



Leveraging PI AF in Terminal Operations

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Enbridge: What we do



We are North America's largest energy infrastructure company



Liquids Pipelines

- 27,000 kilometres of pipe
- 3 million barrels/day

25%

of NA's crude oil
transported



Natural Gas Pipelines

- 39,400 kilometres of pipe
- 437 Bcf of gas storage

20%

of the natural gas
consumed in the U.S.



Natural Gas Utilities

- 3.8 million retail customers
- Serving 500+ communities

40%

of Ontario's energy
needs delivered



Renewable Power

- 30+ renewable power facilities
- 1,750 MW generating capacity

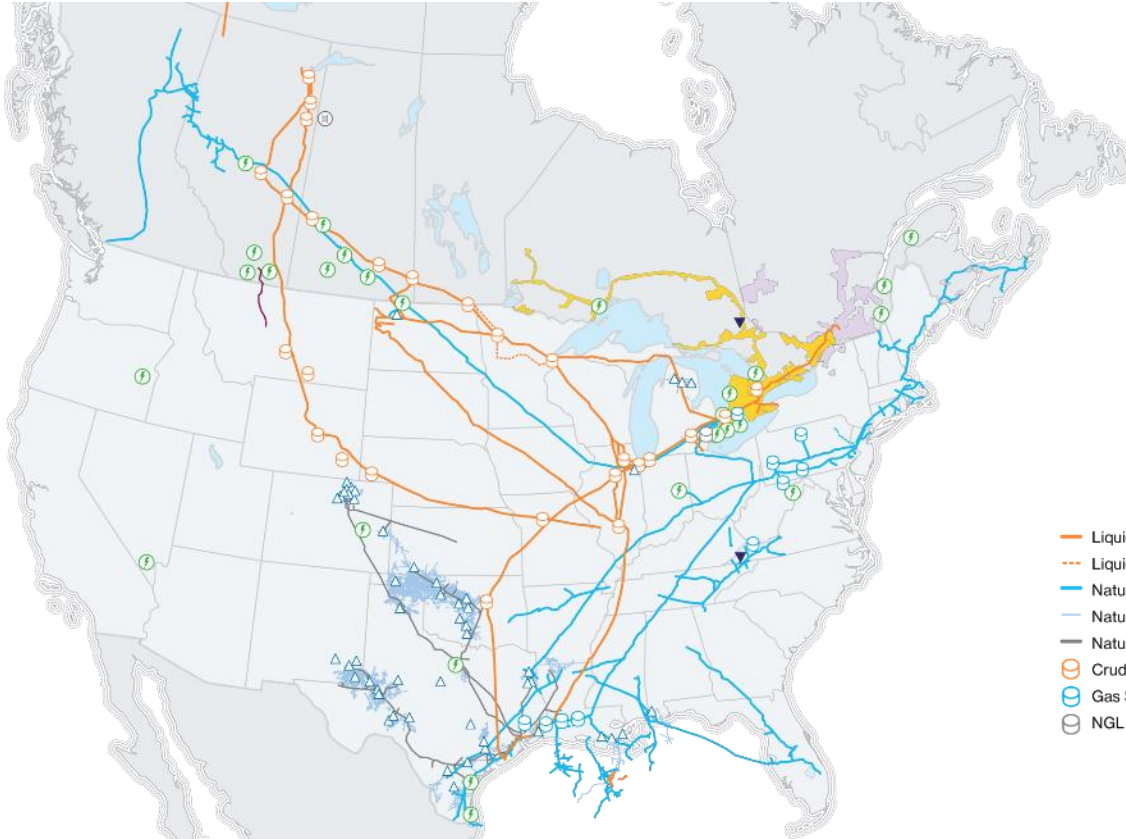
700,000

homes powered
by our assets

Enbridge: What we do



We fuel quality of life for millions of people everyday



- Liquids Pipeline
- - - Liquids Pipeline (proposed)
- Natural Gas Transmission Pipeline
- Natural Gas Gathering Pipeline
- Natural Gas Liquids Pipeline
- Crude Storage or Terminal
- Gas Storage Facility
- NGL Storage Facility
- ▼ LNG Facility
- ⊞ Rail
- Power Transmission
- ⚡ Renewable Energy
- △ Gas Processing Plant
- Gas Distribution Service Territory
- Affiliated Gas Distribution Territory



Operational Data Design and Implementation Services



PI System
Design & Deployment



Maintenance &
Reliability Solutions



Governance &
Training

OSIsoft Partner

One Data Point – Many Users



Plant Managers

- Are we meeting our targets?
- Low frequency data

Process Engineers

- How can we optimize the process?
- High frequency data

Corporate Accounting

- What is our revenue from sales?
- Low frequency data

Maintenance Specialists

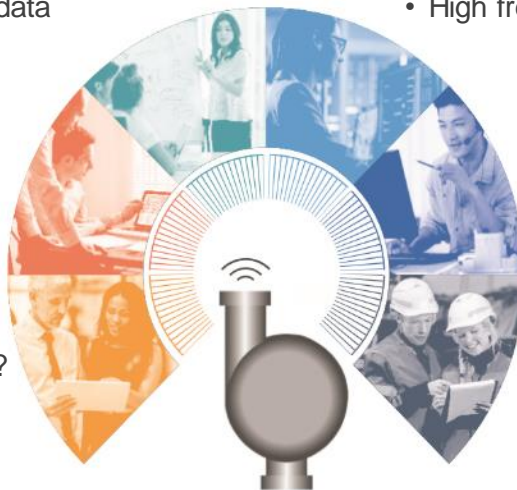
- What is the health of the equipment?
- High frequency data

