How The PI Infrastructure helps Accelerate Business Value

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بترو رابغ
Petro Rabigh

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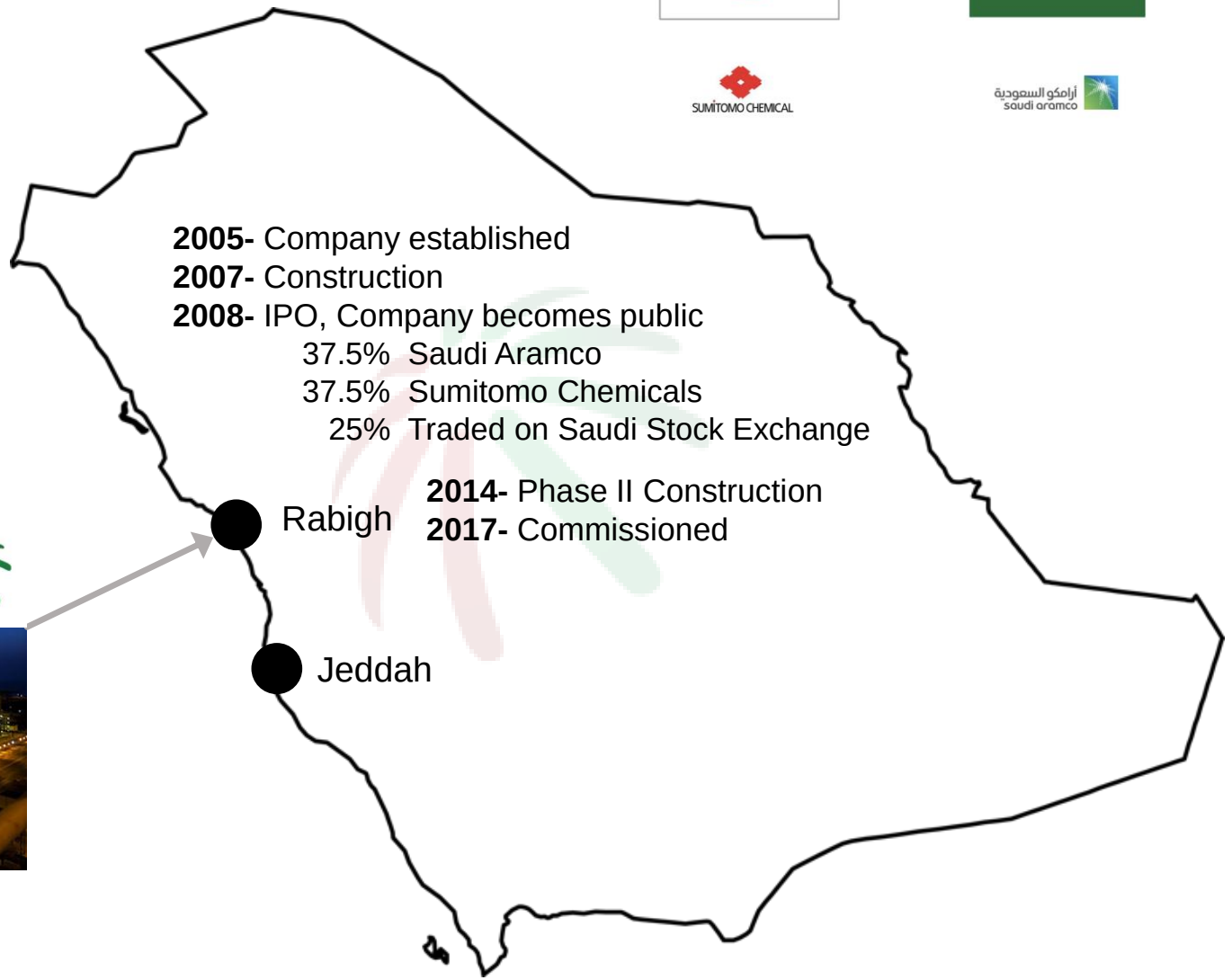
Petro Rabigh

- $20 Billion two phase project
- Built on 3000-acre site
- Integrated Refining & Petrochemical Complex
- World's Largest High Olefin Fluid Catalytic Cracker
- 30 production plants
- 3,500 Employees



Petro Rabigh Products: ***What do we make?***

Feed

- Crude 400,000BPD
- Ethane 125 MMSCFD
- Butane 15,000BPD

Production

- Refined Products 15,000 KTA
- Petrochemicals 5,000 KTA

20+ products produced

Refined Products

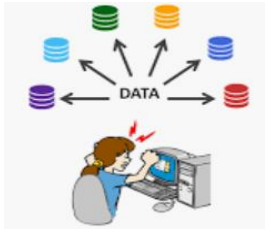
- Diesel
- Gasoline
- Jet Fuel
- Fuel Oil
- LPG
- Naphtha

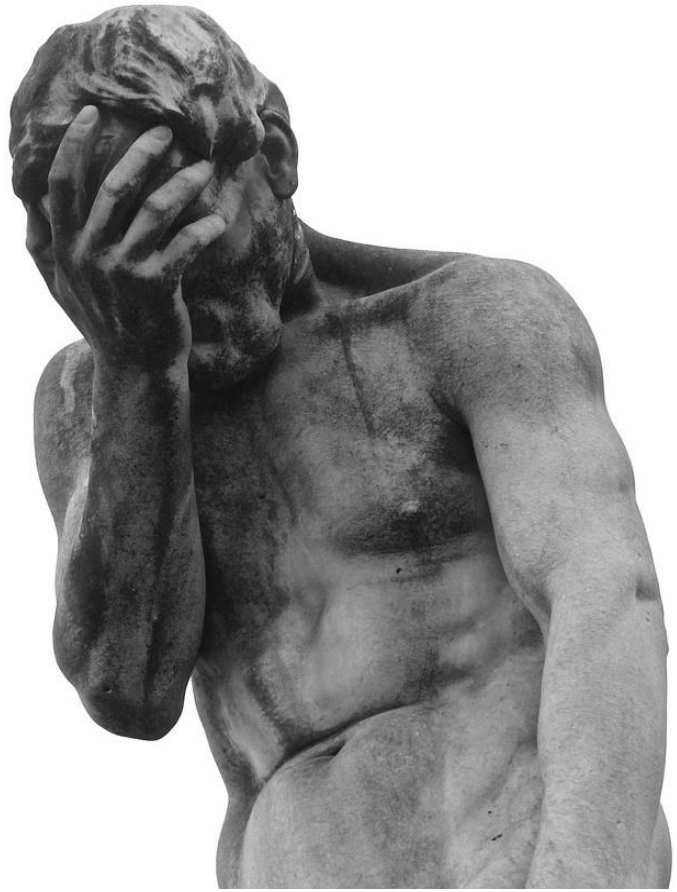
Petrochemicals

MEG	Acetone
PE	EVA
PP	TPO
LDPE	EPR
P-Xylene	PMMA
Phenol	Nylon-6
Benzene	MEG
MMA	POX

The Business Problem: How we used to handle data

- **Past System Performance**
  - Plant users waiting on data
- **Past Data Usability**
  - **No context to data:** operational data not meaningful or consumable for decision making
  - **No real-time insights on operational performance & situational awareness**
- **Past System Reliability**
  - Frequent crashes
  - Long recovery time
- **Past System Limitations**
  - Manual redundancy
  - Tags limits
  - Lab data accessibility, Lack of integration
  - Poor data quality
  - No context to data





The Solution through a partnership with **OSIsoft**

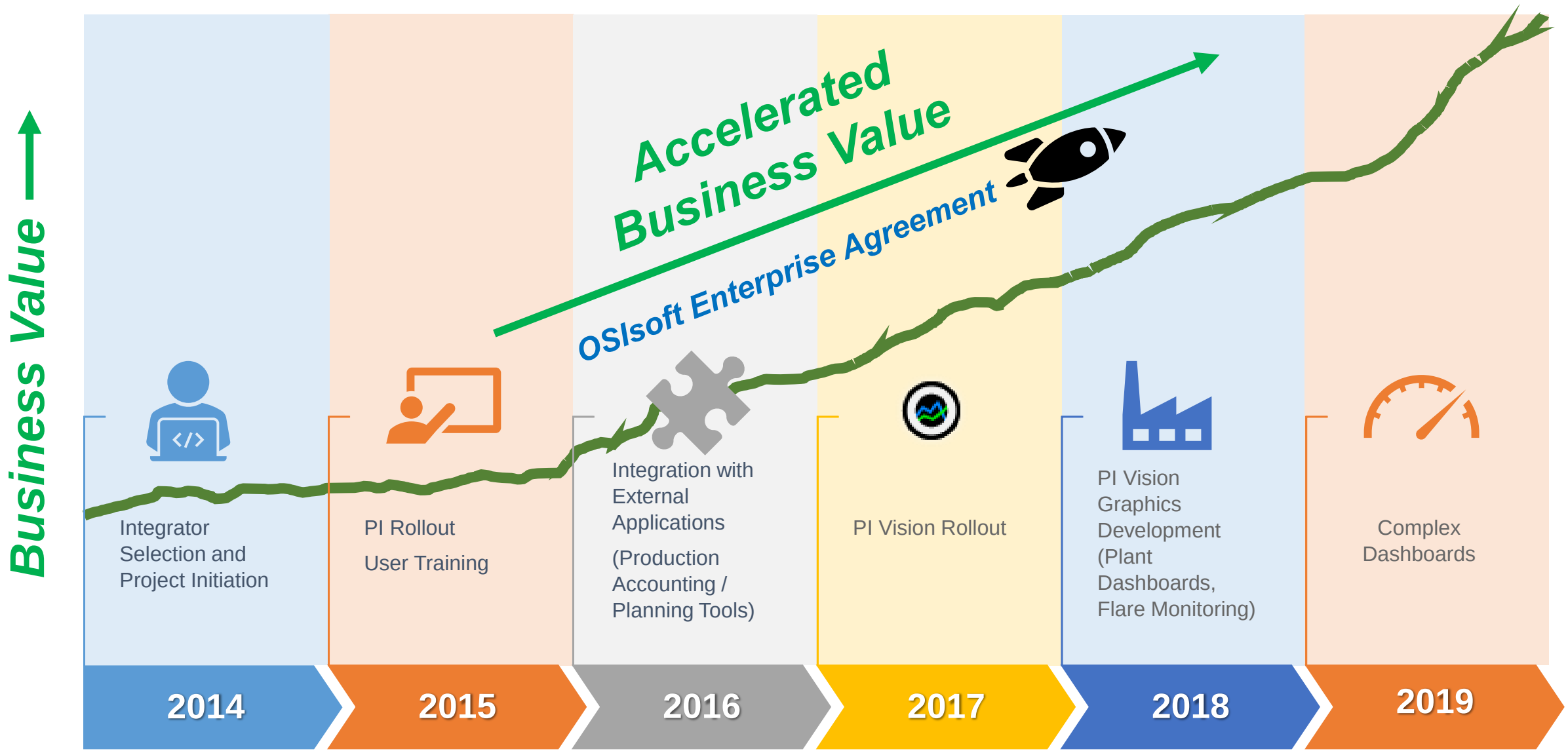
Petro Rabigh Mission Statement:

*"Maximize return on shareholder investment by maintaining a **reliable**, **sustainable** level of **productivity** and **optimum performance** to drive growth and profitability."*

Source: https://www.petrorabigh.com/en/AboutPRC/WhoWeAre/Pages/PetroRabighHistory.aspx

- A robust, efficient, user friendly and innovation platform that is intended to derive intelligence from operations in an effective, scalable and secure manner.
- **A platform that enables Operational Intelligence across Petro Rabigh, to support the company vision and mission**
- PI System chosen as the fit-for-purpose Enterprise-wide **Operations Data Infrastructure**, to deliver pacesetting performance and productivity from the people that support Petro Rabigh's business
- Accelerated Business Value through OSIsoft Enterprise Program Agreement (EPA): **technology, services & support**

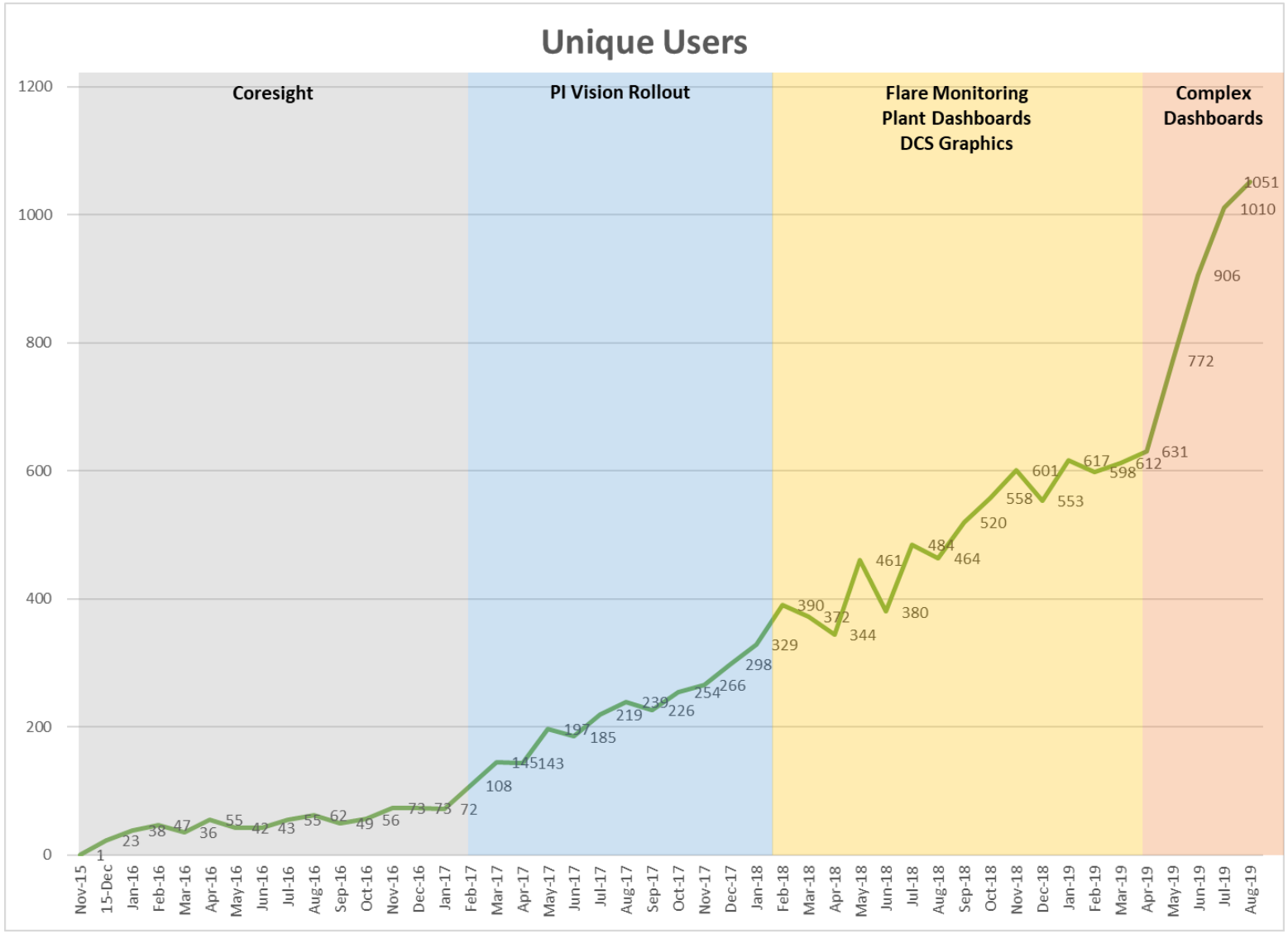
PI System Rapid Deployment & Value Acceleration



Value Acceleration through PI Vision Adoption

UX: Ease of deriving Intelligence from Data by *Simplifying and Unifying end-user interaction*

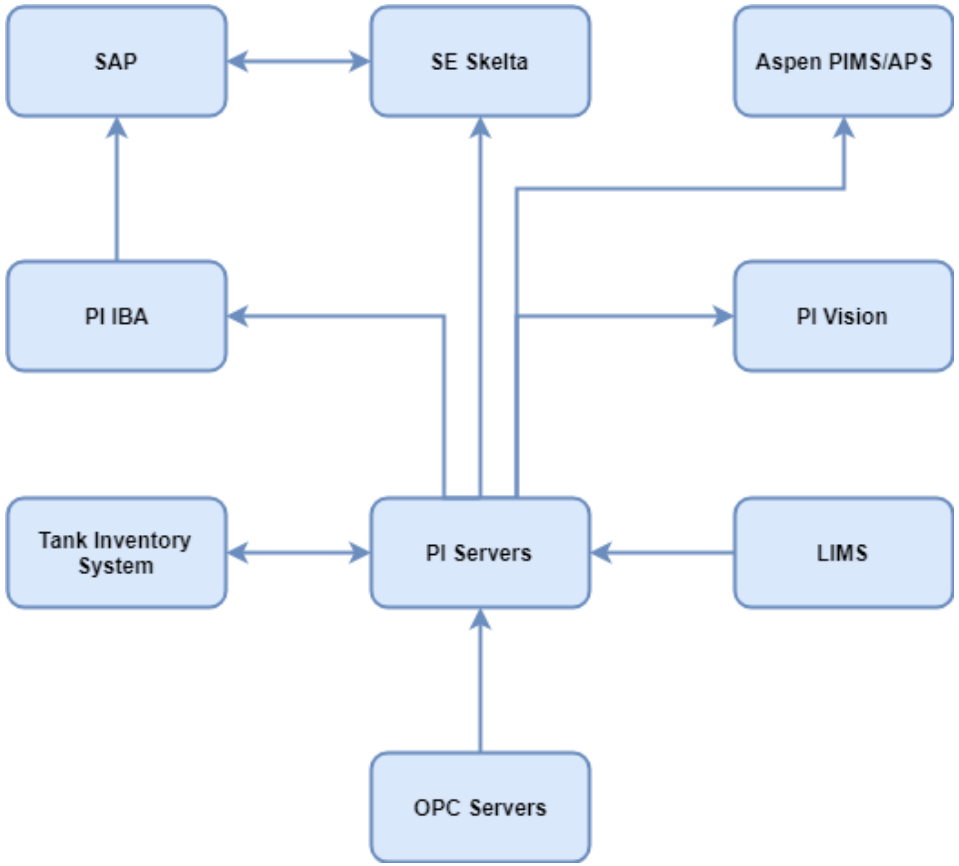
The more effort you invest the more return!



