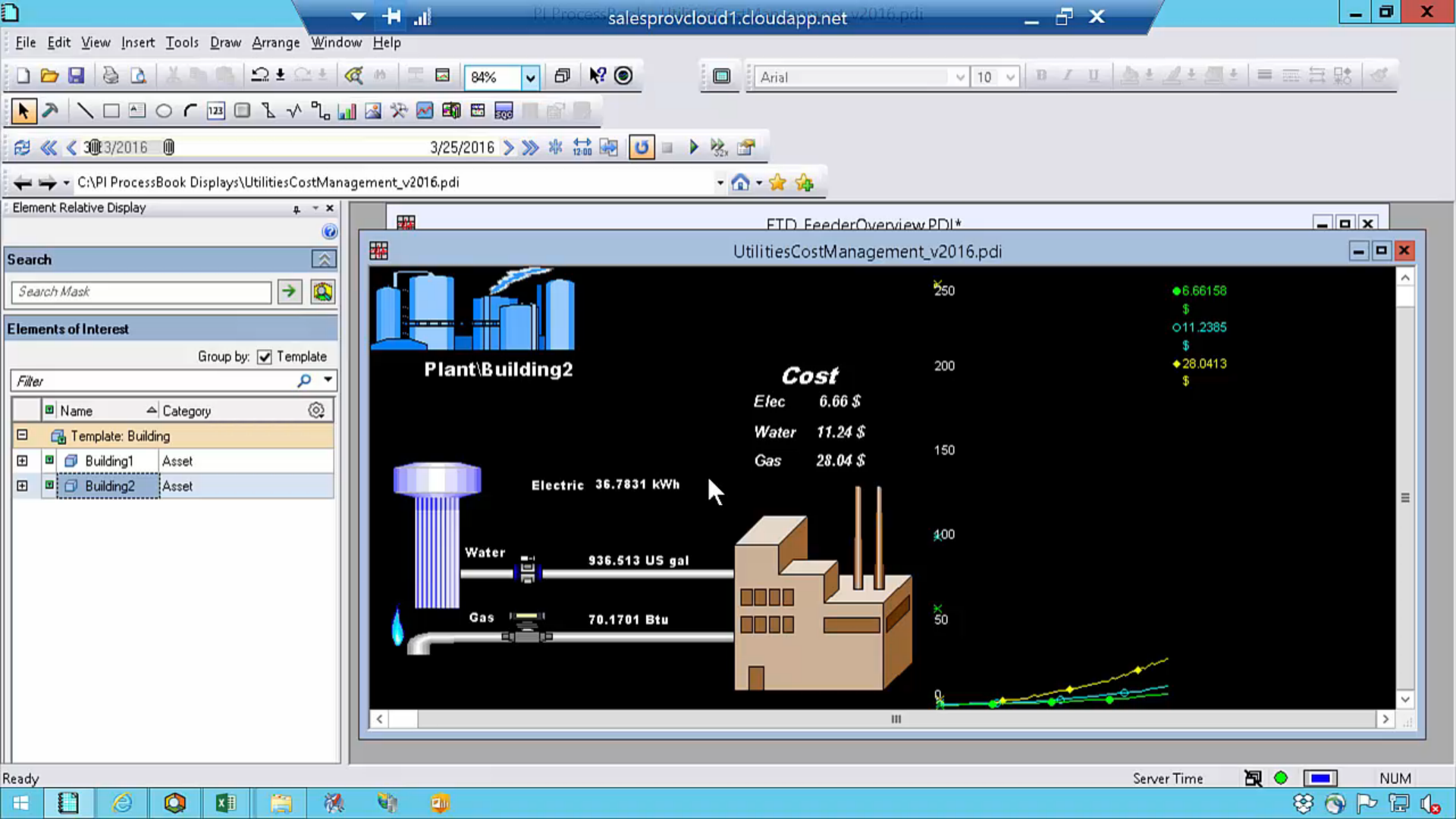
How am I *ever* going to  
constructively look at data  
from all of my operations?