Compliance Reporting

- Are we meeting regulatory requirements?
- Varies by requirement

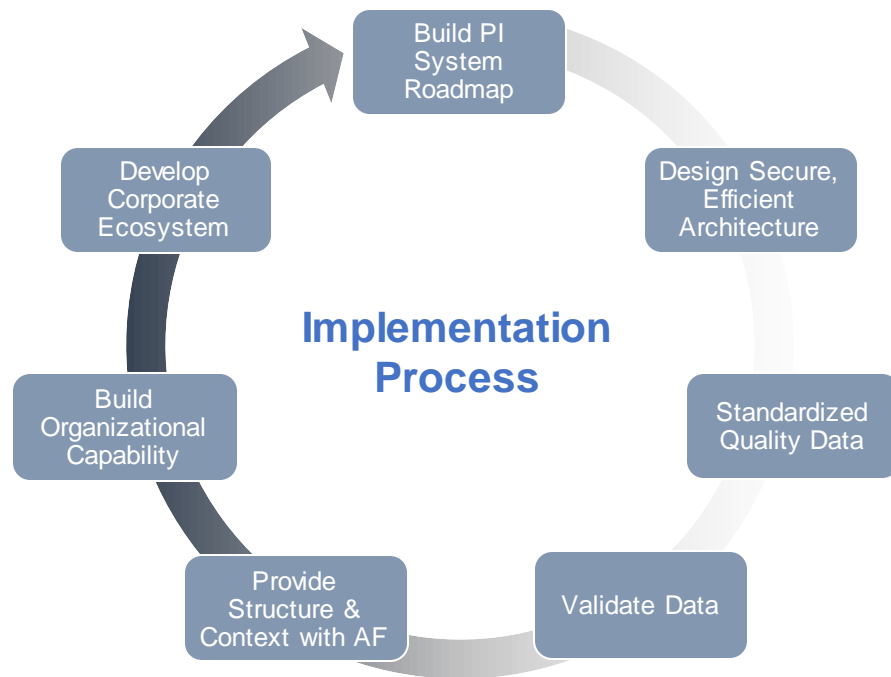
Data Scientists

- Are there new learnings using multiple data sets?
- Varies pending on investigation



Each team has different needs and perspectives for operational data

Building the PI System Value Chain



Technology:

- Secure, efficient architecture
- Fit for purpose data collection and sharing

Governance & Sustainability:

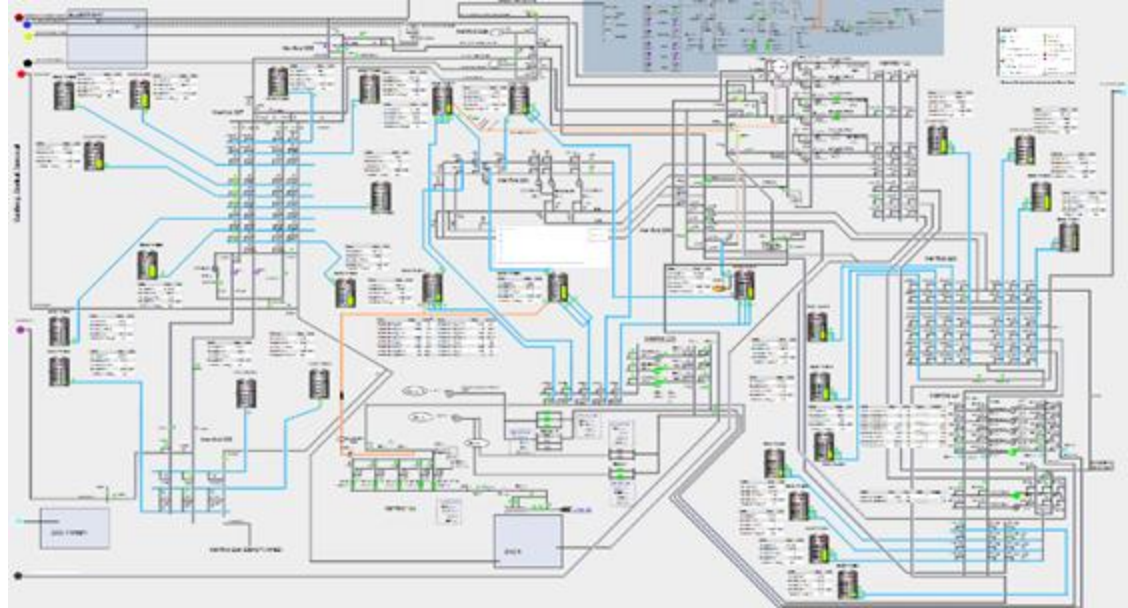
- Apply standards to make data accessible
- Validate data to ensure trust
- Implement robust change management

Deliver value to the organization:

- Develop organizational capability through training, coaching and mentoring users to leverage operational data
- Utilize Corporate Ecosystem

How to Know?