Acceleration of Business Value

*with the **OSIsoft Enterprise Agreement***

- Implemented through System Integrator
- Using OSIsoft Reference Architecture and CoE Support
- Initial Rollout Duration after signing Enterprise Agreement: 6 Months
- Continued growth of the PI System ~ 300K tags, 30K Analysis
- Complex Integrations Simplified



OPERATIONS INFRASTRUCTURE OVERVIEW: PETRORABIGH

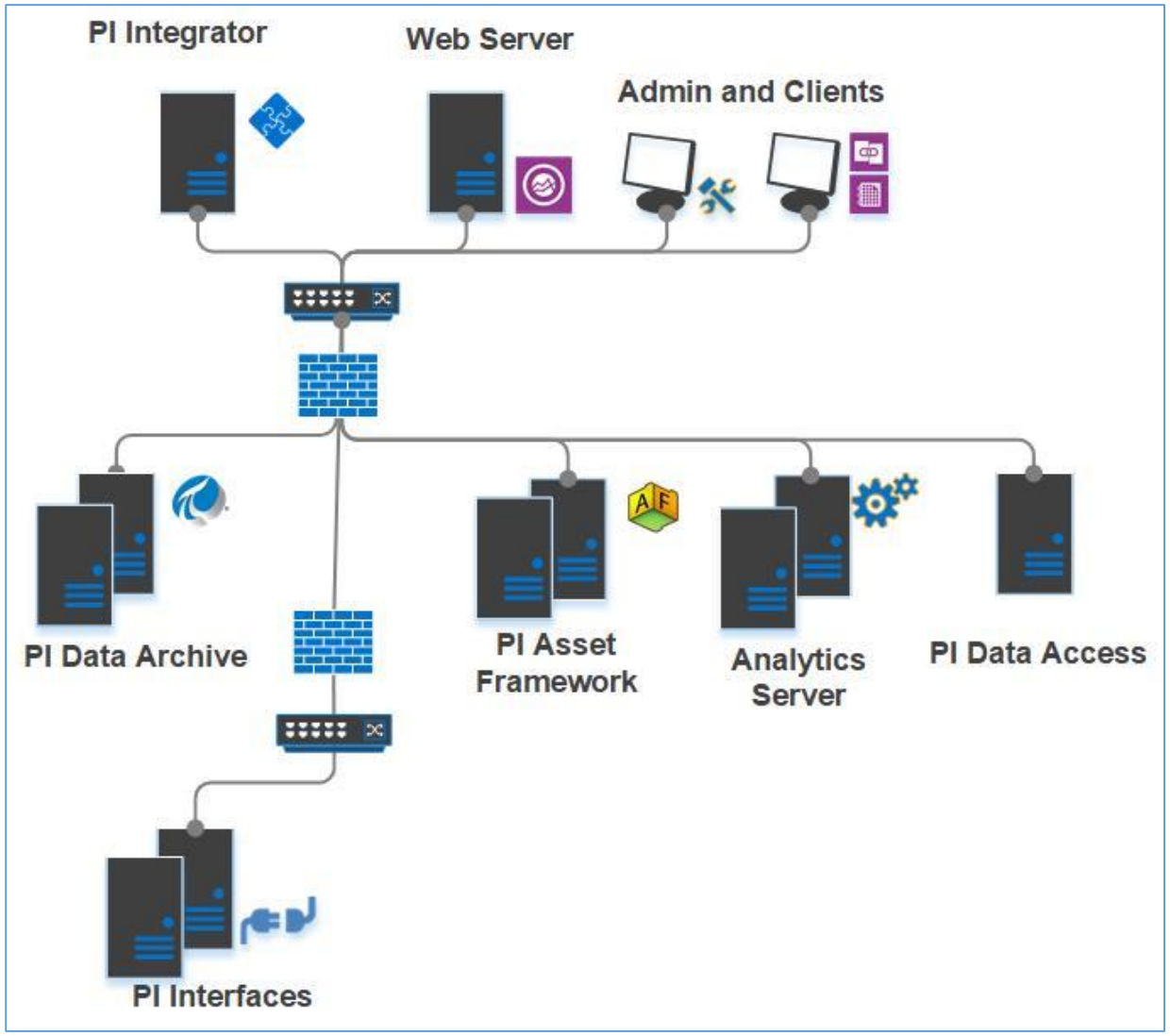
Petro Rabigh's Enterprise PI System Architecture

Deriving From OSIsoft Reference Architecture Ensures Security and Availability Needs are Met

Data Sources:
- ICS OPCs

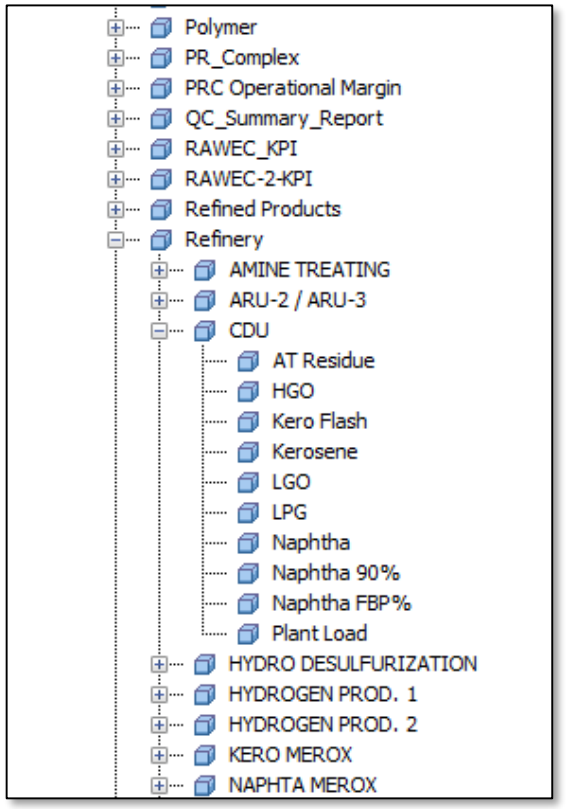
Integration with Systems:
- SE Skelta
- SAP
- Labware LIMS
- Aspen PIMS/APS
- SE Offsite

PI System Components:
- PI Vision
- PI IBA
- PI UFL



Value of establishing the PI Asset Framework

Petro Rabigh PI AF Hierarchy



ENABLES

- ✓Integration
- ✓Context to PetroRabigh Operations Data
- ✓Standardized Asset Models
- ✓Real-time Streaming Analysis
- ✓Single version of truth for Operational Intelligence across PetroRabigh
- ✓Helps accelerate business value
- ✓Allows for Collaboration
- ✓Supports Continuous Innovation & other Solutions

Enables Smart Refining & Petrochemicals

Real-time Operational Intelligence across Petro Rabigh

Wonderware by Schneider Electric

Tank Inventory System

LABWARE Results Count

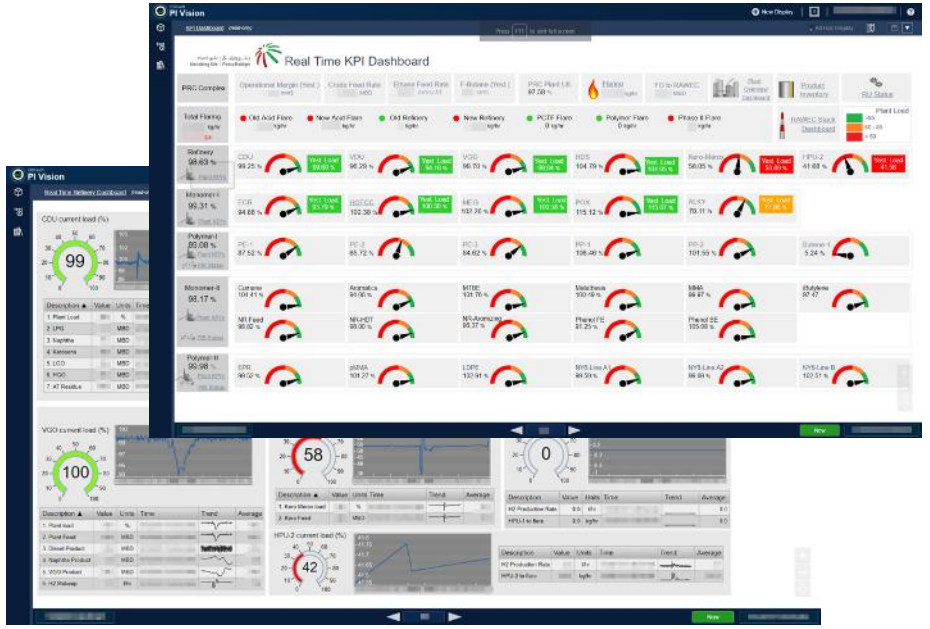
LAB SYSTEM

SAP | aspentech | Wonderware by Schneider Electric

Physical Refining & Petrochemicals Complex

HIGH FREQ OPERATIONS DATA

PI System:
Real-Time Storage, Analysis, and Context



PI Vision, enabling **Operational Intelligence across Petro Rabigh**

PI Infrastructure Enables Use Cases & Business Value

CROSS FUNCTIONAL COLLABORATION


Process Engineers

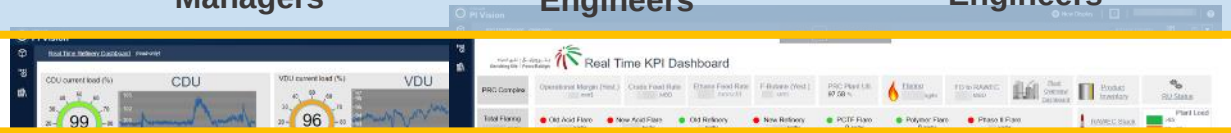

Plant Managers


Reliability Engineers


Maintenance Engineers


Data Analyst

Petro Rabigh Roles



OPERATIONAL DASHBOARDS & KPIS	PRODUCTION ACCOUNTING	FLARE MONITORING	ASSET HEALTH MONITORING
Improved Operational Efficiency & Performance across the complex	Improved Visibility & Accountability in production. Identify Losses in Real-time	Reduced Unnecessary Flaring	Improved Asset Health & Availability

OPERATIONAL INTELLIGENCE

OSIsoft.

