



OSIsoft®
REGIONAL
SEMINARS 2012
The **Power** of **Data**



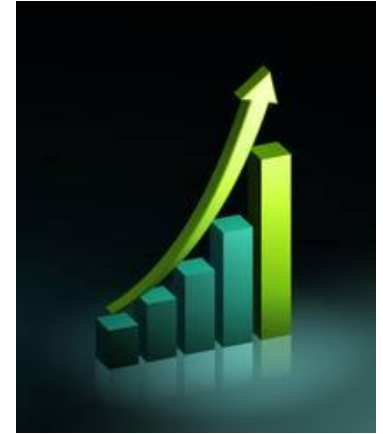
Creating Value with the PI System in Oil & Gas

“From Tactical to Strategic”

Presented by - Craig Harclerode, O&G Business Development Executive
(Houston, Texas USA)

Outline

- Global Issues and Response Themes
- Strategic PI System Value Trends
 1. Value Chain integration
 2. Infrastructure for MES/Solutions
 3. Asset Reliability and Performance Management
 4. Cyber Security
 5. Business Integration and Intelligence
- Concluding Remarks



OSIsoft O&G/PetChem BD Team



Kelly Sherrill

Upstream BD

- 23 years Exp.
- 2 yr @ OSIsoft
- 21 yrs Amoco/BP
- Enterprise Apps.
- Field of Future
- Solutions Specialist
- BBA New Mexico
- **Houston**



Heathcliff Howland

Midstream BD

- 20 years Exp.
- 8 yrs @ OSIsoft
- Motive Power Focus
- BS ME Maritime Academy
- USCG 3rd Assistant Engineer's license
- **San Leandro**



Craig Harclerode

Downstream BD

- 33 years Exp.
- 6 yrs @ OSIsoft
- 15 yrs Amoco Oil
- 6 yrs Honeywell IAC
- 6 yrs Aspentech
- BS ChE Texas A&M
- MBA Rice
- **Houston**



Sandra Peterson

Chem/PetChem BD

- 27 years Exp
- 1 yr @ OSIsoft
- 7 yrs Honeywell
- 5 yrs Aspentech
- 7 yrs Consulting
- BS ChE Auburn
- MBA Texas
- **Houston**

The Standard in O&G

% Global Capacity Using The PI System

Production
55%

Pipelines
35%

LNG
25%

Manfngn
60%

Biofuels
15%

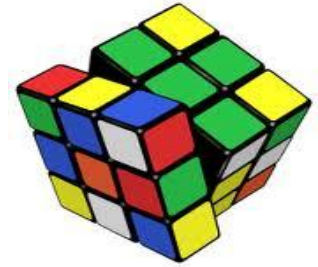


Globally Common Issues in O&G

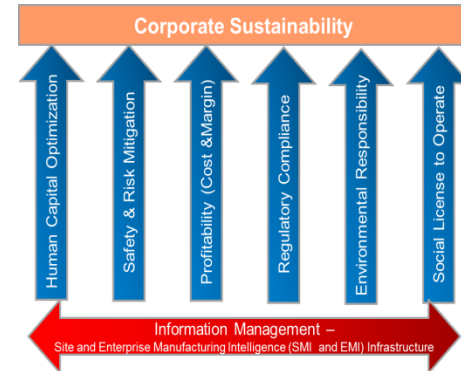
1. Asset Safety, Reliability and Performance
2. Remote operational awareness and support
3. Knowledge/Availability of Expertise and Collaboration
4. Value Chain Integration & Real-Time Situational awareness
5. Cyber Security