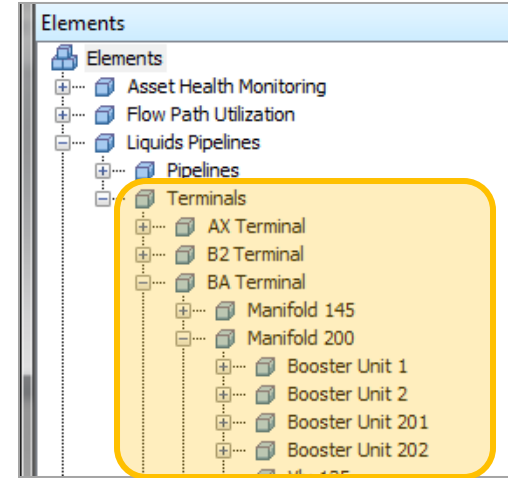
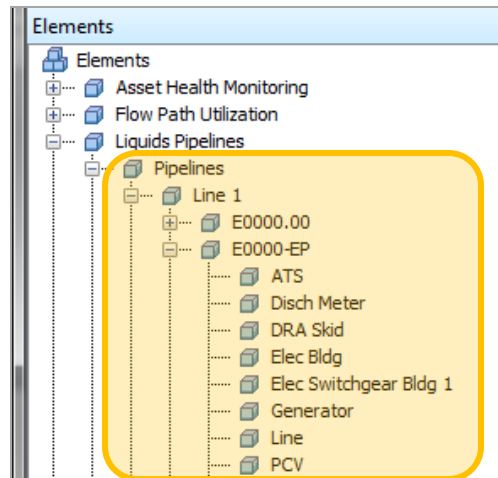
- Where is the information?
- How can we understand our terminal operations better?
- What would happen if everyone knew?



Information is unlocked by our PI System?

The Journey

- Upgrade HA PI System and Implement Purdue Model
- Develop Standards & Rename ~350,000 tags
- Implement PI AF in Corporate PI System
 - 20 Standard Element Templates
 - Integrate Business Data for Context
 - Design Hierarchy
- Support Solution Development



PI AF Opens the Door

Enbridge Liquid Pipelines – Terminal Operations

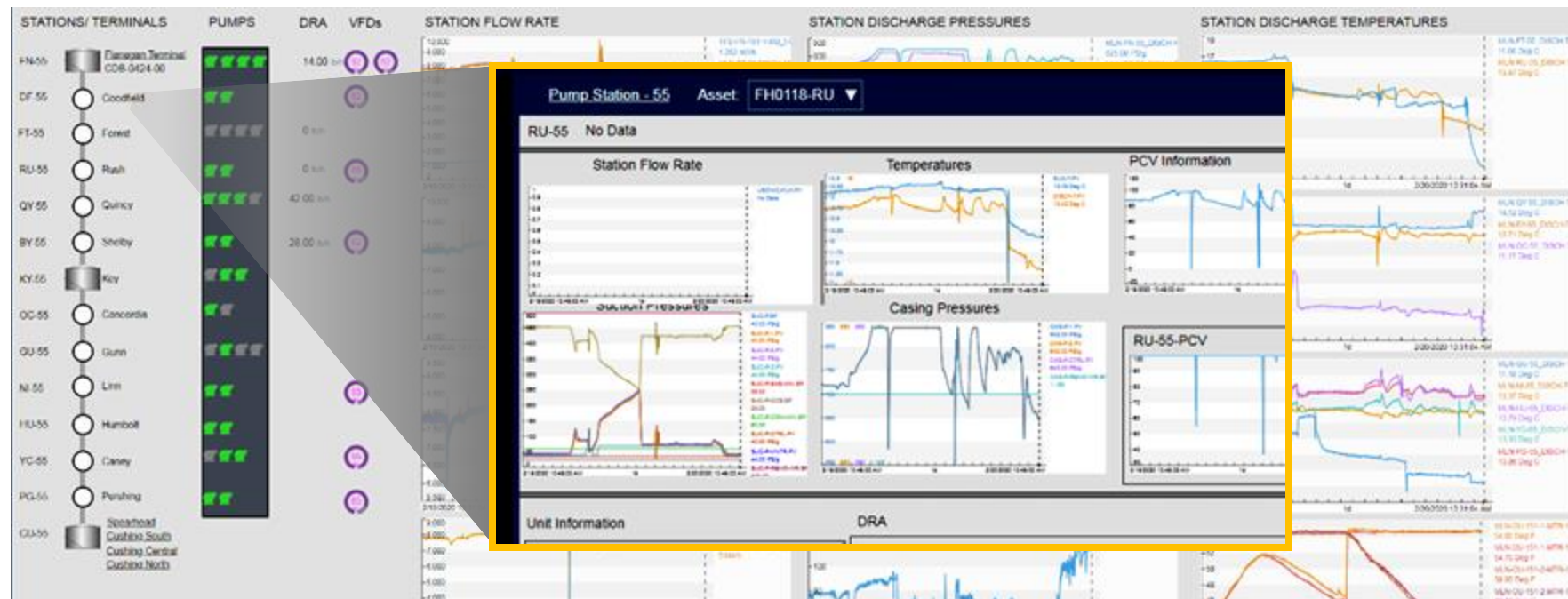
The Journey – Pipelines



The New Way!