Reliability
Security
Extensibility
Agility

Scalability
Availability
Connectivity
Simplicity

Use Case 1: Daily Operations Reports

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CHALLENGES

- No Single Version of Truth
- Multiple sources of data (and many Excel sheets)
- Delayed response
- Low awareness of overall complex

SOLUTION

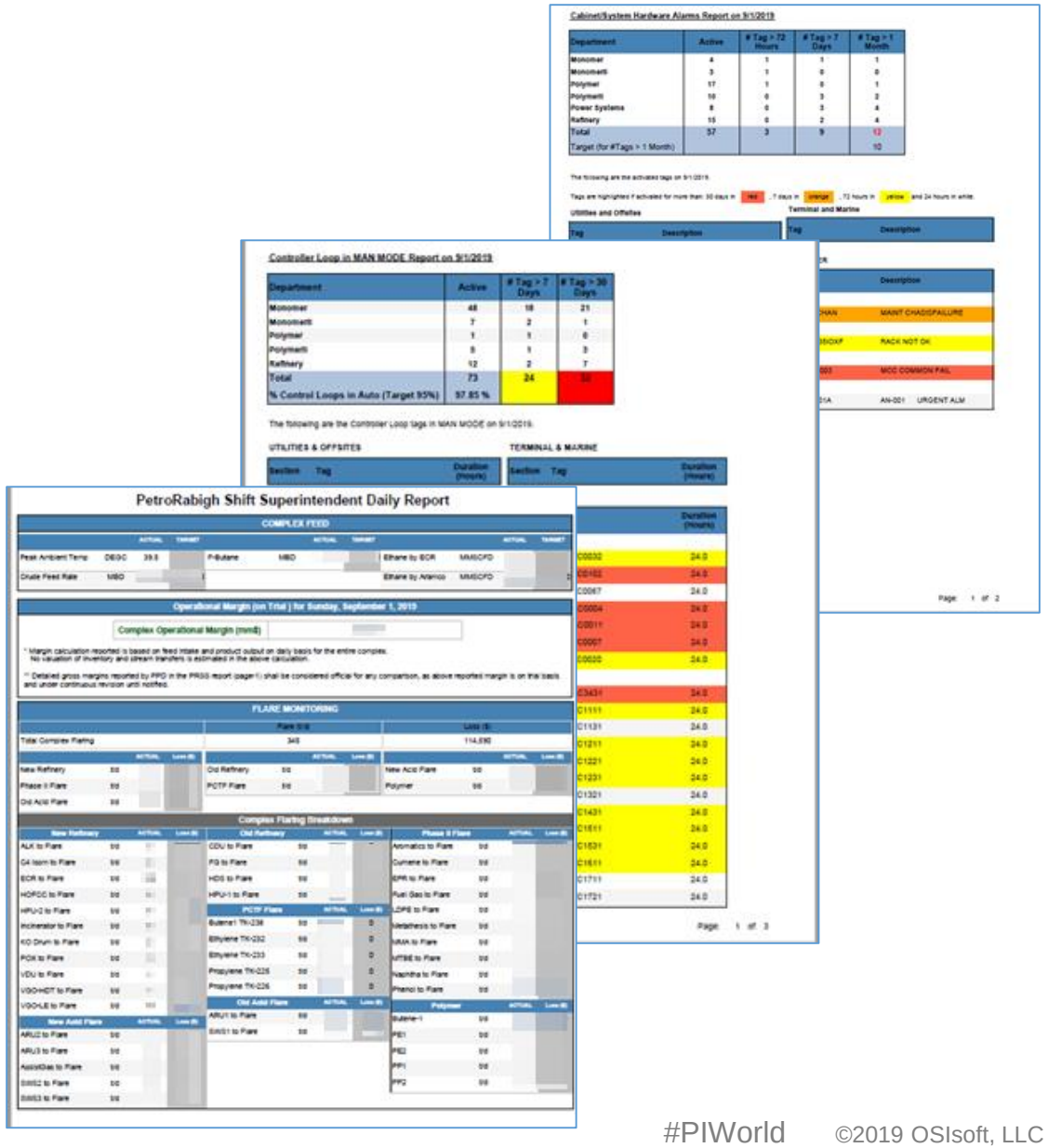
- Get all required data in PI System
- Create centralized reports (One Version of Truth)
- Simplify reports generation and distribution

BENEFITS

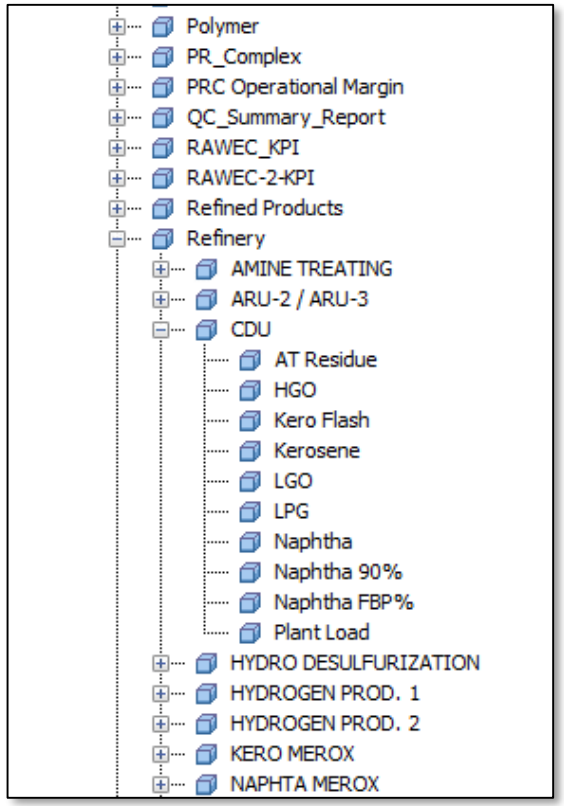
- Improved Plant Operational Performance
- Better Tracking & Controls
- Faster response to identified issues

Use Case 1: Daily Operations Reports

- KPIs and calculations developed on AF to monitor:
  - Plants Performance
  - Safety System Bypasses
  - Critical Systems hardware
  - Control Loops Uptime
- Reports on SSRS, generated and shared daily



Use Case 1: Daily Operations Reports



REFINERY

CDU		ACTUAL	TARGET
Plant Load	%		
LPG	MBD		
Naphtha	MBD		
Kerosene	MBD		
LGO	MBD		
HGO	MBD		
AT Residue	MBD		
Naphtha 90%	DEGC		
Naphtha FBP%	DEGC		
Kero Flash	DEGC		

VGO HYDRO TREATER		ACTUAL	TARGET
Plant Feed	MBD		
Recycle to Feed	%		
Plant Load	%		
1st Train Feed	MBD		
2nd Train Feed	MBD		
VGO Prod	MBD		
H2 Make Up	t/h		
Diesel Prod	MBD		
Naphtha Prod	MBD		
R1001 WABT	deg.C		
R2001 WABT	deg.C		
QC Results			
Result Time	hrs		
VGO Sulphur	wt%		

AMINE TREATING		ACTUAL	TARGET
QC Results			
Result Time	hrs		
LPG Prod. RSH	ppm		
H2S	ppm		

ARU-2 / ARU-3		ACTUAL	TARGET
QC Results			
Result Time	hrs		
ARU2 Lean DGA	%		
ARU3 Lean DGA	%		

VACUUM DISTILLATION		ACTUAL	TARGET
Plant Feed	MBD		
Plant Load	%		
ALD Cutter	MBD		
Kero Cutter	MBD		
LVGO Prod	MBD		
VGO Prod	MBD		
VR Production	MBD		
Complex Fuel Oil Yield	Vol%		
QC Results			
Result Time	hrs		
VR Viscosity	cst		
VR Flash	deg.C		

NAPHTA MEROX		ACTUAL	TARGET
Naphtha Feed	MBD		
Naphtha Load	%		
QC Results			
Result Time	hrs		
RSH Prod	ppm		
Prod. Color	-		

KERO MEROX		ACTUAL	TARGET
Kero Feed	MBD		
Kero Load	%		
QC Results			
Result Time	hrs		
RSH Prod	ppm		
Prod. Color	-		

HYDRO DESULFURIZATION		ACTUAL	TARGET
Plant Feed	MBD		
Plant Load	%		
LVGO	%		
Gas Oil Prod	MBD		
R-01 In Temp	deg.C		
R101 In Temp	deg.C		
DHT Naphtha Prod	MBD		
Diesel Flash	DEGC		

HYDROGEN PROD. 1		ACTUAL	TARGET
Plant Load	%		
H2 Prod	t/h		
S/C Ratio	-		
Reformer DP	kg/cm2		

HYDROGEN PROD. 2		ACTUAL	TARGET
Plant Load	%		
H2 Prod	t/h		
S/C Ratio	-		
Reformer DP	kg/cm2		

SWSs and SRUs		ACTUAL	TARGET
SWS1 Stripped Water Sulfide	wtppm		
SWS1 Stripped Water NH3	ppm		
SWS3 Common WTR B0003 Sulfide	mg/L		
SWS3 Common WTR B0003 NH3	mg/L		
SRU1 Amine Gas Feed	Nm3/hr		
SRU1 SWS Gas Feed	Nm3/hr		
SRU2 Train-1Amine Gas Feed	kg/hr		
SRU2 Train-1 SWS Gas Feed	Nm3/hr		
SRU2 Train-2 Amine Gas Feed	kg/hr		
SRU2 Train-2 SWS Gas Feed	Nm3/hr		