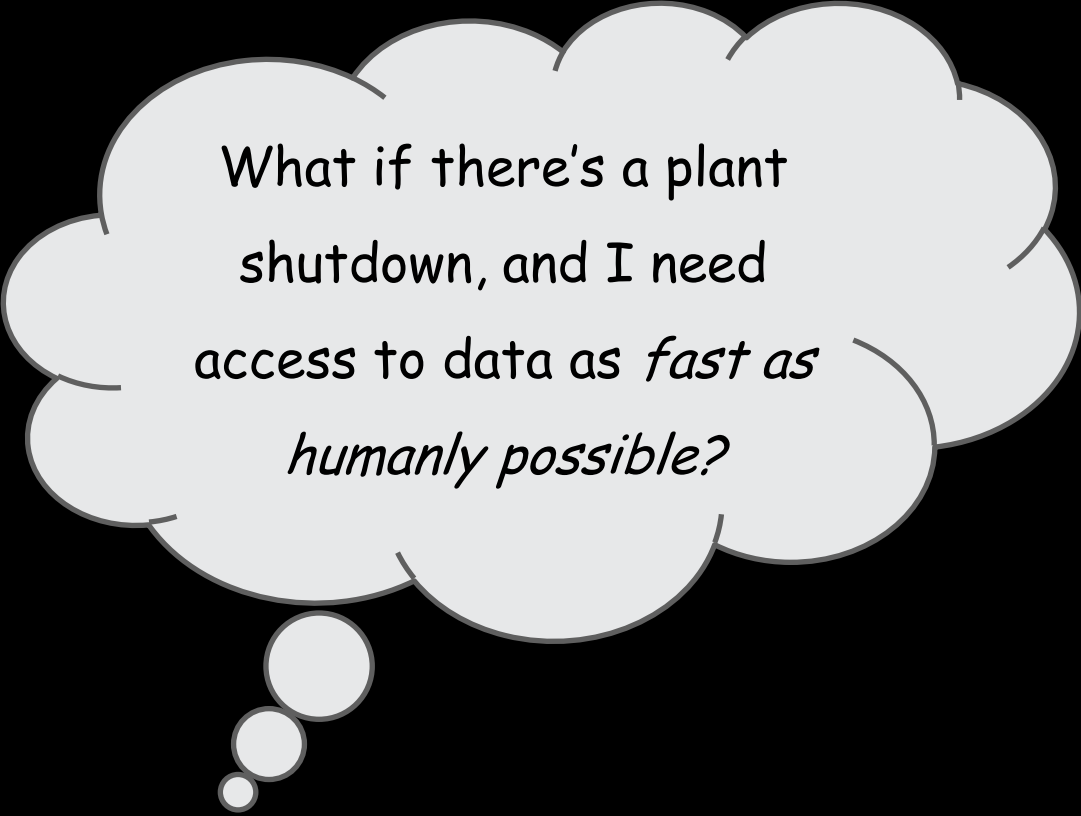




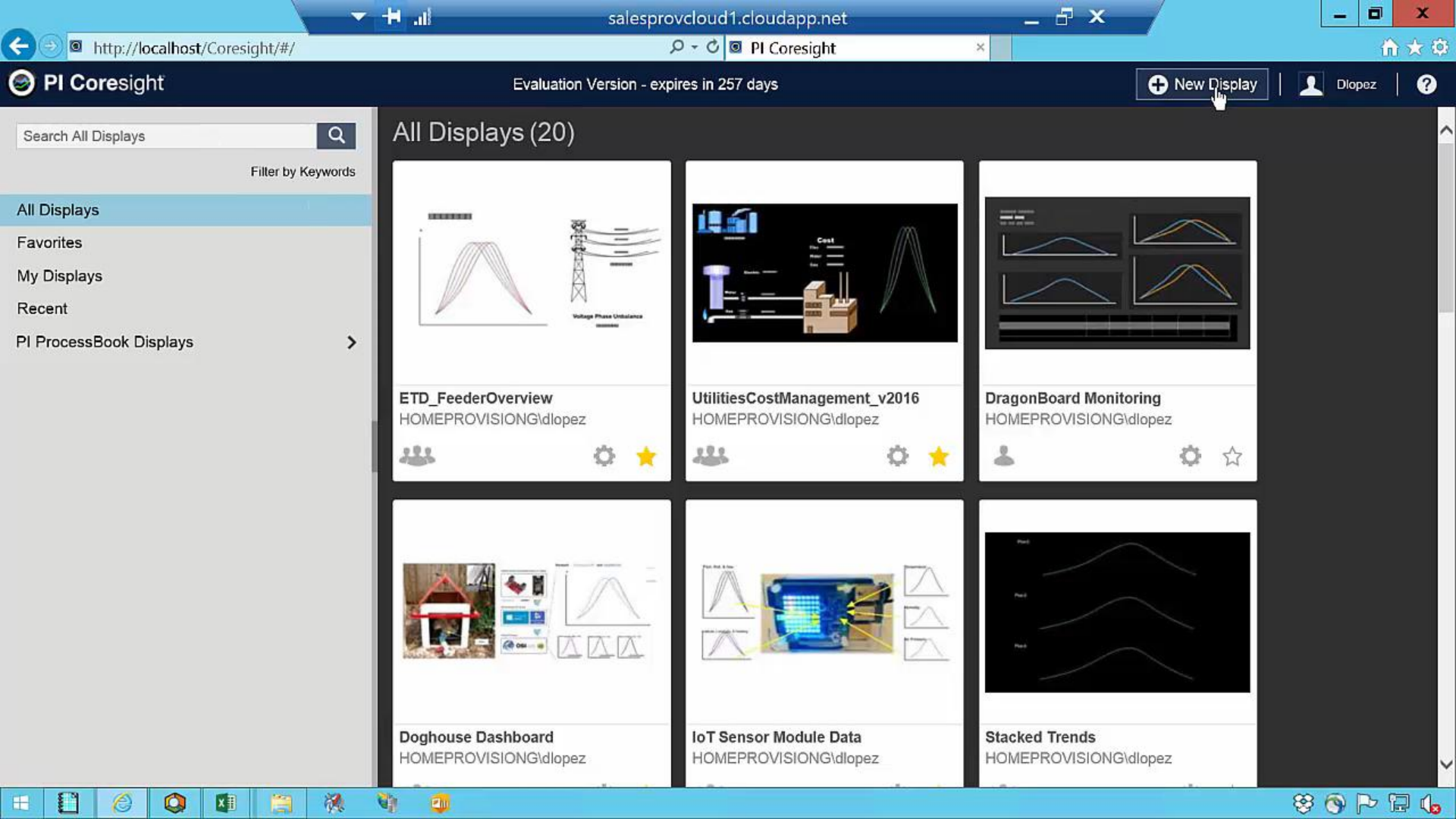
What if I need to share  
my grid and building  
displays with my  
coworkers?