Enbridge Liquid Pipelines – Terminal Operations

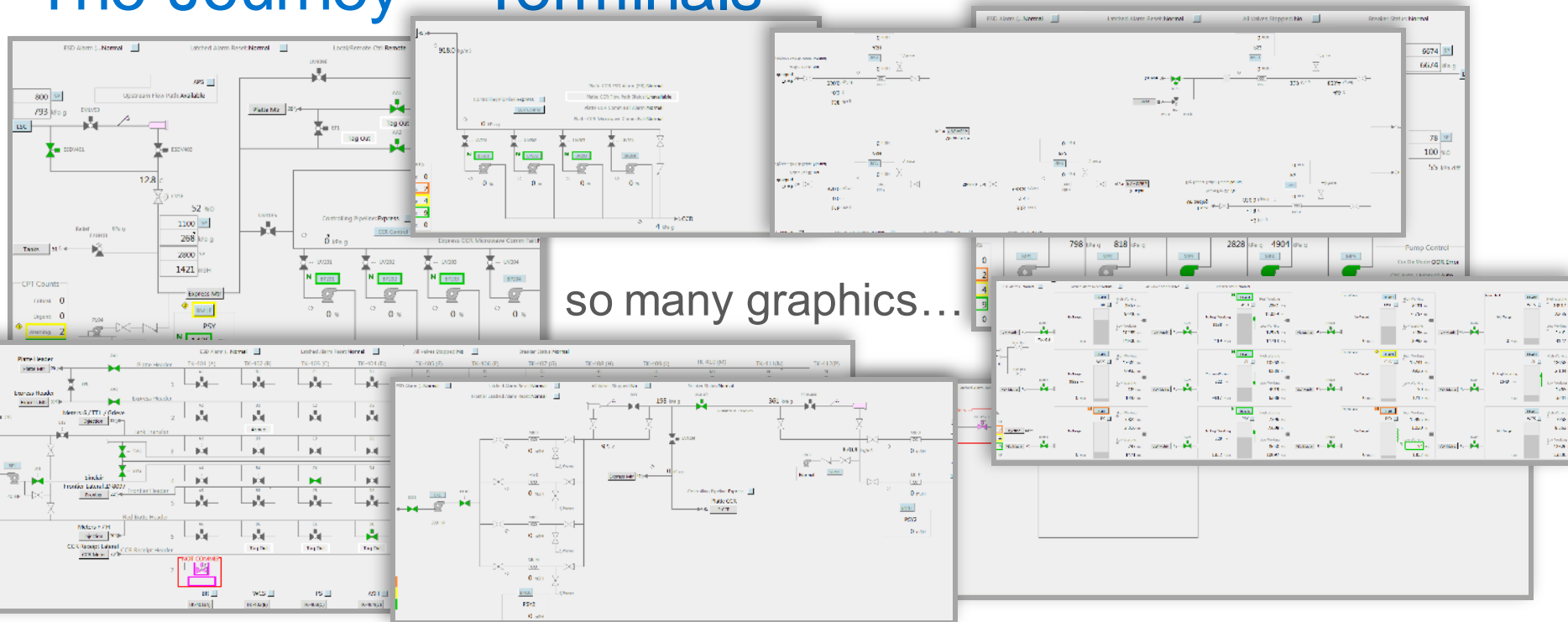
The Journey – Pipelines



System and Details - Wow!

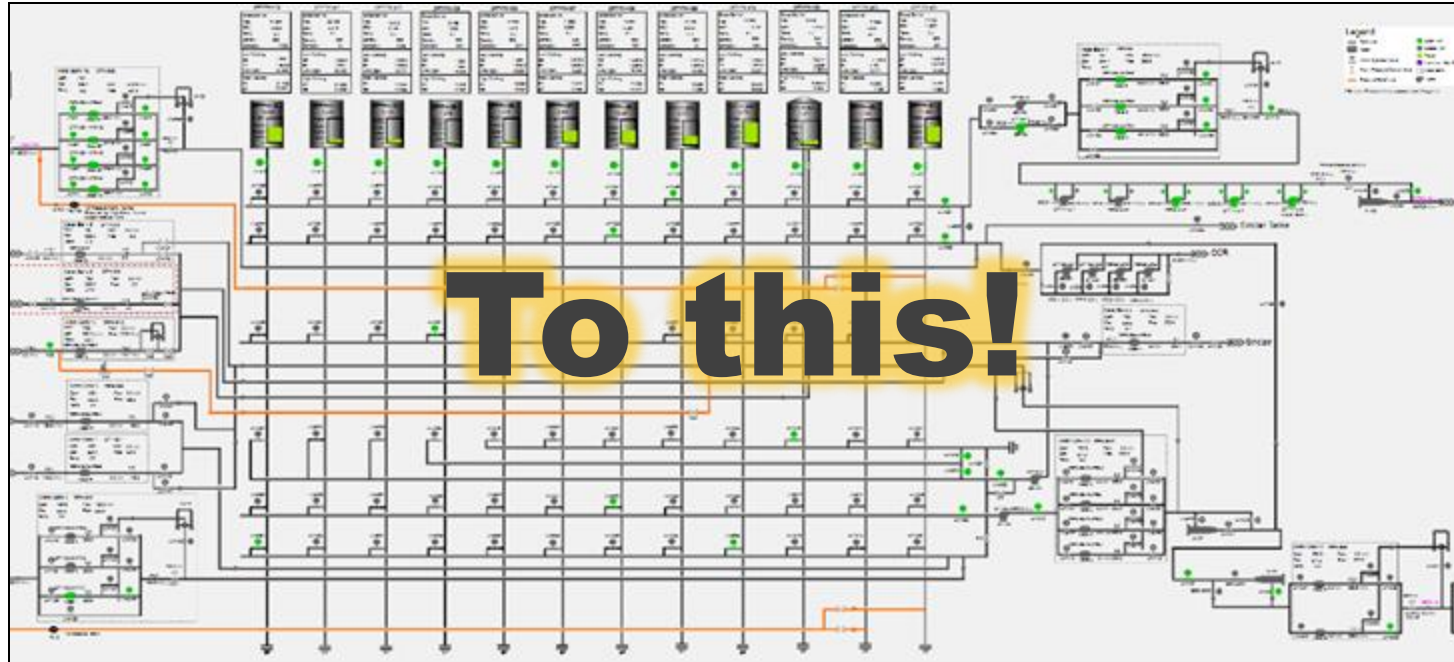
Enbridge Liquid Pipelines – Terminal Operations