Use Case 2: Operational Dashboards & KPIs

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CHALLENGES

- No real time visibility on operations
- Plant performance reports are typically a day old

SOLUTION

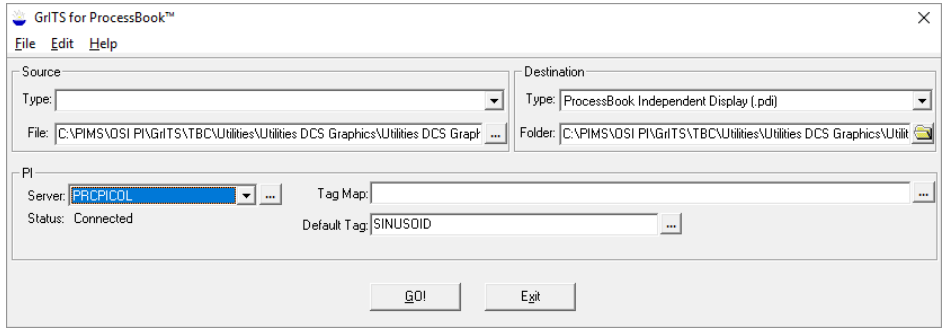
- Unified view to the complex and individual plants using PI Vision
- Display different calculated KPIs in context

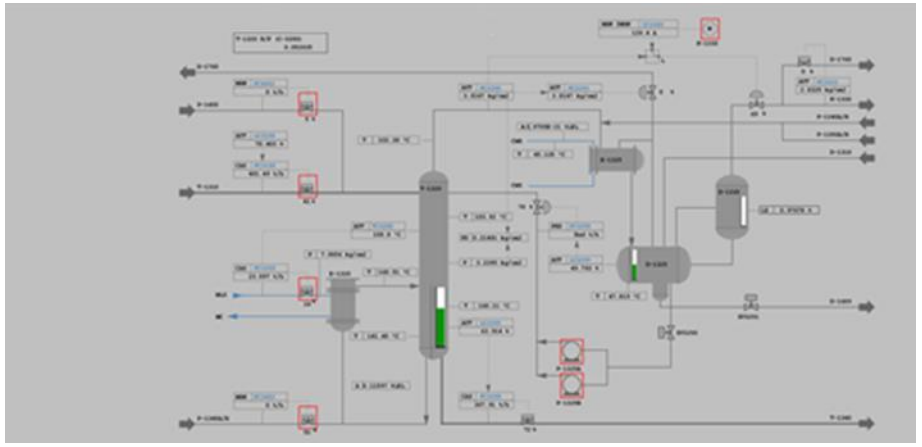
BENEFITS

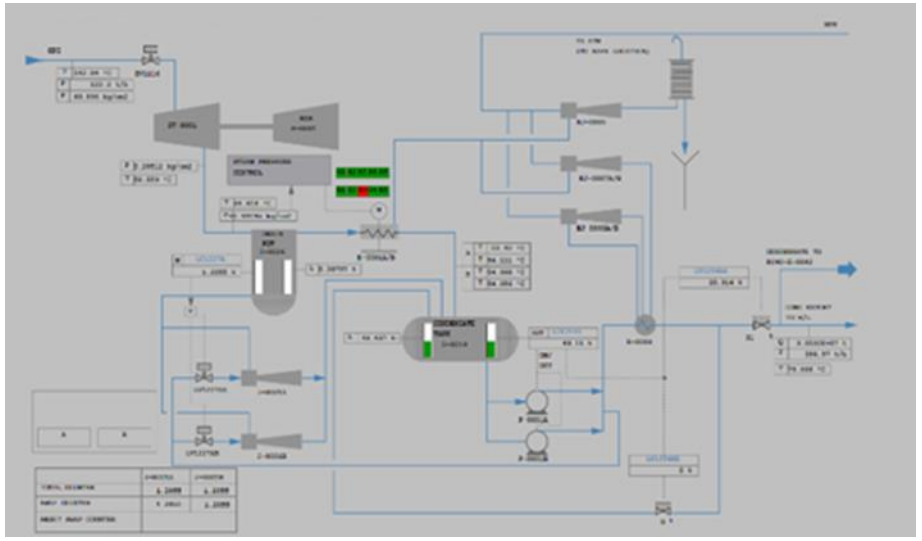
- Enabled immediate decisions from real-time data
- Real-time Operational KPIs provides true performance awareness
- Enables Offsite Monitoring

Use Case 2: DCS Graphics Conversion

- The First Request By Users
- Quick conversion with GrITS from Data South Systems







Use Case 2: KPI Dashboards for Plant Management

Use Case 2: KPI Dashboards for Plant Management

Use Case 3: Asset Health Monitoring

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CHALLENGES

- Equipment problems required Proactive Monitoring
- Faster response to equipment abnormality needed
- Large equipment number

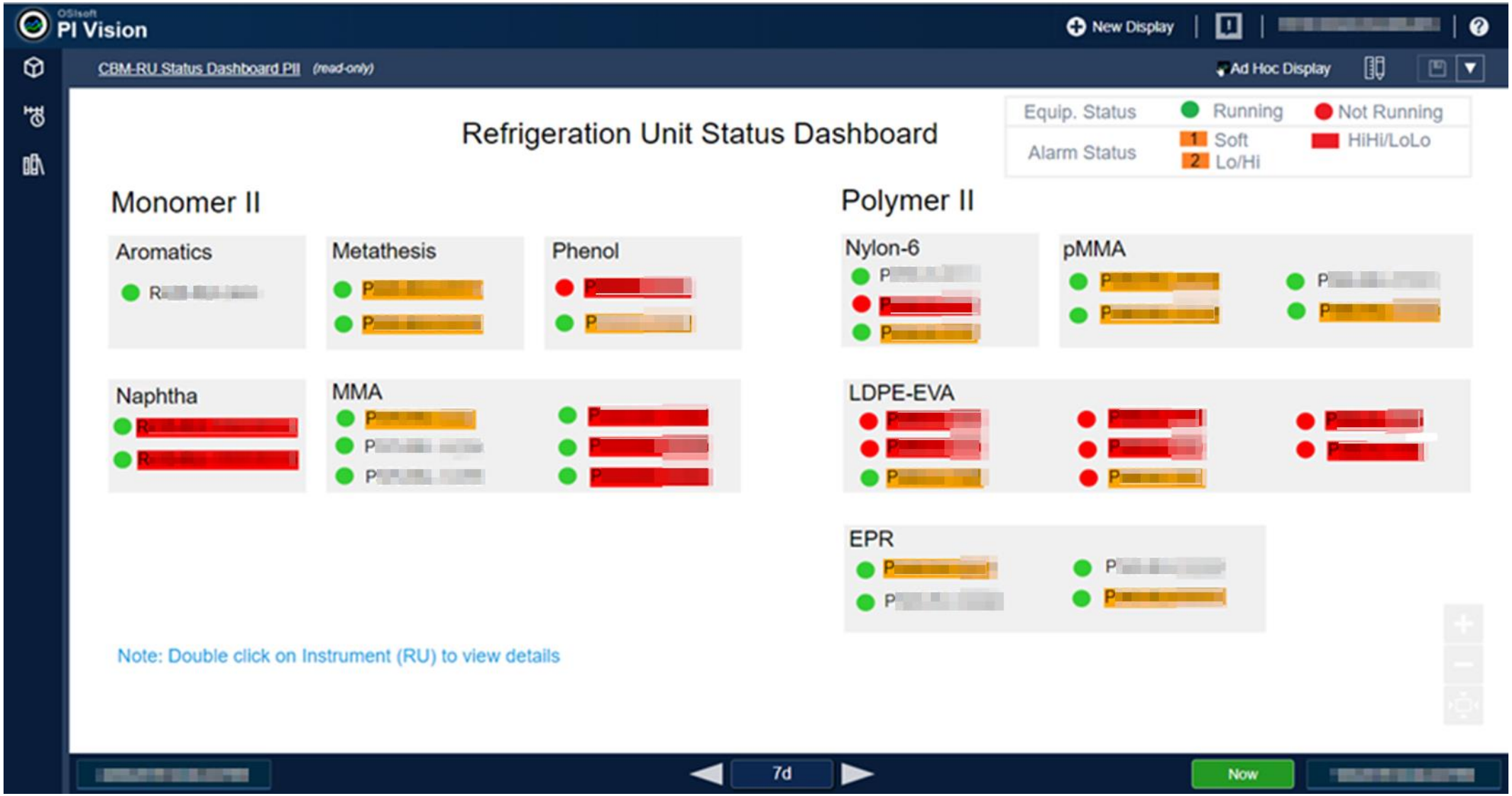
SOLUTION

- AF Structure for critical equipment and measurements
- Simple dashboards showing Actionable Information