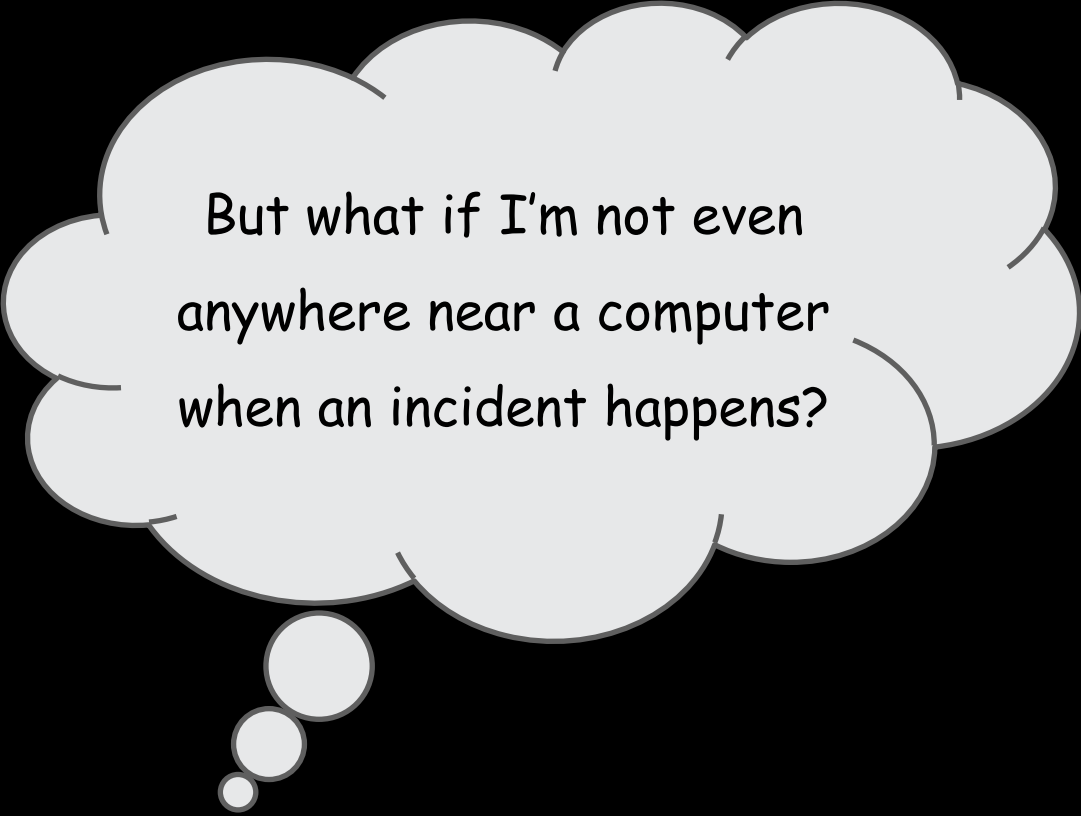






What if there's a plant  
shutdown, and I need  
access to data as *fast as*  
*humanly possible?*





But what if I'm not even  
anywhere near a computer  
when an incident happens?



## Data Enhancement: adding Structure and Analyses

## Asset Framework (PI AF)

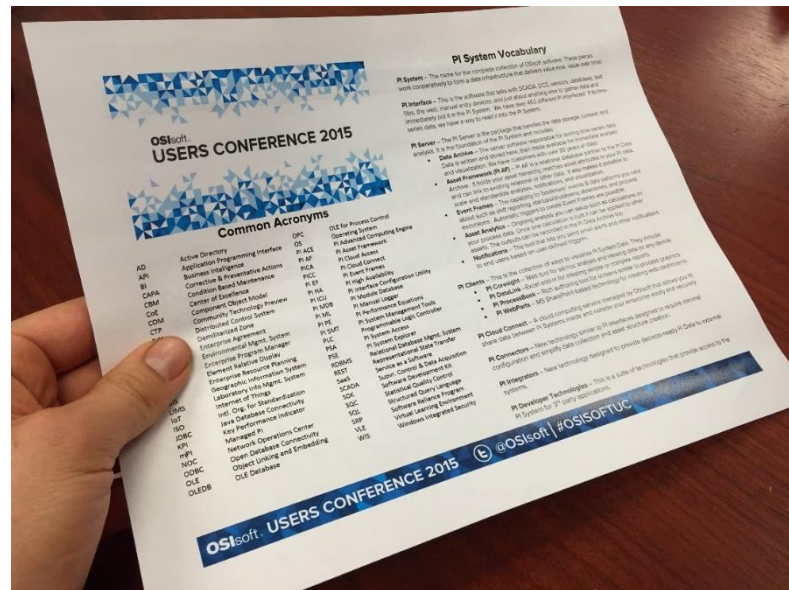
Relational database partner to the PI Data Archive.

It holds your asset hierarchy, matches asset attributes to your PI data, and can link to existing relational or other data. It also makes it possible to scale and standardize analyses, notifications, and visualization.

# PI DataLink

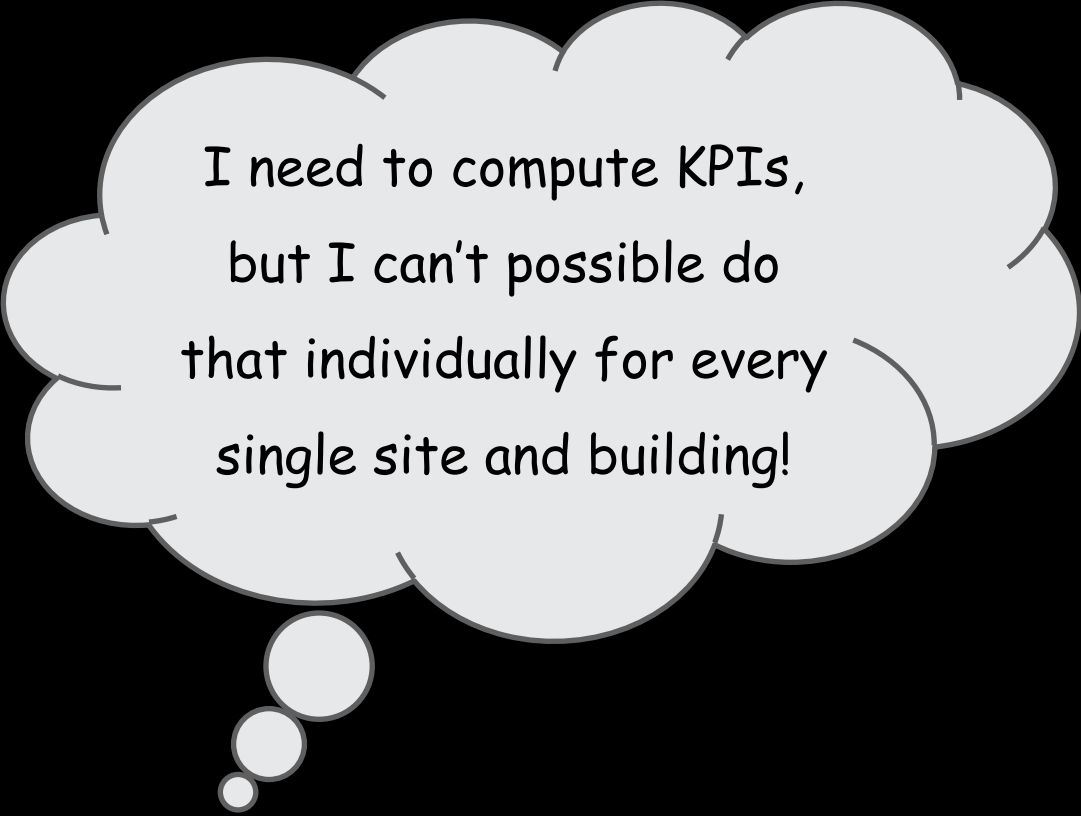
Excel add-in for creating simple or complex reports.