The Journey – Terminals



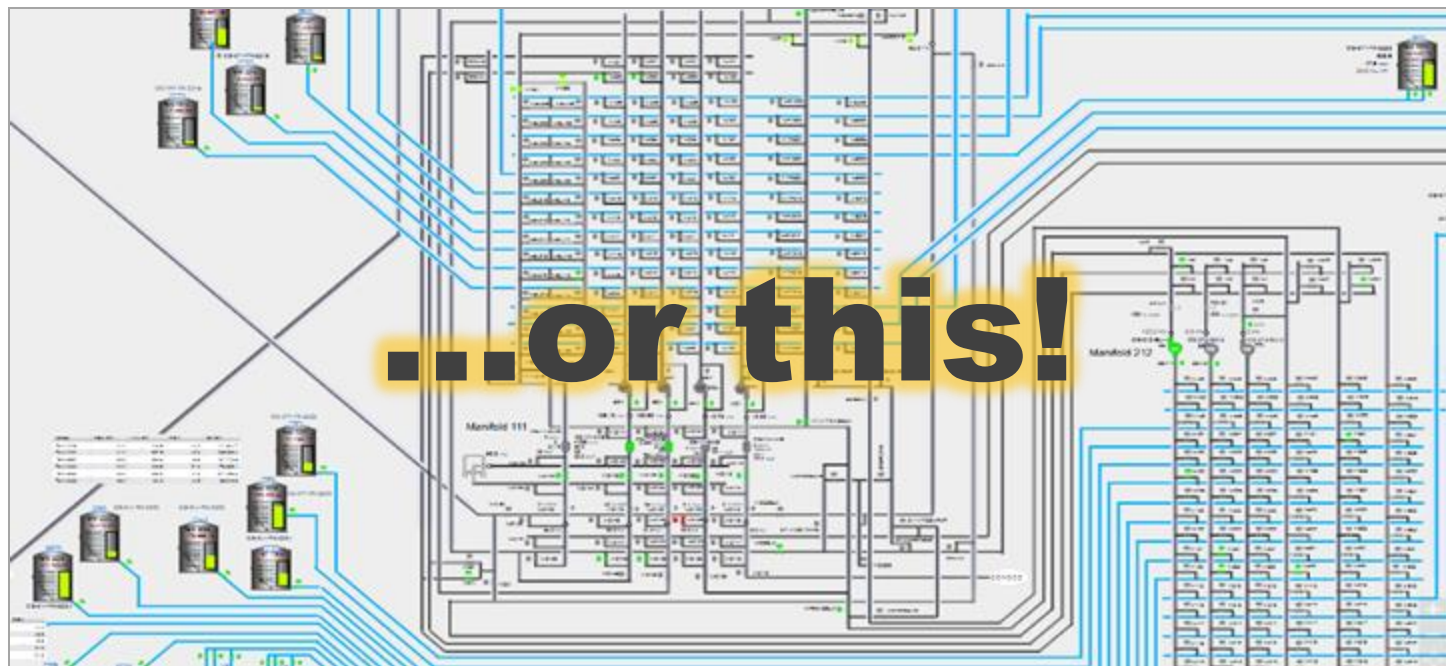
Too many graphics, hard to see detail!

The Journey – Terminals



The whole picture all in one spot!

The Journey – Terminals



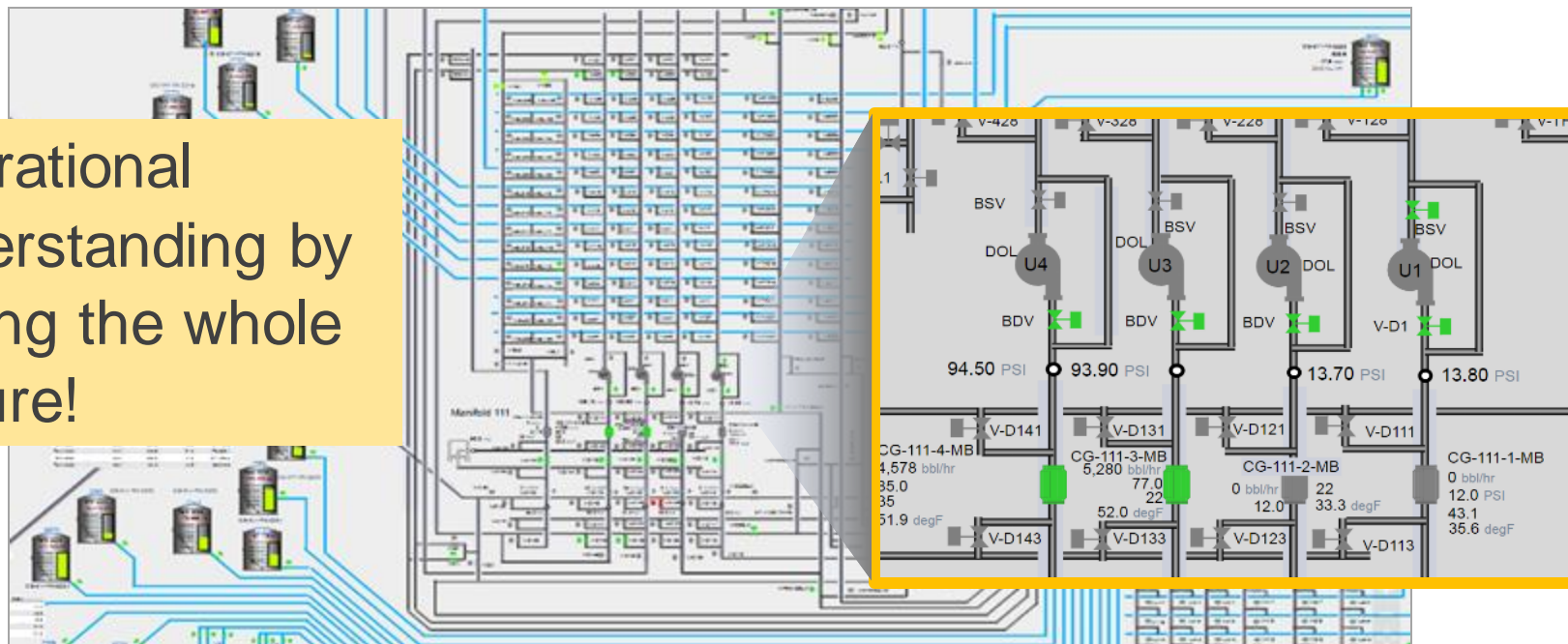
The whole picture all in one spot!