PI System - From Tactical to Strategic



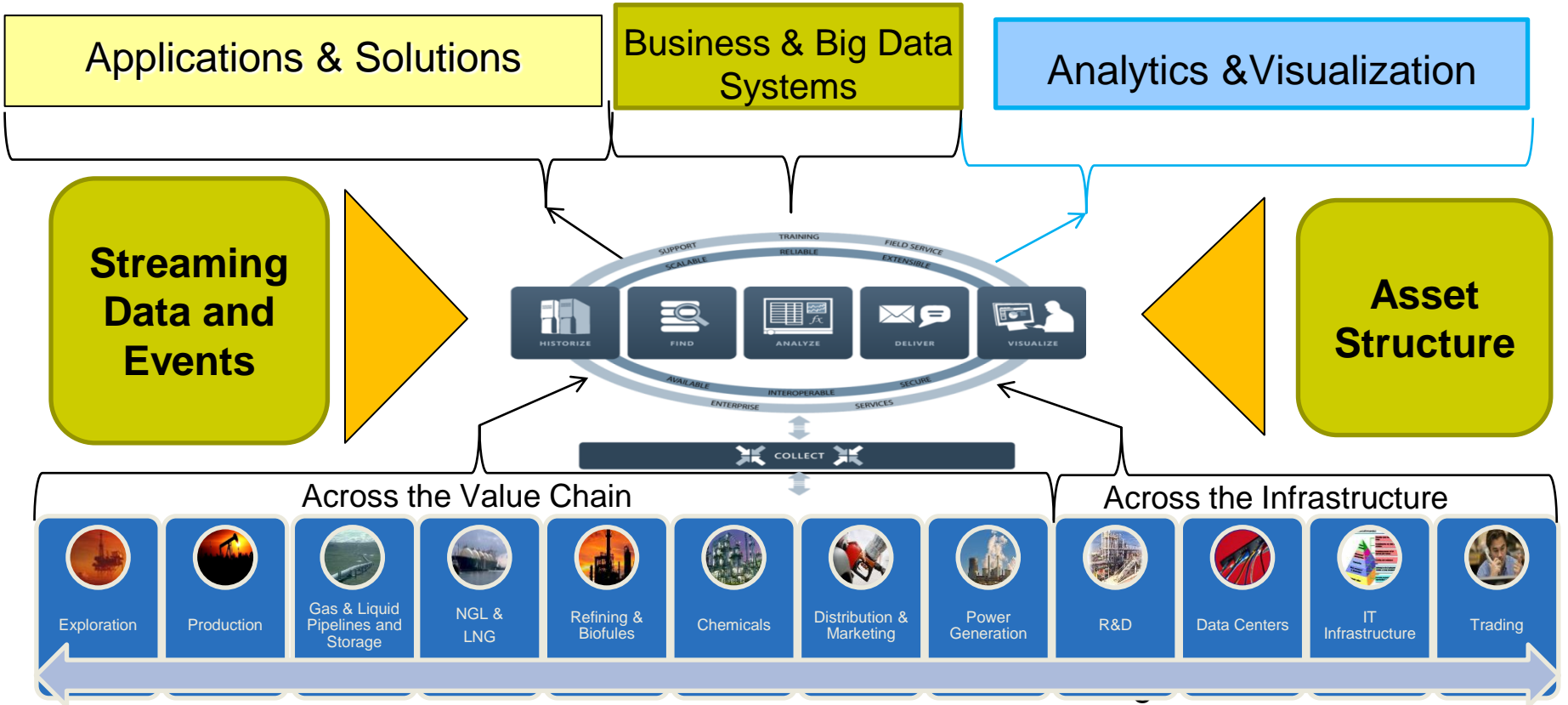
1. Manufacturing & Business Integration and Intelligence
2. Simplification of IT, Applications & Solutions Landscape
3. Remote Monitoring and collaboration – internal and external
4. A key element of Cyber Security strategy
5. Core element in sustainability vision – ability to endure