And more...

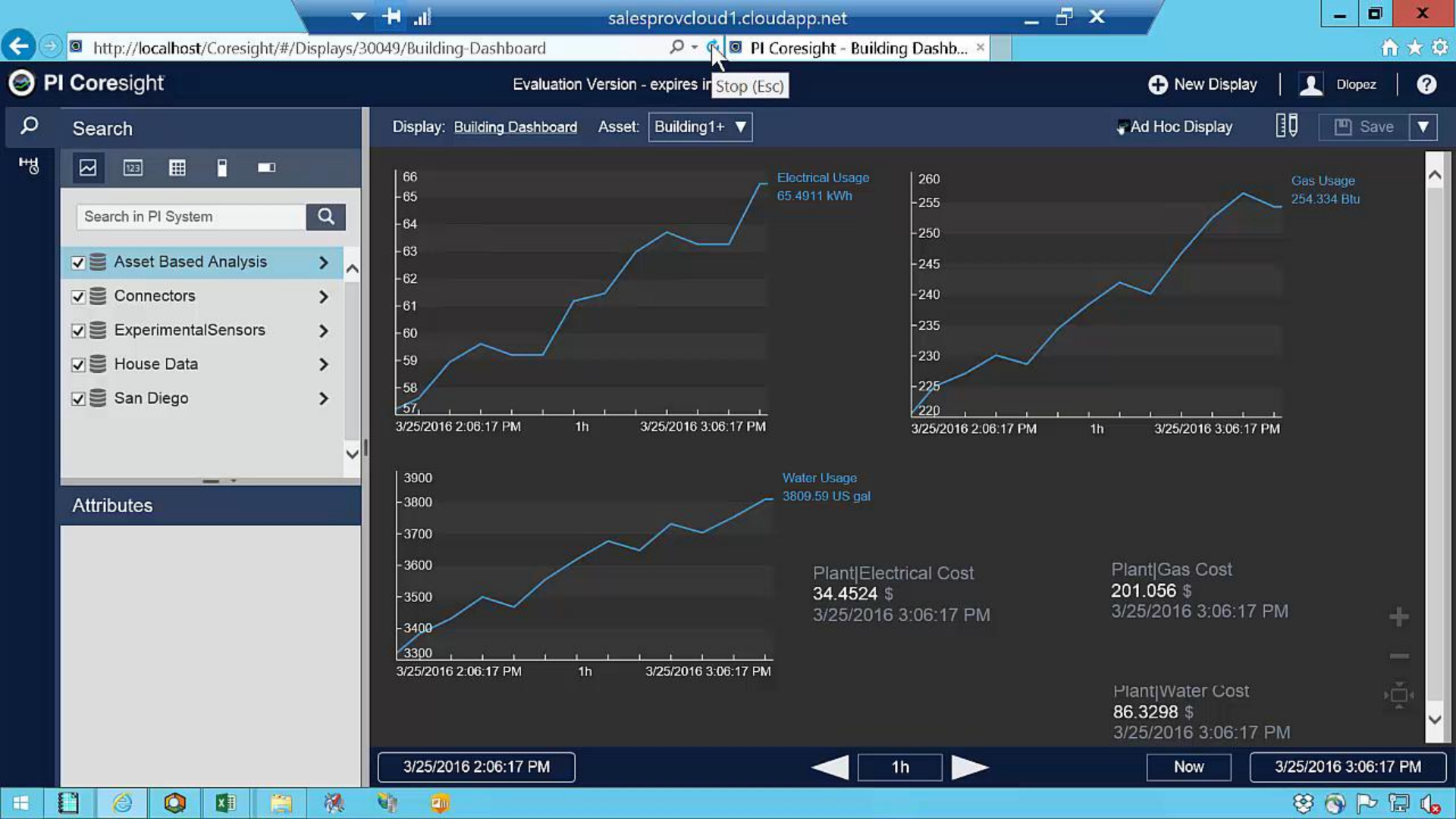


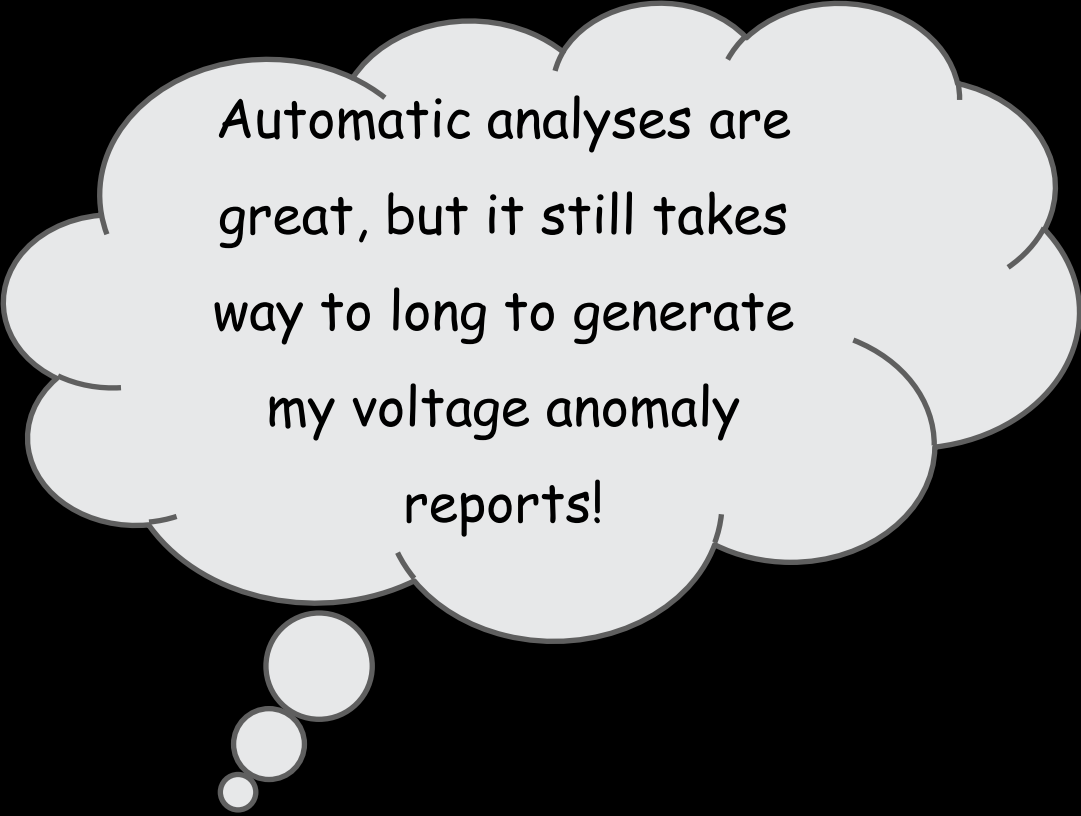
*Your handy info sheet!*





I need to compute KPIs,  
but I can't possible do  
that individually for every  
single site and building!





Automatic analyses are  
great, but it still takes  
way to long to generate  
my voltage anomaly  
reports!

Elements

- TX242
- TX261
- TX262
- TX511
- TX512
- TX531
- TX532
- TX551
- TX552
- TX571
- TX572
- California
  - Fresno
    - Mariposa
      - FD111
      - TX531
      - TX532
    - Merced
      - FD222
      - TX551
      - TX552
    - San Luis Obispo
      - FD333
      - TX571
      - TX572

- Elements
- Event Frames
- Library
- Unit of Measure
- MyPI
- Notifications
- Contacts
- Analyses

Merced

- General
- Child Elements
- Attributes
- Ports
- Analyses
- Version

Group by: ☒ Category ☐ Template

Filter

	Name	Value	Time Stamp
Category: <None>			
	District	Fresno	1/1/1970 12:00:00 AM
	Power	80317.7265625 W	3/25/2016 3:00:00 PM
	Substation Number	55	1/1/1970 12:00:00 AM
Category: Location			
	Latitude	37.2987 °	1/1/1970 12:00:00 AM
	Longitude	-120.4714 °	1/1/1970 12:00:00 AM

Substation Number

File Home Insert Page Layout Formulas Data Review View **PI DATALINK** Tell me what you want to do... Sign in Share

Current Value Single Value Compressed Data Multiple Value Sampled Data Timed Data Calculated Data Calculation Time Filtered Calculation Explore Compare Events Search Asset Filter Properties Update Settings About Help Notification Search Resources Notifications

F7 {=PIEFDat('Violation High Datalink'!\$D\$3,'Violation High Datalink'!\$B\$3,'Violation High Datalink'!\$C\$3,0,"\*",'Violation High Datalink'!\$E\$3,"\*", "\*", "\*", "\*", "\*", "active in

	E	F	G	H	I	J	K	L	M	N	O
1											
2	<b>Event Template</b>										
3	Voltage Phase Limit Violation High										
4											
5											
6	<b>Duration</b>	<b>Event template</b>	<b>Primary e.</b>	<b>Maximur.</b>	<b>Maximur.</b>	<b>Maximur.</b>	<b>Maximur.</b>	<b>Maximur.</b>	<b>Maximur.</b>	<b>Minimum.</b>	<b>Minimu</b>