Enbridge Liquid Pipelines – Terminal Operations

The Journey – Terminals



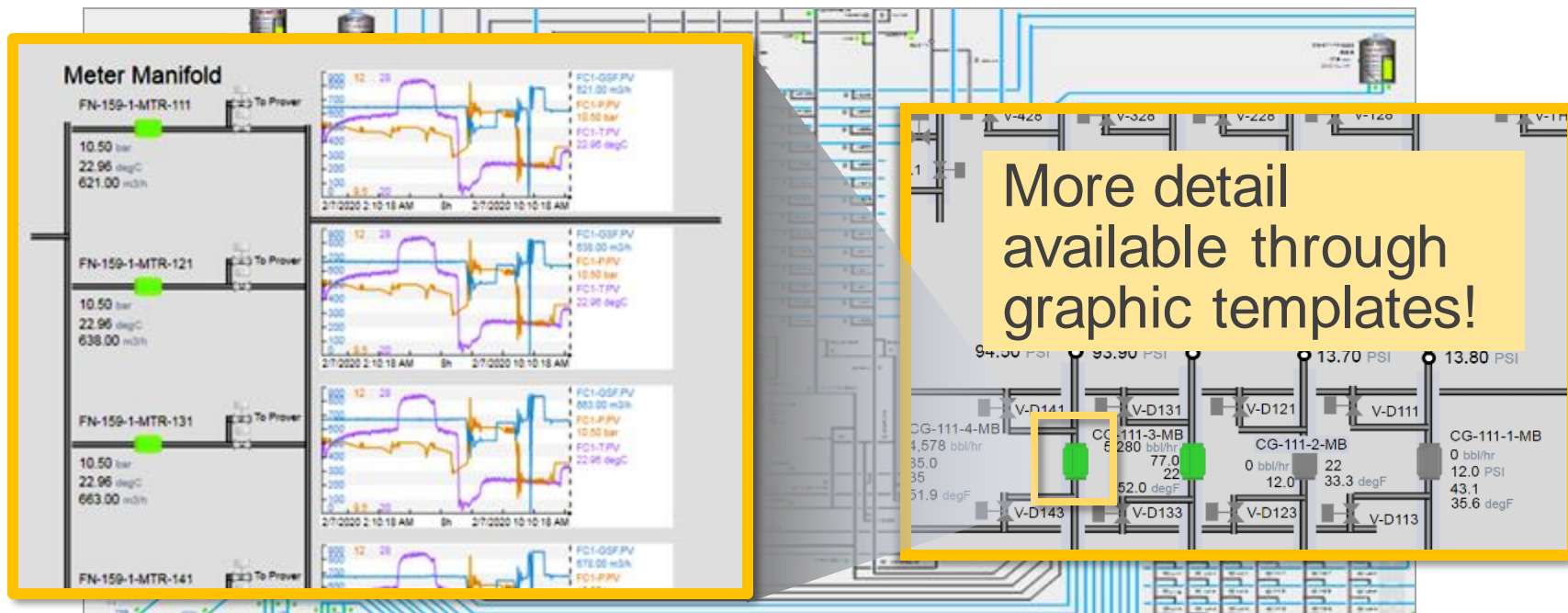
Operational understanding by seeing the whole picture!



Improved Navigation allows more details!

Enbridge Liquid Pipelines – Terminal Operations

The Journey – Terminals



System and details - WOW!

The Journey / The Idea!

- What if PI could tell us **which pipe is active?**
- Consulted Internal / External Teams
- Developed Logic

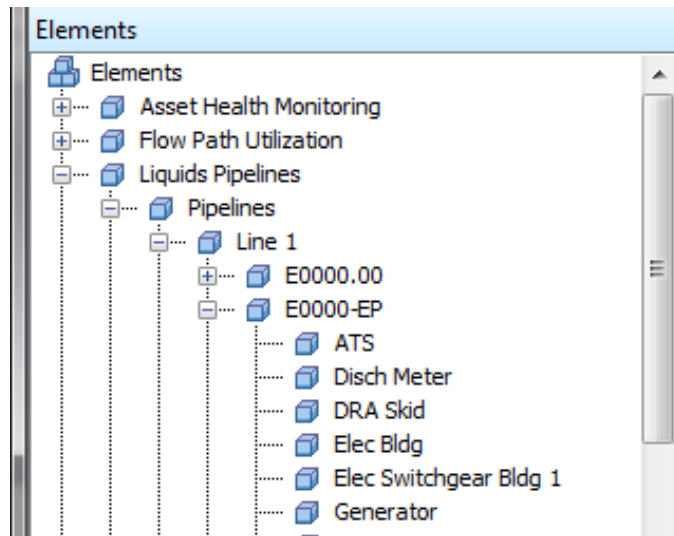


I think we can!

The Journey / The Idea!