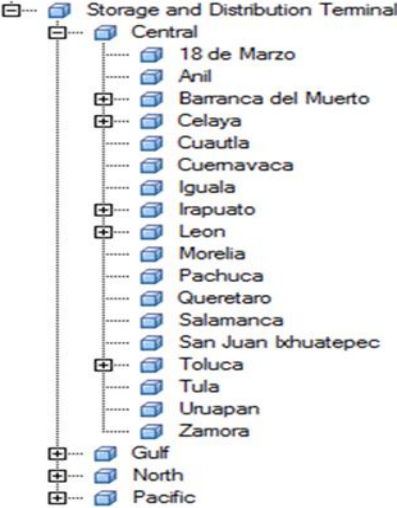
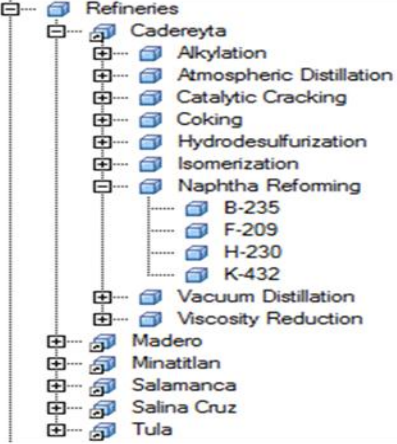
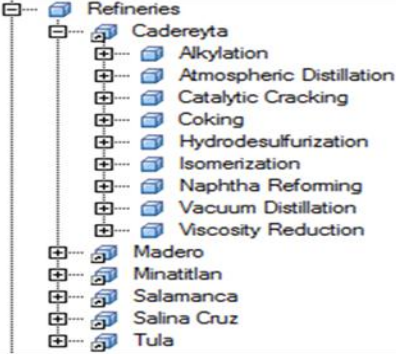
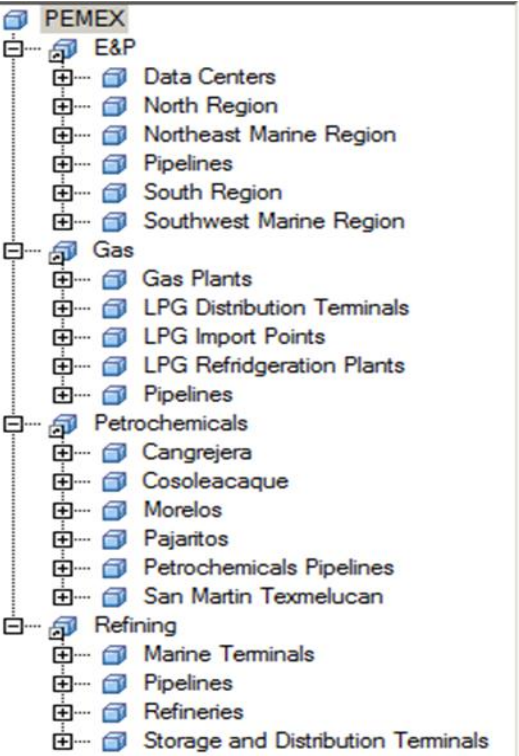