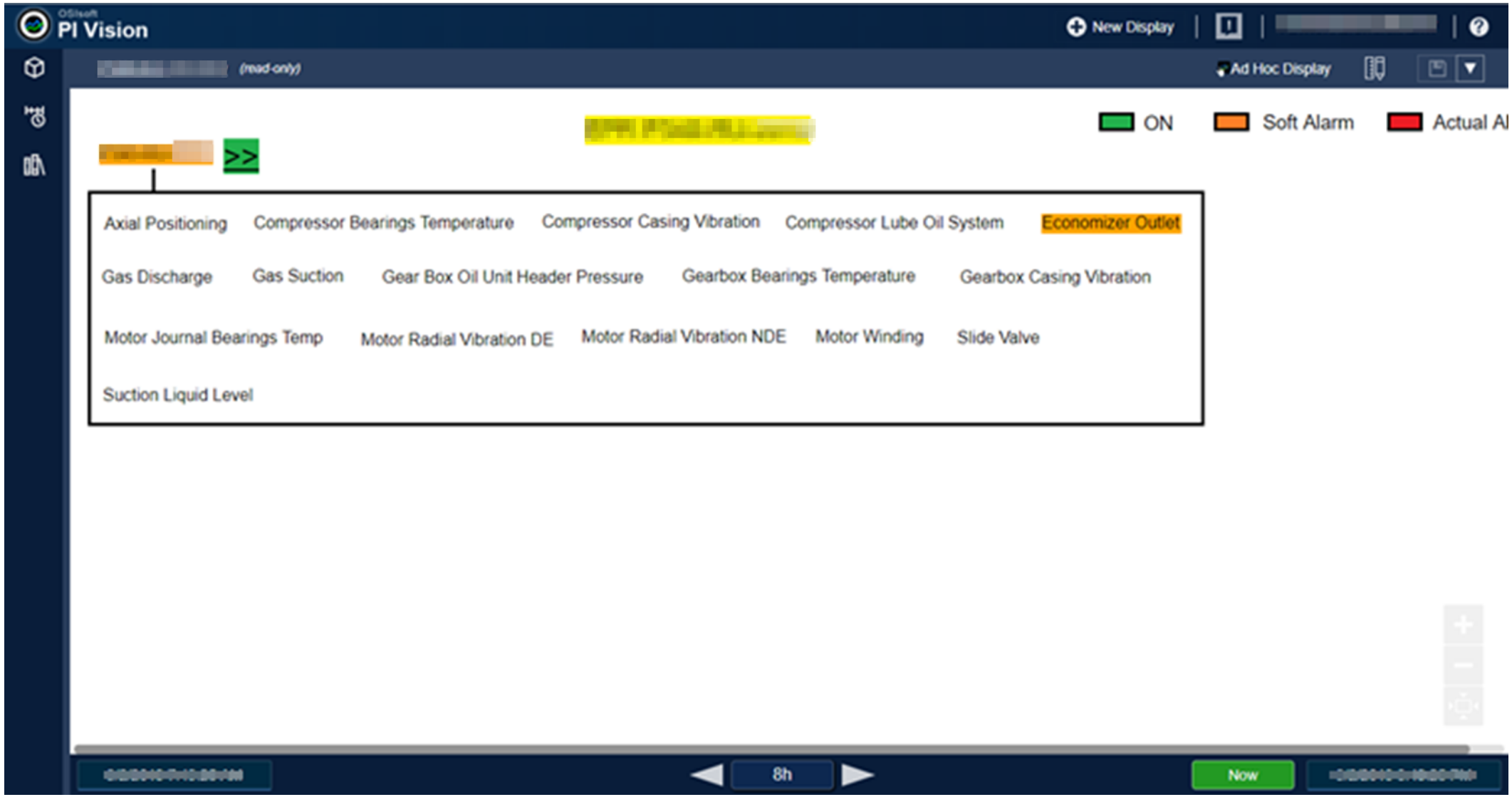
BENEFITS

- Identify types of equipment problem easily and immediately
- Enables Offsite Monitoring

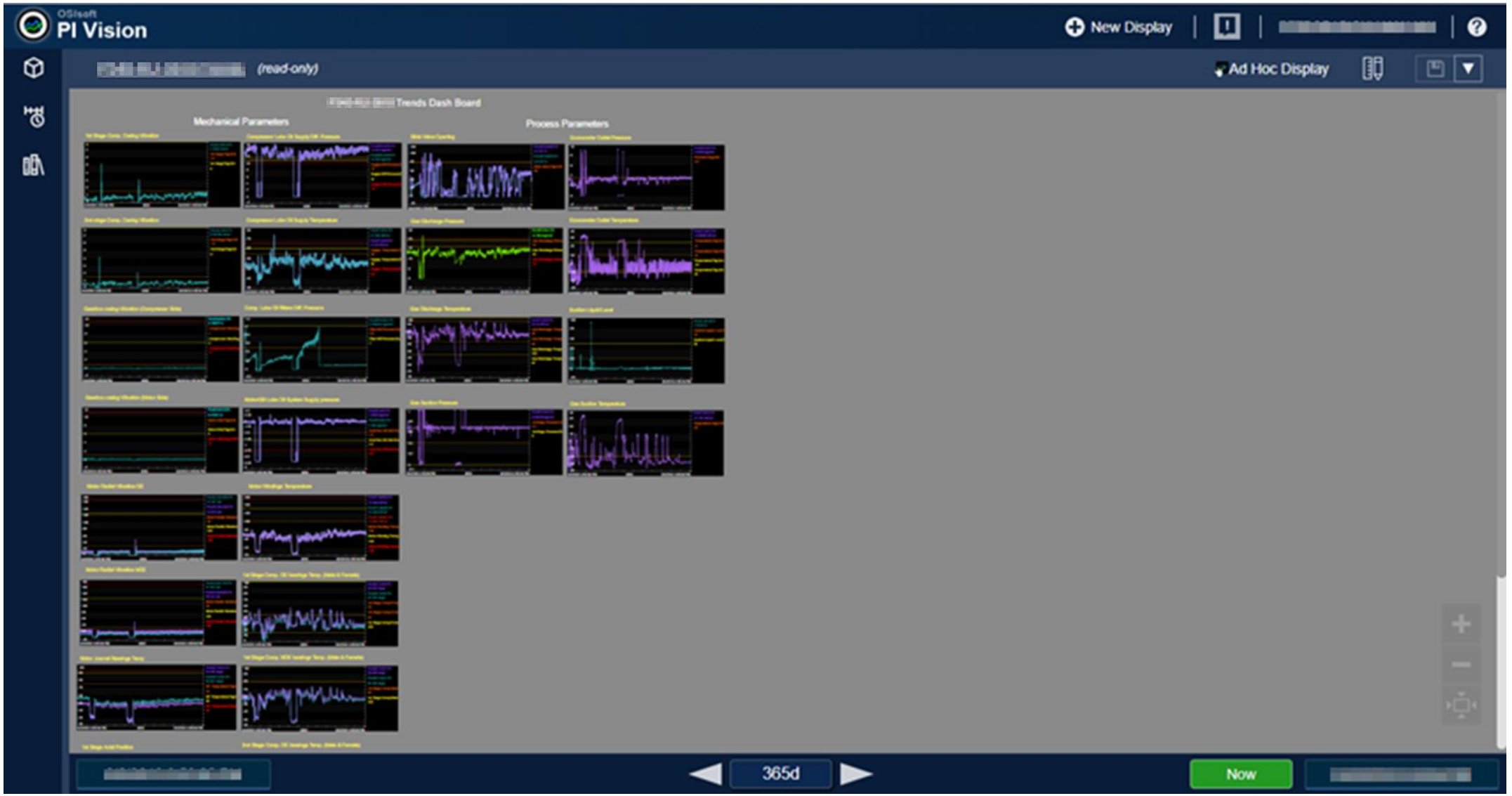
Use Case 3: Asset Health Monitoring Dashboards



Use Case 3: Asset Health Monitoring Dashboards



Use Case 3: Asset Health Monitoring Dashboards



Use Case 4: Production Accounting

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CHALLENGES

- Previous historian reliability impacts time and quality of data
- Simple modifications were difficult and take time
- Recalculations and recovery took 3 days
- Inability to upgrade or patch bugs