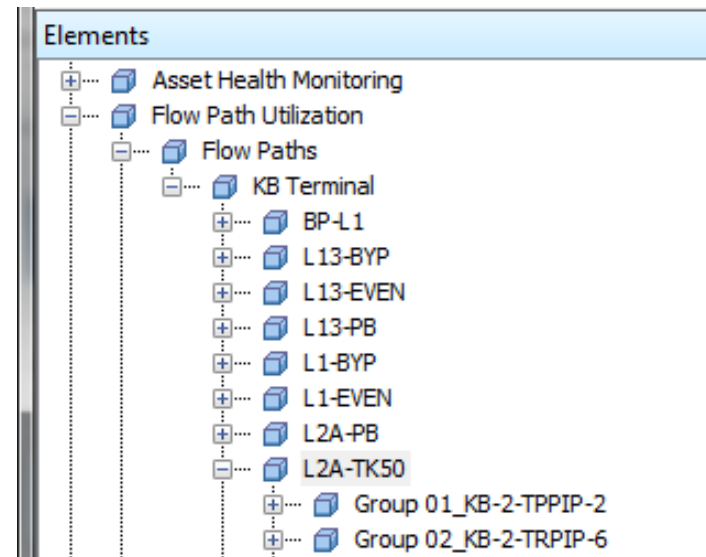
Traditional Asset Hierarchy

Based on Corporate Maintenance System Hierarchy for location and equipment type



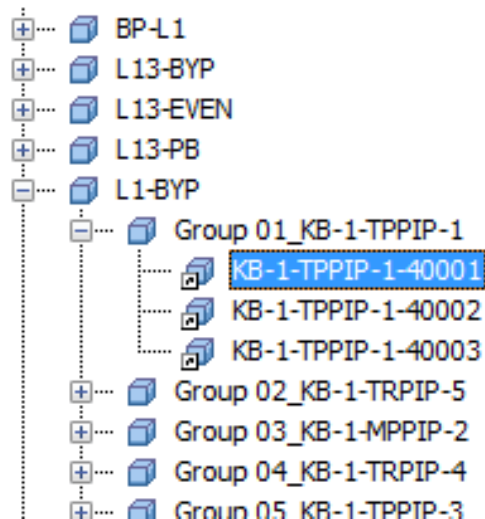
Linear Hierarchy

Used to connect segments of pipe to instrumentation to define availability and utilization



The Journey / The Idea!

- Pipe-by-pipe basis
- Rolled-up to manifolds
- Solution hierarchy
 - Inventory
 - Usage



Filter			
		Name	Value
Category: AF Calc			
		AVL.AF	0
+		UTIL.AF	Not Utilized
Category: PI Data			
		90-DAY-UTIL-TIME-PCT.PE	62.5012856
		90-DAY-UTIL-TIME.PE	1350.02783

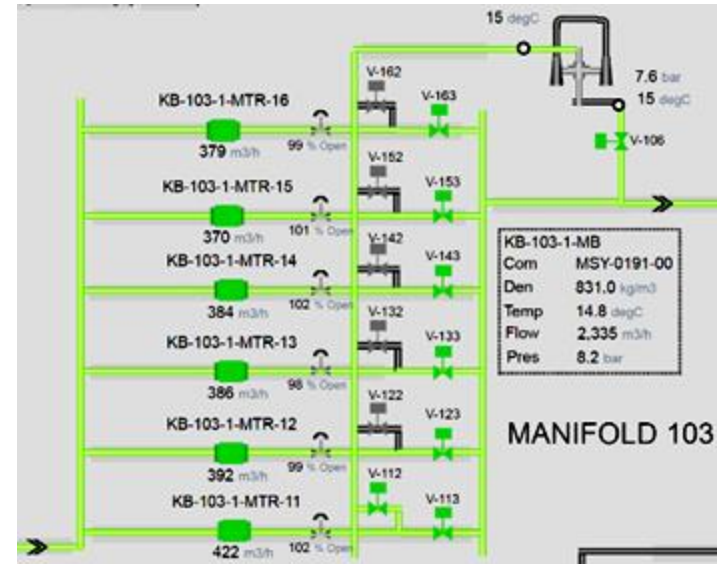
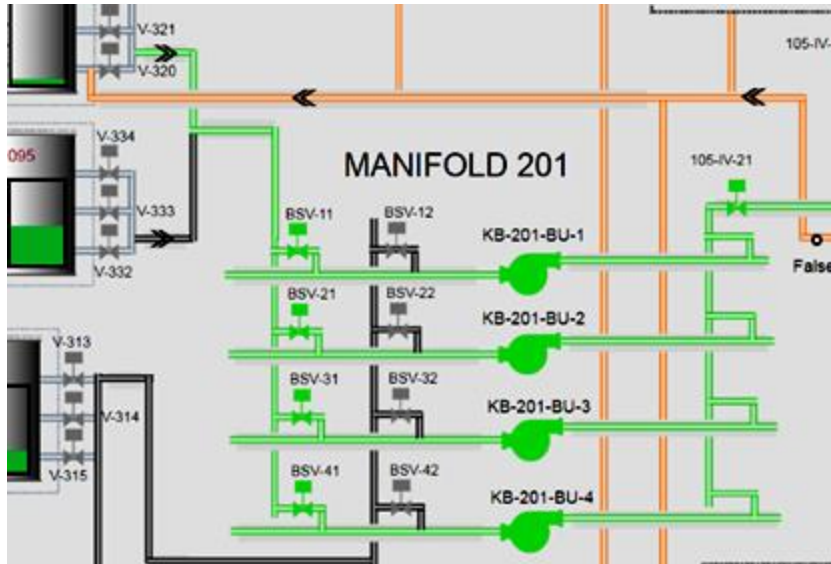
Things are starting to click!