7	0 0:10:00	Voltage Phase Limit Violation High	FD555	109.9421	105.934	103.0736	1023.694	1050.175	1048.754	106.768	93.6765
8	0 0:10:00	Voltage Phase Limit Violation High	FD666	100.1918	103.0541	98.76744	1010.351	1050.123	1011.924	96.97386	91.6087
9	0 0:10:00	Voltage Phase Limit Violation High	FD333	99.97093	108.2153	94.84286	1048.408	1050.264	1027.27	98.86689	94.6444
10	0 0:10:00	Voltage Phase Limit Violation High	FD333	96.78886	102.3428	99.8277	1050.143	1023.626	971.6736	91.56831	94.6801
11	0 0:10:00	Voltage Phase Limit Violation High	FD666	90.34863	106.9114	107.2804	1018.089	1000.161	1050.398	90.34629	96.0939
12	0 0:10:00	Voltage Phase Limit Violation High	FD555	103.2439	101.8524	103.4403	1050.087	957.8765	1010.424	98.93798	93.8282
13	0 0:10:00	Voltage Phase Limit Violation High	FD666	107.6656	105.084	104.4312	950.7023	1015.984	1050.175	96.97787	95.6023
14	0 0:10:00	Voltage Phase Limit Violation High	FD888	104.836	102.1731	109.236	1045.068	1050.52	1039.125	91.82115	97.2250
15	0 0:10:00	Voltage Phase Limit Violation High	FD222	108.6546	102.4799	103.5355	1001.858	1050.132	968.3033	105.938	99.5810
16	0 0:10:00	Voltage Phase Limit Violation High	FD777	100.4897	106.6306	107.7545	1046.238	1018.773	1050.386	97.86021	95.9199
17	0 0:10:00	Voltage Phase Limit Violation High	FD333	99.79897	103.6171	96.99825	1050.236	1011.371	1010.635	98.36559	95.6945
18	0 0:10:00	Voltage Phase Limit Violation High	FD666	101.445	106.2929	107.6649	1043.478	1050.39	1043.225	95.39925	96.1912
19	0 0:10:00	Voltage Phase Limit Violation High	FD222	104.1351	93.71505	105.9987	1050.1	1050.1	1050.1	1050.1	1050.1
20	0 0:10:00	Voltage Phase Limit Violation High	FD333	102.0198	104.7169	102.6978	975.4791	1050.191	1042.848	100.5055	94.4545
21	0 0:10:00	Voltage Phase Limit Violation High	FD333	97.55103	94.39329	109.6561	1031.719	971.4897	1050.118	92.43526	90.3739
22	0 0:10:00	Voltage Phase Limit Violation High	FD666	104.0566	96.98071	109.1768	1050.32	988.5154	1048.801	101.2108	92.2250
23	0 0:20:00	Voltage Phase Limit Violation High	FD666	100.7048	109.0218	99.44457	1040.78	1042.265	1050.57	96.52729	91.0633