SOLUTION

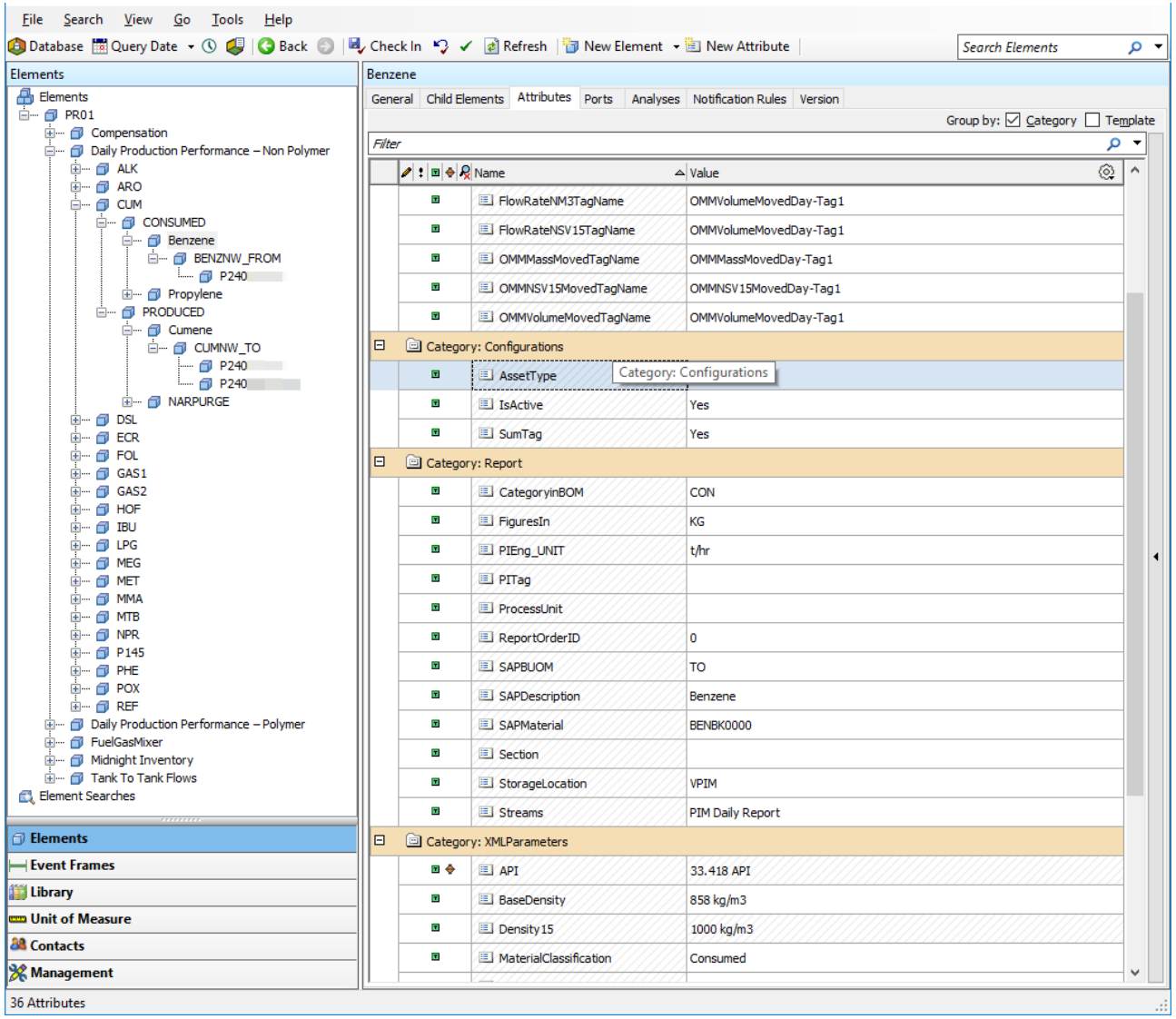
- Develop Production Accounting model in AF
- Eliminated custom code by depending on native interfaces

BENEFITS

- Easy model changes
- Stable & Reliable
- Reusing AF for Gross Margin calculations
- Recalculations in one hour

Use Case 4: Production Accounting

- Migrate Production Accounting to PI AF
- Compensation Calculations in PI ACE
- PI AF simplified maintenance & modifications.
- Provided quick and flexible recalculations



Use Case 5: Real-time Flare Monitoring

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CHALLENGES

- Lack of visibility in what's being flared
- Delayed identification of flaring sources
- Weak awareness of flaring cost
- Multiple organizations involved to generate manual reports

SOLUTION

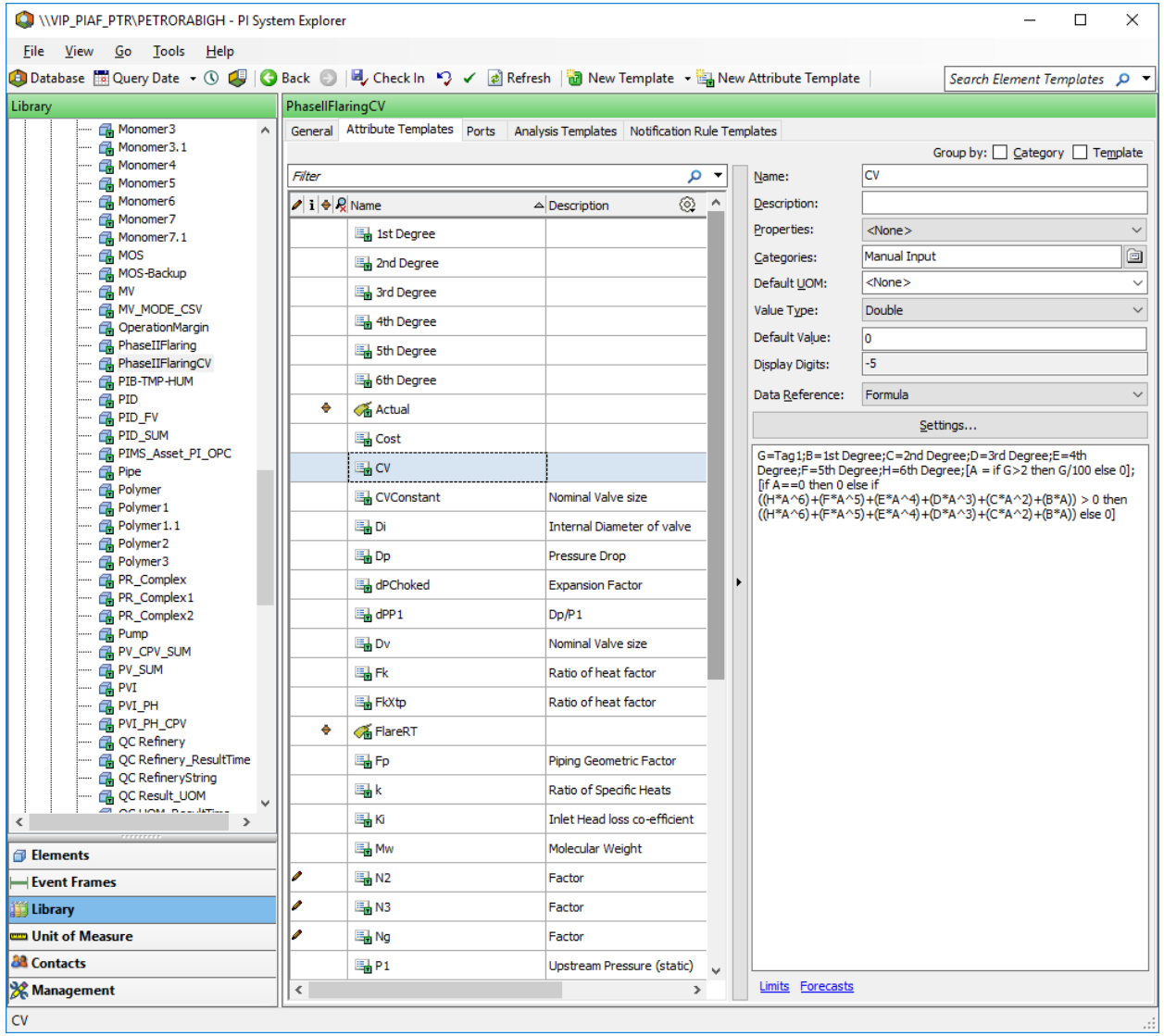
- Model flare valves in AF
- Dashboards reflecting flaring in real-time
- Cost calculations and easy source identification

BENEFITS

- Supported our Flare Reduction Program
- Company awareness and quick reactions
- Real-Time identification of flare sources/valves
- Improved Collaboration and Teamwork