The Real-Time Integrated O&G Value Chain

Strategic Integration of the Enterprise Operations



Framework for Enterprise Data & Information



Pertamina Downstream Value Chain

Assets

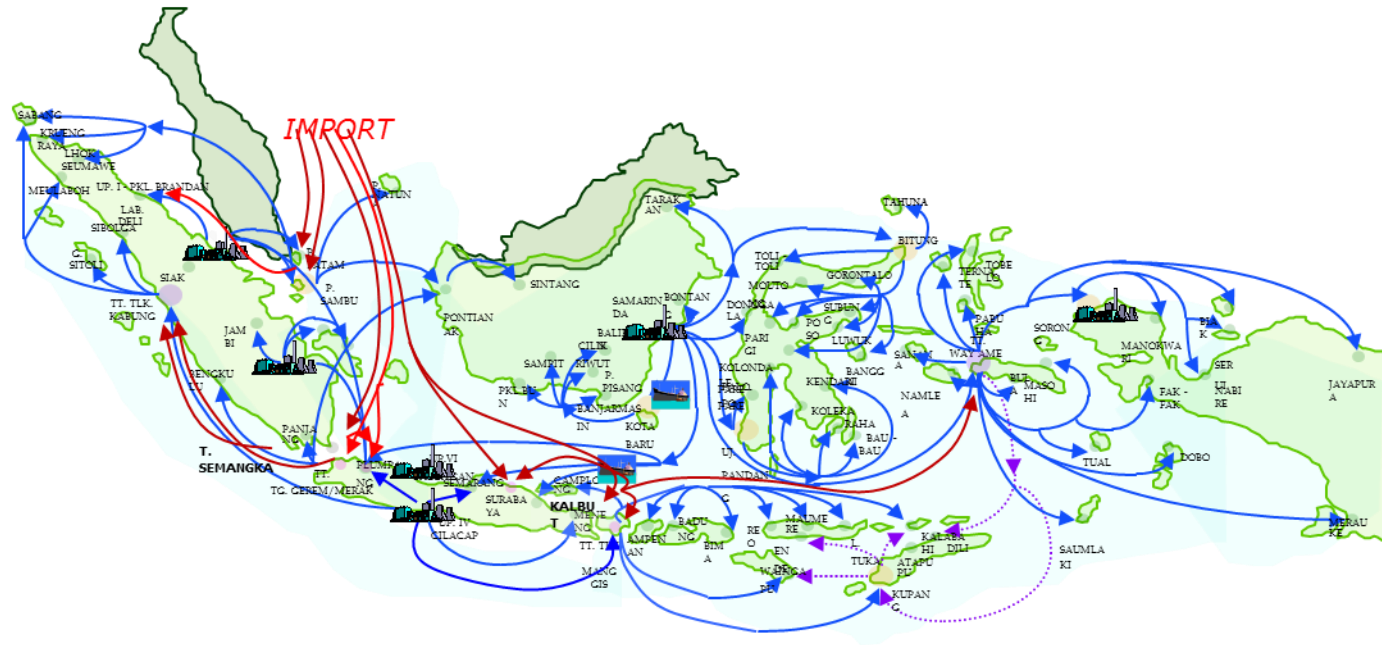
6 Refineries :
1,034 Million bbl/day

120 + Depots

98 Vessels

3,400 Fuel Stations

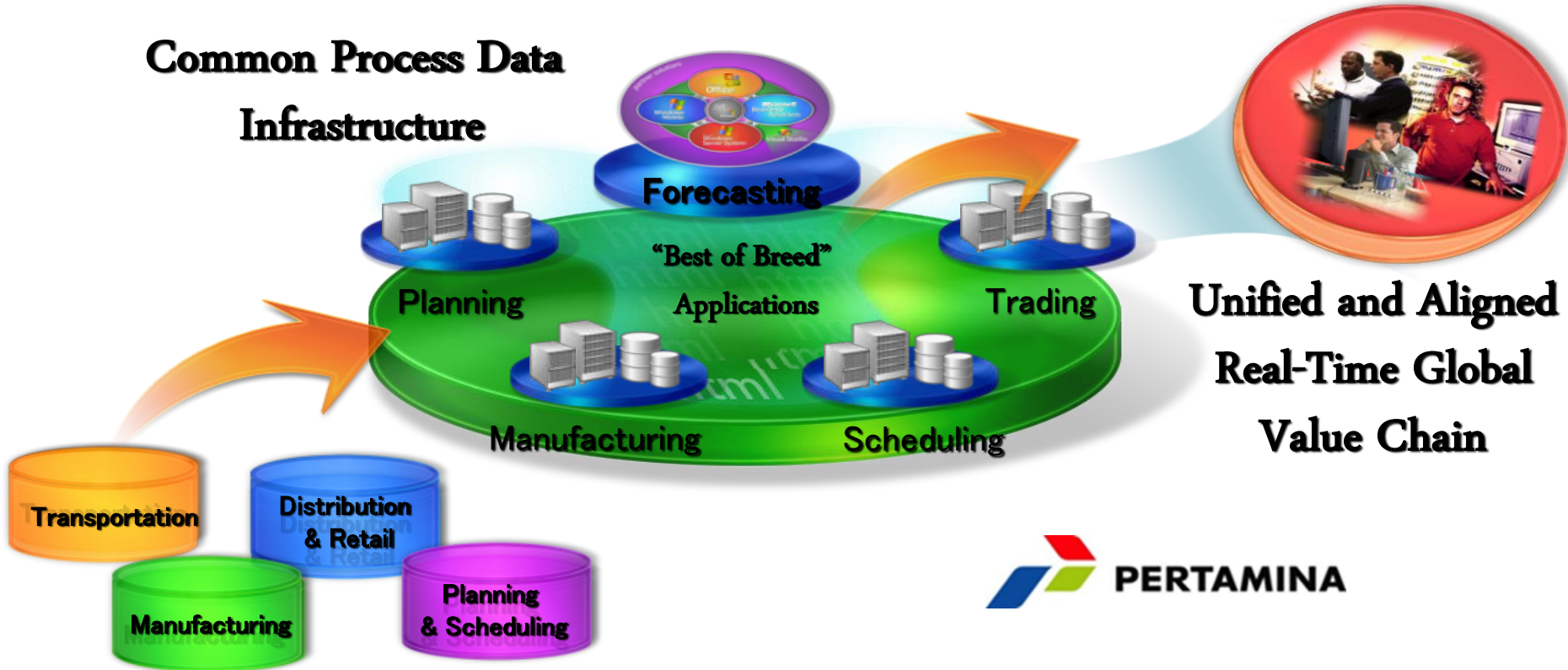
Sales Volume :
1,200 Million bbl/day
(92 % Market Share)