### Compare Events

Database Event name

Search start Event template

Search end Element name

Element template

☐ Limit to database level

+ More search options

Preview

Events (131 found)

- OSIDEMO\_FD555 Voltage Phase Limit Violation High
- OSIDEMO\_FD666 Voltage Phase Limit Violation High
- OSIDEMO\_FD333 Voltage Phase Limit Violation High
- OSIDEMO\_FD666 Voltage Phase Limit Violation High
- OSIDEMO\_FD555 Voltage Phase Limit Violation High
- OSIDEMO\_FD666 Voltage Phase Limit Violation High

2016-03-21 16:50:00.000



salesprovcloud1.cloudapp.net

FileHomeInsertPage LayoutFormulasDataReviewViewPI DATALINKTell me what you want to do...Sign inShare

PasteClipboard

Font

Alignment

Number

Styles

Cells

Editing

B1

	F	G	H	I	J	K	L	M
1								
2								
3								
4								
5	. Event template	. Primary element	. Average Voltage Phase Unbalance	. Maximum Voltage Phase Unbalance	. Voltage Phase Unbalance	. Substation		
6	Voltage Phase Unbalance	FD333	5.274526165	6.191229869	4.968958264	San Francisco		
7	Voltage Phase Unbalance	FD555	5.541049498	6.346798983	5.272466337	San Luis Obispo		
8	Voltage Phase Unbalance	FD666	3.690101152	6.101891394	2.886171071	Santa Clara		
9	Voltage Phase Unbalance	FD666	4.742644627	6.406953523	4.187874995	Santa Clara		
10	Voltage Phase Unbalance	FD777	3.896123728	6.26906719	3.105142573	Santa Cruz		
11	Voltage Phase Unbalance	FD555	3.284063188	6.097625268	2.346209161	San Luis Obispo		
12	Voltage Phase Unbalance	FD888	4.245346602	6.193308196	3.596026071	Tulare		
13	Voltage Phase Unbalance	FD888	4.37658723	6.433099377	3.691083181	Tulare		
14	Voltage Phase Unbalance	FD222	4.450455783	6.019894435	3.927309565	Merced		
15	Voltage Phase Unbalance	FD333	4.914371169	6.084919478	4.524188399	San Francisco		
16	Voltage Phase Unbalance	FD666	5.294009238	6.013400683	5.05421209	Santa Clara		
17	Voltage Phase Unbalance	FD666	3.915229405	6.567082492	3.031278377	Santa Clara		
18	Voltage Phase Unbalance	FD111	2.191480439	6.042847343	0.907691471	Mariposa		
19	Voltage Phase Unbalance	FD666	4.033369801	6.312685911	3.273597765	Santa Clara		
20	Voltage Phase Unbalance	FD111	5.863697264	6.029076379	5.808570892	Mariposa		
21	Voltage Phase Unbalance	FD555	3.846917791	6.308139268	3.026503966	San Luis Obispo		

Phase Unbalance Analysis

Phase Unbalance Raw Data

Phase Unbalance Datalink fct

Ready

100%

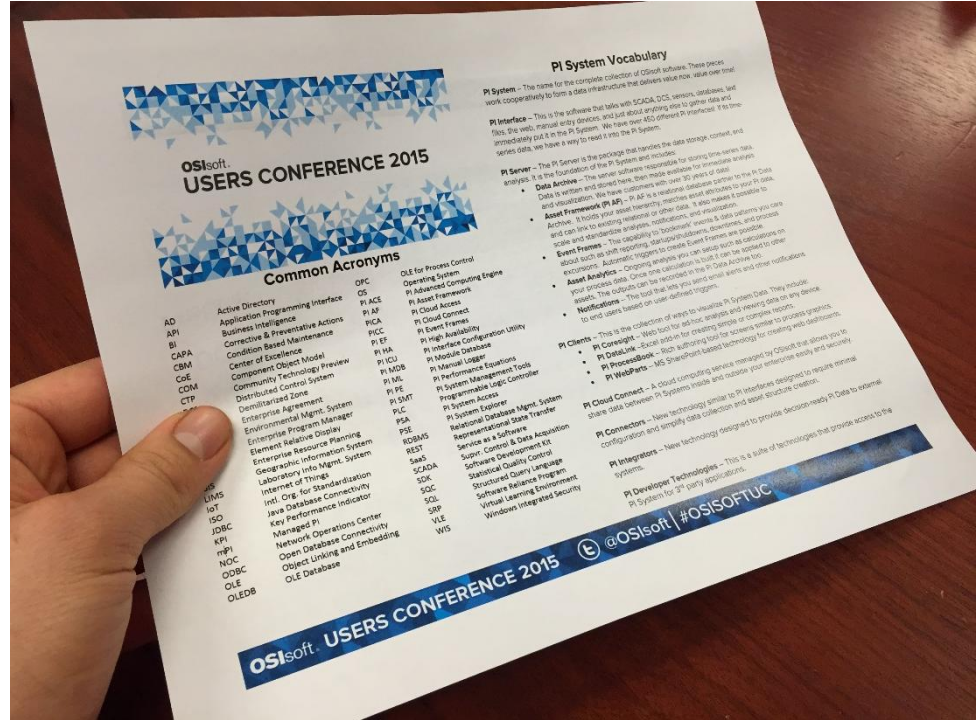


# *What Are the Pieces of the PI System?*



# Remember to Take a Look at...

## Your handy info sheet!



# The PI System has 3 Layers

## PI Interfaces

Collect

OPC

Modbus

Wonderware

DNP3

RDBMS

And hundreds more!