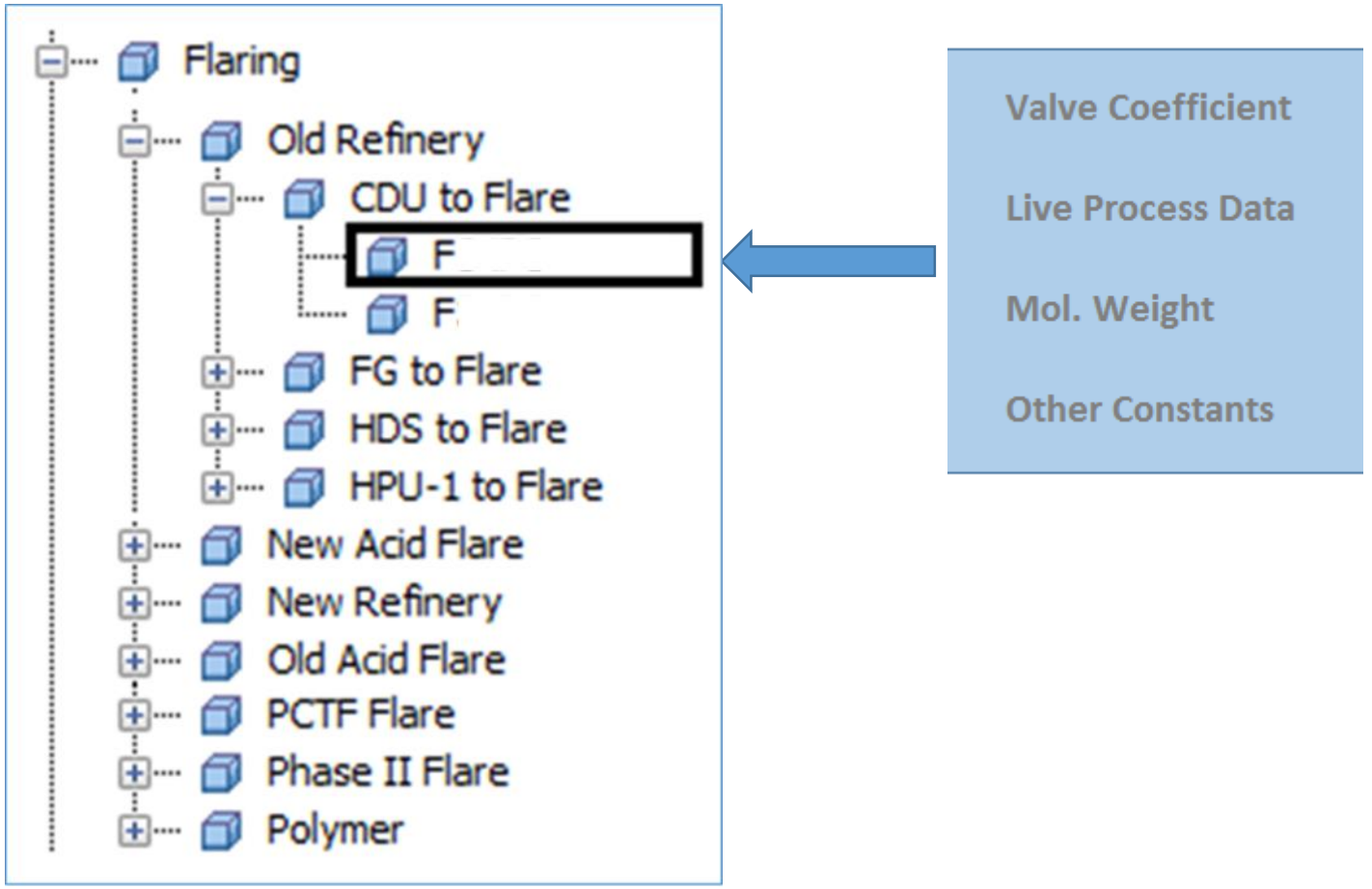
Use Case 5: Real Time Flare Monitoring

- All flare valves modeled in PI AF
- Cost Calculation included



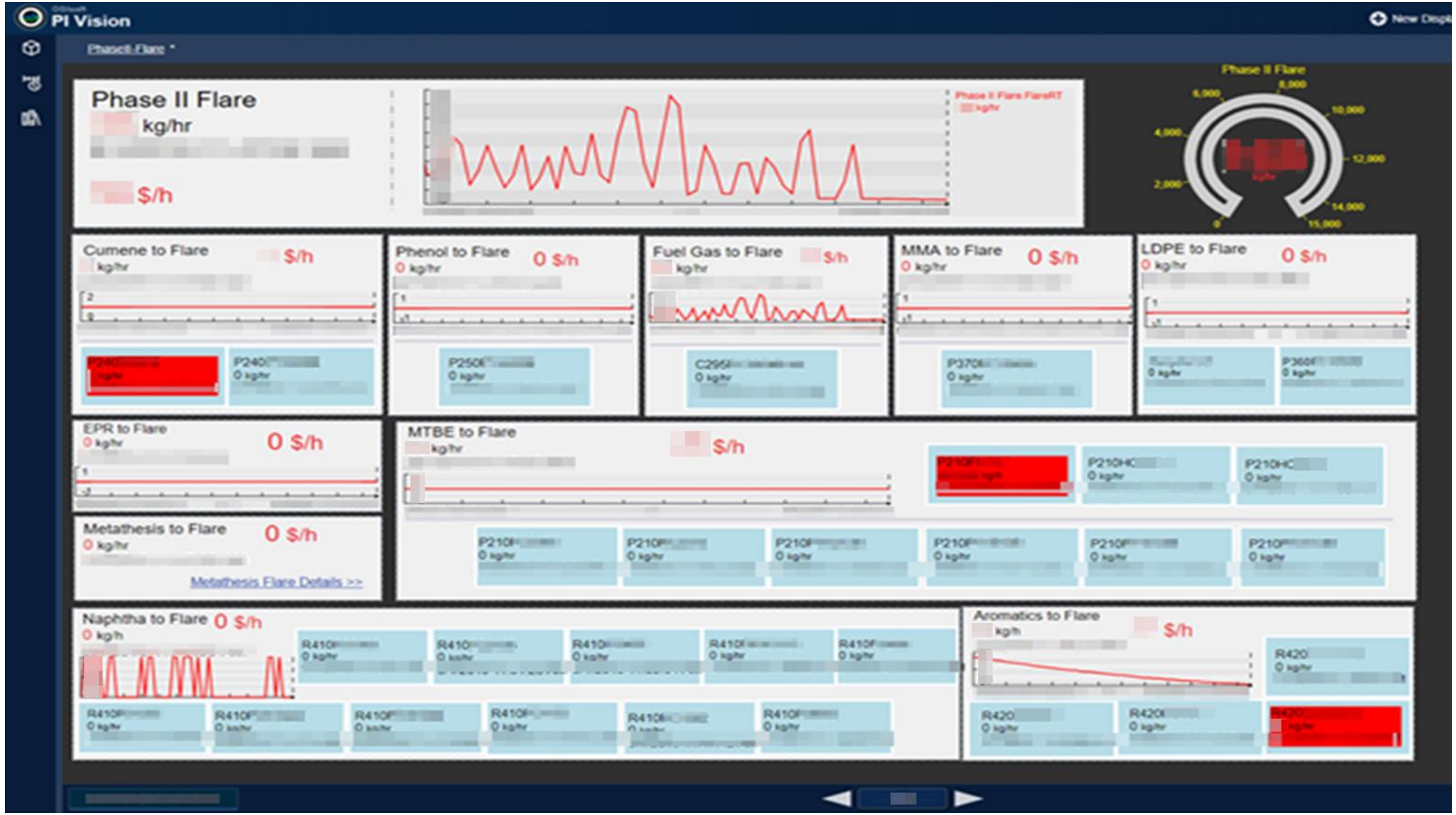
Use Case 5: Real Time Flare Monitoring

- Hierarchical Implementation for rollups
- Simplifies Graphics Development



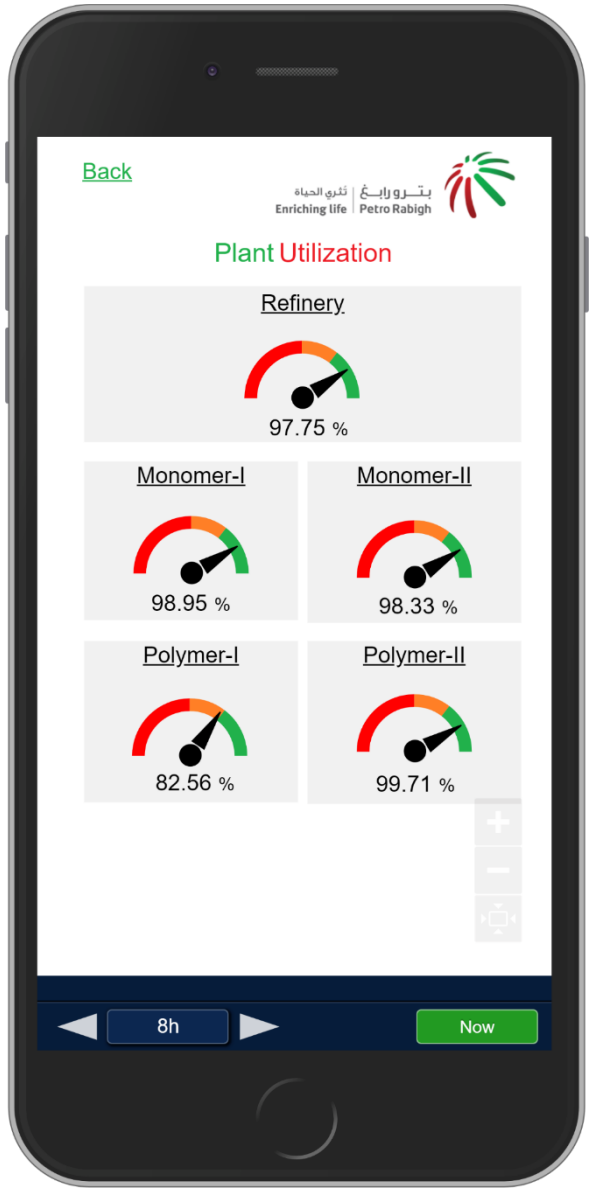
Use Case 5: Flare Monitoring Dashboards

Use Case 5: Flare Monitoring Dashboards

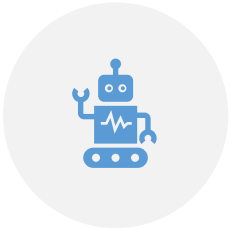


What's Next?

- Mobile Dashboards
- PI AF Models for:
  - Safety System Performance
  - APC Performance Monitoring
  - Control Loops Performance
- Third Party Data Sharing



Petro Rabigh Tips for Success



AUTOMATED QA/QC TOOLS

REVIEW AND REVISE EXPENSIVE ANALYSIS

CAREFULLY DESIGN AF STRUCTURE

START SLOW AND BUILD

WORK WITH TEMPLATES (AF AND PI VISION)

Summary:
Transforming PetroRabigh through Operations Data

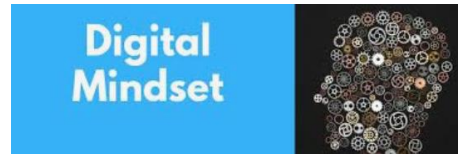
BUSINESS TRANSFORMATION THROUGH OPERATIONS DATA INFRASTRUCTURE

ENABLERS

People, Process & Technology

OPERATIONS DATA MANAGEMENT	STANDARDIZATION	CONTEXT	OPEN PLATFORM
UX AND EASE OF ADOPTION	SYSTEM RELIABILITY	SYSTEM DEPENDENCY	INTEGRATION
SCALABILITY	SECURITY	COMPATIBLE WITH EMERGING TECHNOLOGIES	FOUNDATION TO DIGITAL TRANSFORMATION
ADOPTION AND CONTINUOUS INNOVATION	CROSS FUNCTIONAL COLLABORATION	PROACTIVENESS THROUGH OPERATIONS INTELLIGENCE	IMPROVED WORK PROCESSES AND PRACTICES

Continuous Innovation, Improvement & Business Value Realization



Presenter

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Questions?

Please wait for the **microphone**

State your **name & company**

Please remember to…

Complete Survey!

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