Enbridge Liquid Pipelines – Terminal Operations

The Journey / The Results!



PI Vision lets us see the active piping



The picture say it all?

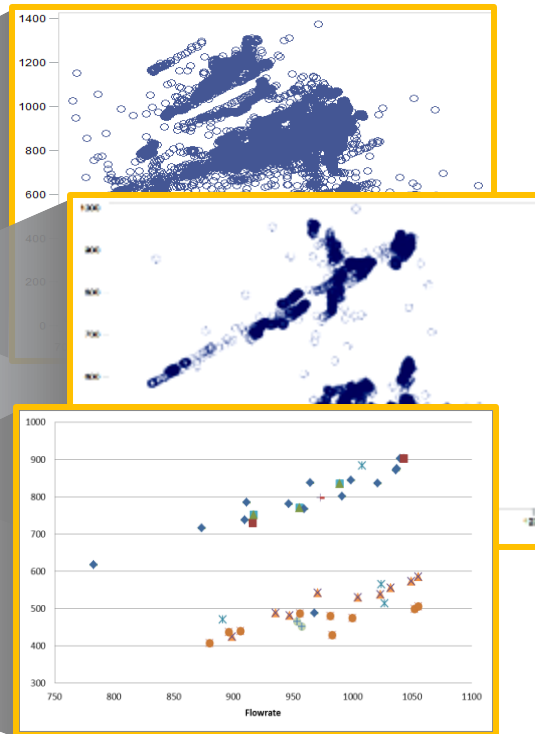
Enbridge Liquid Pipelines – Terminal Operations

The Journey / The Result!



SAS Operational Statistics

- OLE DB connection to SAS EG via SQL script
- Pull min, max, or Point in time information
- Allows single flow path Operational Analysis



And now we know!

Enbridge Liquid Pipelines – Terminal Operations

The Journey / The Result!

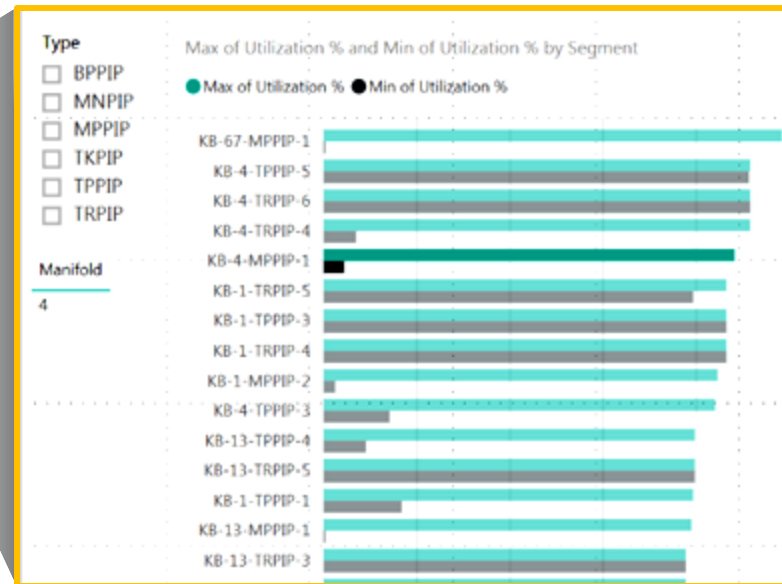


PowerBI Operational Statistics

- OLE DB connection to PowerBI via SQL script

Risk Based Inspection

- Data Fed into RBI Model using Excel PI Data Link



And now we know!

The Journey & The Reward!



- **Operational troubleshooting** decreased from days to minutes
- **Frequency of deliveries** and injections easy to find
- **Hydraulic models** can be vetted against operating data
- **Risk-based inspection model** can be easily updated with actual usage values

Discussions have changed from **If** to **Why!**

CHALLENGES

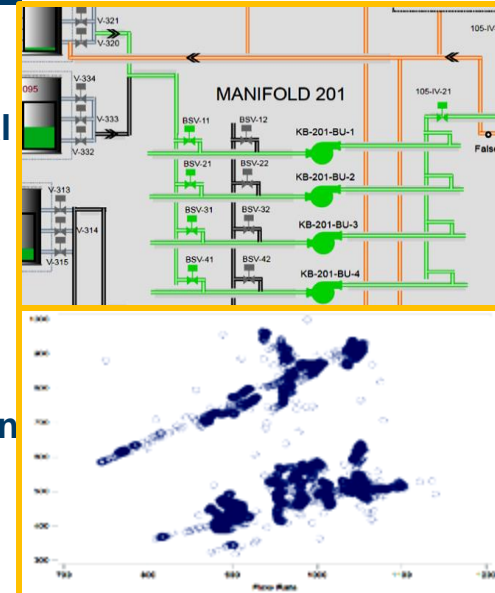
- Inability to “see” our terminals!
- Not knowing the terminal flow paths!
- Determining “Why” instead of “if”!

SOLUTION

- Standardize and Validate the data!
- Get the AF structure right!
- Leverage PI Vision to see the whole picture!
- Integrate with SAS and Power BI!

BENEFITS

- Improved Operational troubleshooting!
- Flow path evaluation of operational data
- Validation of hydraulic models!
- Risk-based inspection models using Operational Data!



“ Moving our PI System from a tag based “historian” to an asset based infrastructure with PI AF has changed our conversations from what happened to **Why!** ”

Presenters



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Questions?

Please wait for
the **microphone**

State your
name & company



Save the Date...



AMSTERDAM
October 26-29, 2020