One of the most complex Downstream Supply Chains in the world

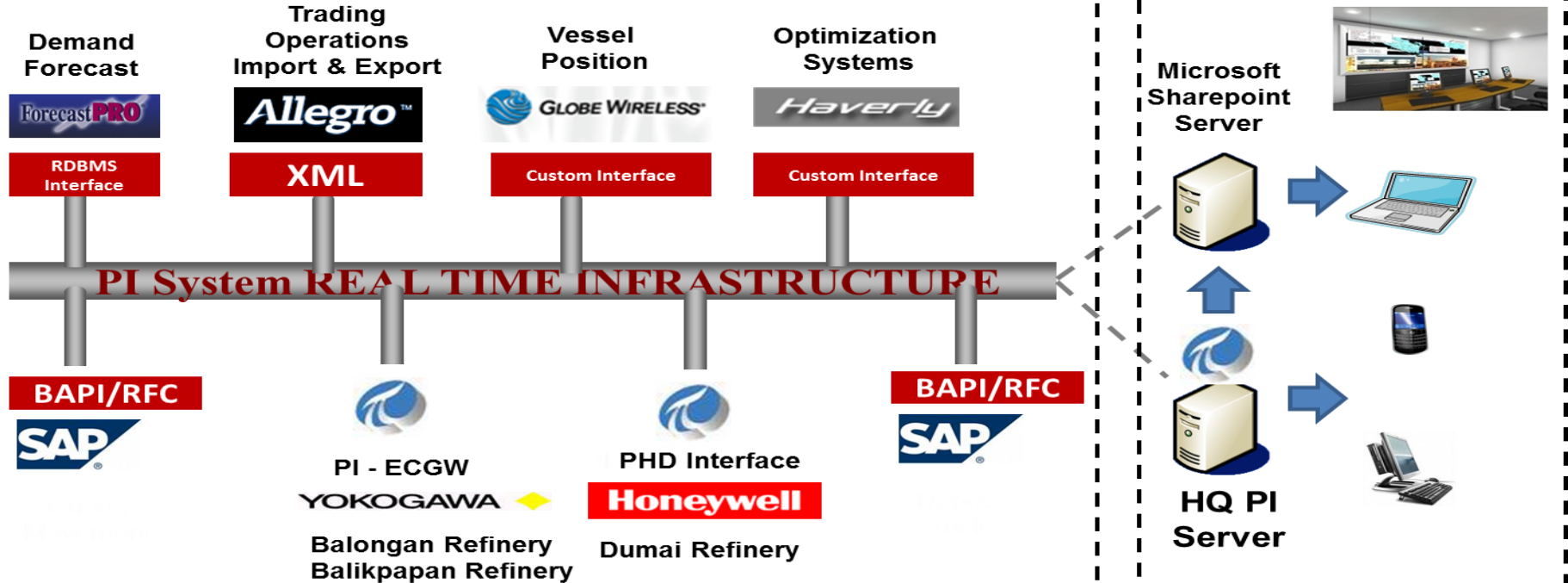
An Enterprise Real-Time Infrastructure is Key to Value Chain Situational Awareness and Optimization