## PI Server

Store & Enhance

Data Archive



Historical data

Real-time data

Asset Framework



Asset Analytics

Asset Structure

Event Frames

Notifications

## PI Clients

Deliver

PI Coresight

PI ProcessBook

PI DataLink

IT Data Warehouses

BI tools

Esri ArcGIS

Foreign PI Systems



Real Time  
Troubleshooting



Keep the  
Process Healthy



Report on  
data quickly



Avoid  
breakdowns



# PI 101: Class Outline

“Infrastructure” what is it good for?

See how the PI System **actually works**  
and how the PI system **fits together**

What the **most successful users** use their PI System for



# What companies use the PI System for

## 6 Common Uses



# Leveraging the PI System in Water Loss Control

## COMPANY and GOAL

Halifax manages water and wastewater for 325,000

HALIFAX



## COMPANY and GOAL

Halifax manages water and wastewater for 325,000 people. Halifax wanted to both **find and reduce leaks** in real-time and reduce water main breaks

- Operators and planners often relied on estimates rather than real data to do their job

- “We can see the turbidities and chlorine levels at the plant – and also out in the distribution system. That is a beautiful thing!”

- Halifax detected and addressed a big leak of 700 gallons per minute that had been running for 9 hours.
- The company’s Infrastructure Leakage Index (ILI) improved from 9 to 2.5.

0,000  
leaks and  
e main  
ch as 50%

# ESP Reliability Improvement Saves \$40M/y

Global O&G Company

Company faced highly expensive repair costs from electrical submersible pump (ESP) failures so they wanted to **reduce costs through the detection of failure** before these pumps breakdown.

Company faced highly expensive repair costs from electrical submersible pump (ESP) failures so they wanted to **reduce costs through the detection of failure** before these pumps breakdown.

submersible pumps leading to high repair costs.

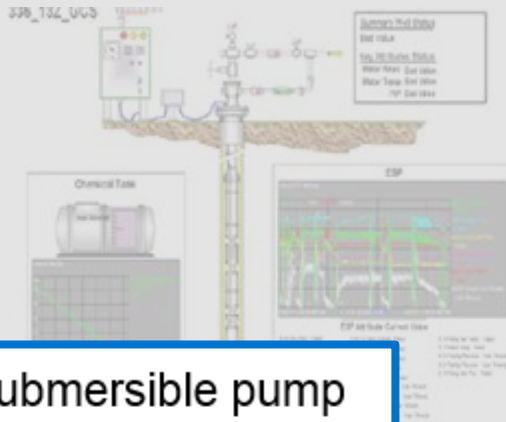
- **\$100M+/yr in repair of Electrical Submersible Pump (ESP)**
- 3,800 ESPs with **20% failure rate per year**

Notifications to alert engineers of potential failures.

- Develop a PI System based **application to predict ESP failure**
- Setup PI Notifications to generate **exception-based reporting**

production by 65% and mean time between failure by 35%.

- Greater than **\$40M/year** saving in reduced maintenance alone





# Enhancing SAGD Operational Safety and Reservoir Monitoring & Optimization

SUNCOR

Goal was to **enhance SAGD Operational Safety** and streamline abnormal reservoir response reporting.

In Situ Application Support Group, Firebag



in situ  
reduces our  
environmental  
footprint

Goal was to **enhance SAGD Operational Safety** and streamline abnormal reservoir response reporting.

In Situ Application Support Group, Firebag

- Need to collect real-time information for a large number of wells and conditions
- Full deployment of Asset Framework and Notifications
- PI Interfaces collect data from a large number of wells with similar instrumentation.
- Improved operations visibility
- Better energy and environmental regulatory reporting

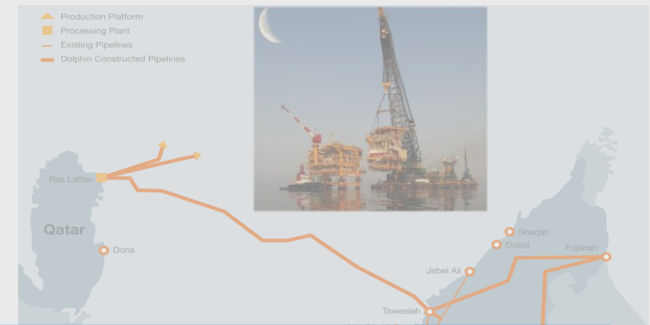
# Environmental Regulatory and Corporate Sustainability Reporting

Dolphin Energy

“We did the project to ensure the AECS can **produce reliable data for all air emission reporting** including corporate KPI.”

Dr. Rola Atiyeh

“We did the project to ensure the AECS can **produce reliable data for all air emission reporting** including corporate KPI.”



Multiple s  
and data  
time consuming to QA/QC and  
generate reports

- Calculations and reliability issues due to instrument failures and process shutdown, created data gaps

to reconcile/validate values for  
accurate data reporting

- Well documented equation methods
- Real-time data quality and emission limits monitoring

reconciled PI System data, meeting  
EHS compliance and reporting  
requirements

- Reduction of the risk of being fined for non-compliance
- Calculation methodologies can be verified by 3<sup>rd</sup>-party auditors
- Saves substantial time for QA/QC

**DOLPHIN ENERGY** **دولفين للطاقة**

# Combining Real-time and Spatial Decision Making with the PI Integrator for Esri ArcGIS

DONG Energy

We wanted to be able to view data across our entire portfolio of off-shore wind turbines in a way that would allow us to **reduce health, safety and environmental risk** as well as **reduce operating costs**.

**DONG**



We wanted to be able to view data across our entire portfolio of off-shore wind turbines in a way that would allow us to **reduce health, safety and environmental risk** as well as **reduce operating costs**.

**DONG**  
energy

Working on an offshore wind turbine is 15x more expensive compared to onshore

- Working on an offshore wind turbine is 15x more expensive than onshore
- Increase operational efficiency while expanding fleet

Integration of PI System data with spatial data on a map

Integration of PI System data with spatial data from Esri ArcGIS

SAP Integration to support work dispatching

turbines and reduce cost up to ~20M EUR/year.

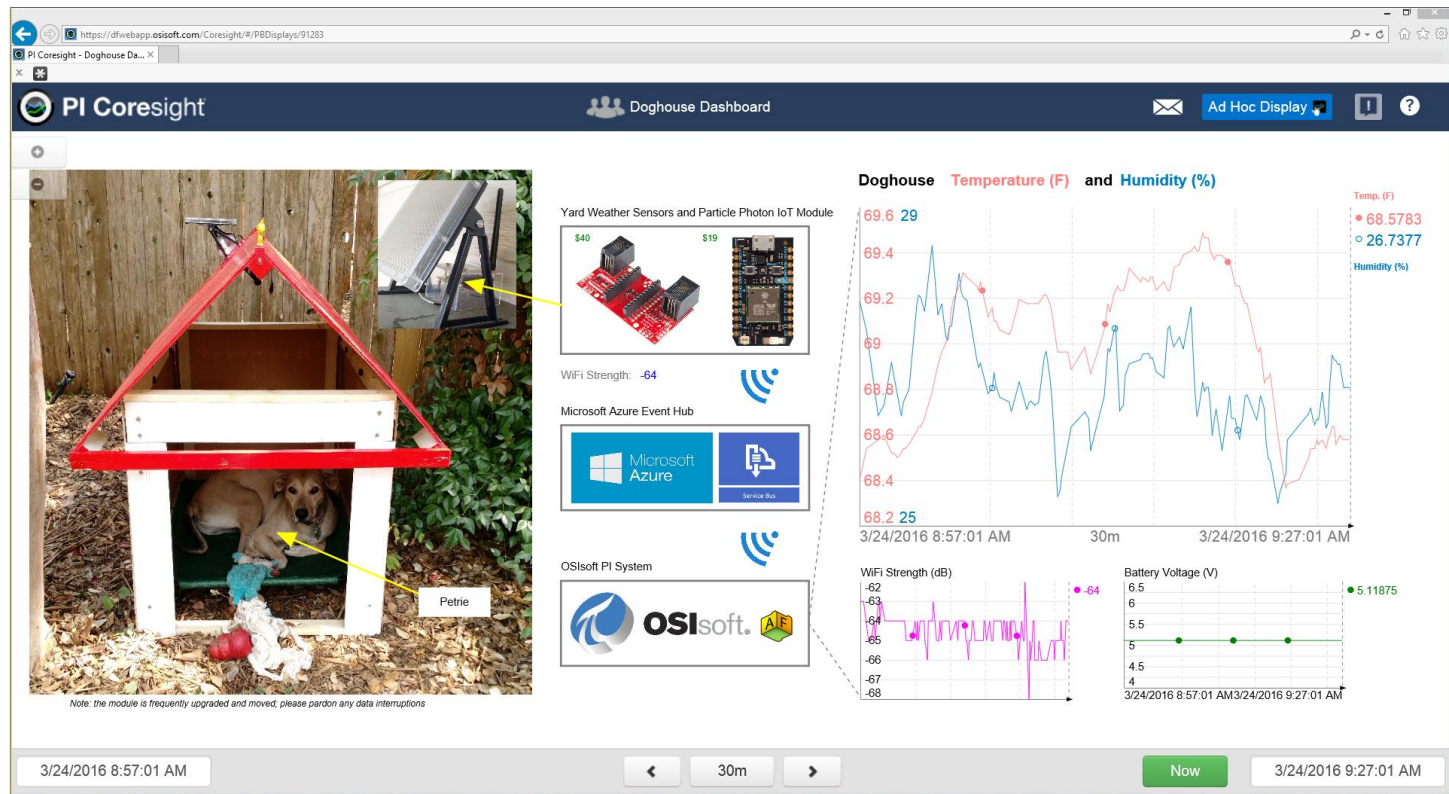
- Unscheduled visits/turbine/year will be reduced from 4 times to 2 times
- Fast decision making in Technical Support



*What **tasks or goals** are you **already** using the PI System for?*

*What **new tasks or goals** are you interested in using the PI System for?*

# I'll Share First: How I Am Excited to Use the PI System



Safety & Security



Energy  
Utilization



Process  
Efficiency



Asset Health



Quality



Regulatory  
Performance



What **tasks or goals** are you  
**already** using the PI System for?

What **new tasks or goals** are you  
interested in using the PI System for?

2:00



# Quick Review: What is the PI System

Collect

data using  
PI Interfaces

Manage &  
Enhance

data within the  
PI Server

Deliver

data via  
PI Client Tools



# Quick Review: What the PI System Does.

Wherever your data starts

to wherever your data needs to go

The **PI System Infrastructure**  
is everything in between



After today, we hope  
you're equipped to  
think up **new goals!**

What companies use the PI System for

## 6 Common Uses



# How Can You Learn More?



*OSIsoft YouTube Channel*



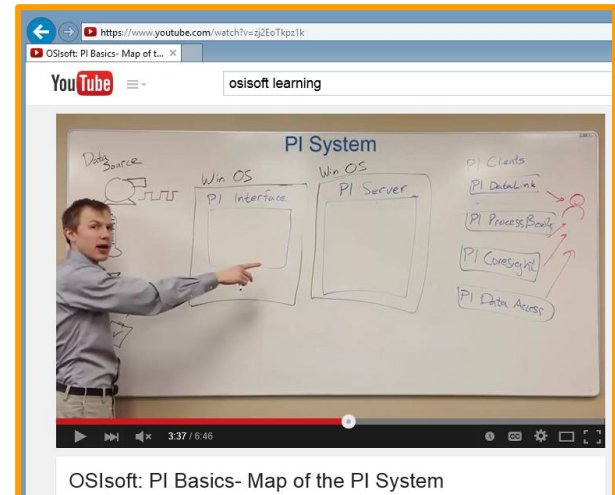
*PI Square Users Community*



*Live Classes &  
Virtual Learning  
Environment (VLE)*



*Tech Support &  
Field Service*



9,237  
19 2

<http://icons8.com>

## Questions

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



Please state your **name & company**

## Please remember to...

Complete the Online Survey  
for this session



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# After You Leave, What's Next at the UC?

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**Come meet us and ask us questions! 😊**

The background of the image is a dark blue gradient with a faint, stylized geometric pattern of triangles. Overlaid on this is a faint, light blue silhouette of the San Francisco skyline, including the Golden Gate Bridge on the left and the Transamerica Pyramid on the right.

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