**Common Process Data
Infrastructure**

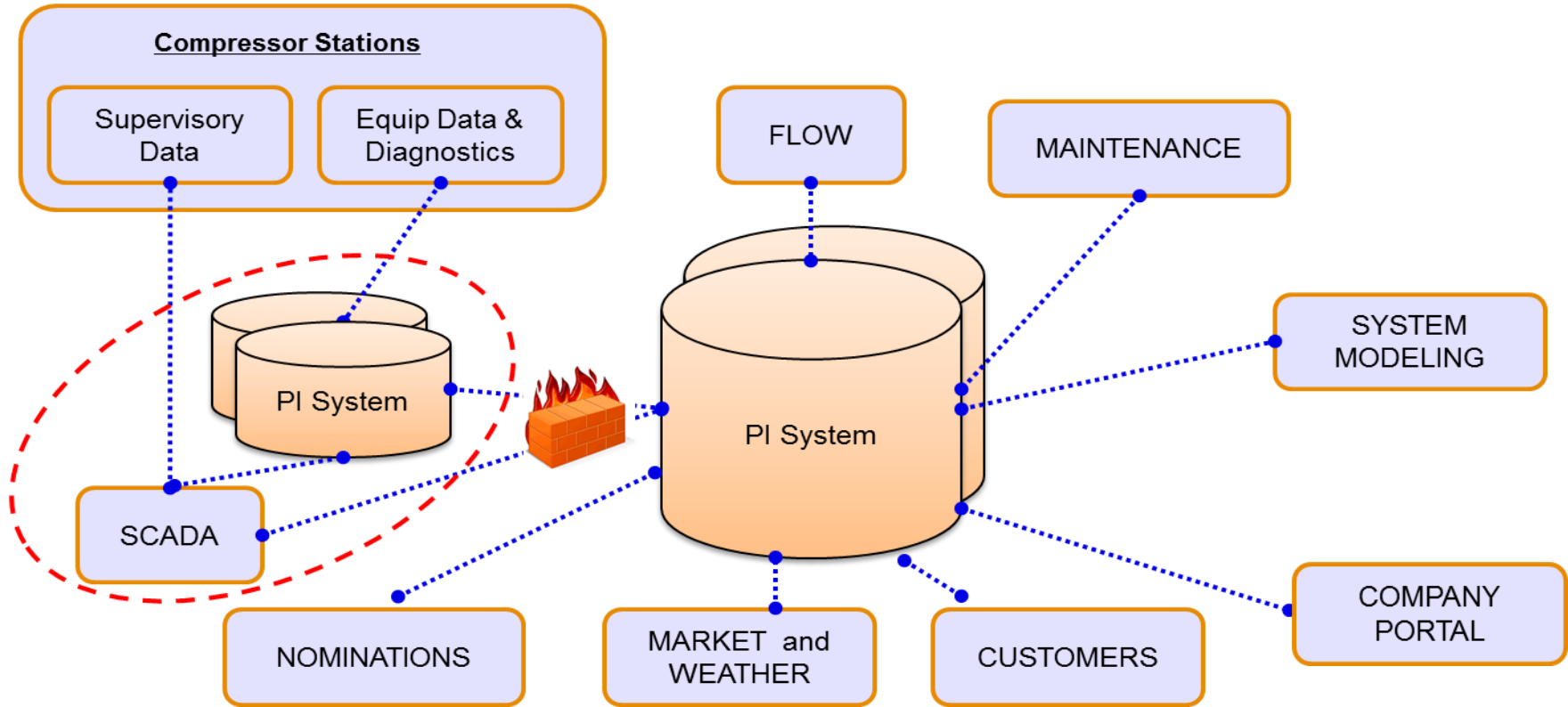


Downstream Value Chain Integration Architecture

SOFTWARE



Strategic Use of the PI System in Pipelines



NiSource Overview



15,500
Pipeline Miles

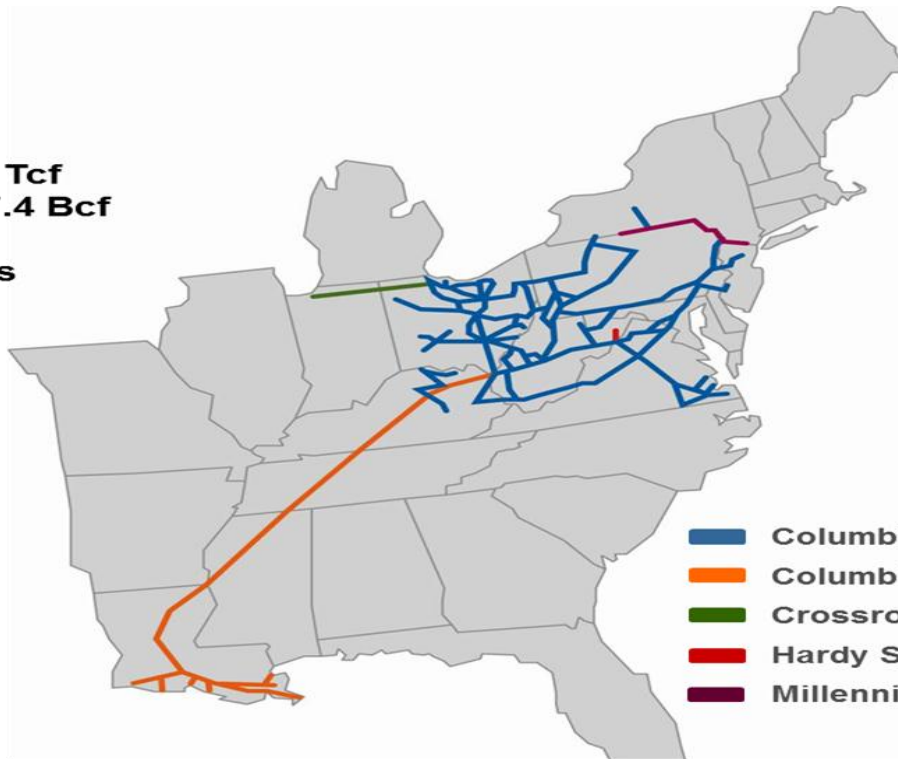
Annual Deliveries: 1.4 Tcf
Peak Day Deliveries: 7.4 Bcf
Serving 40 Markets
Operations in 16 states


37
Storage Fields

Capacity: 640 Bcf
Daily Delivery: 4.7 Bcf
Working Gas: 280 Bcf

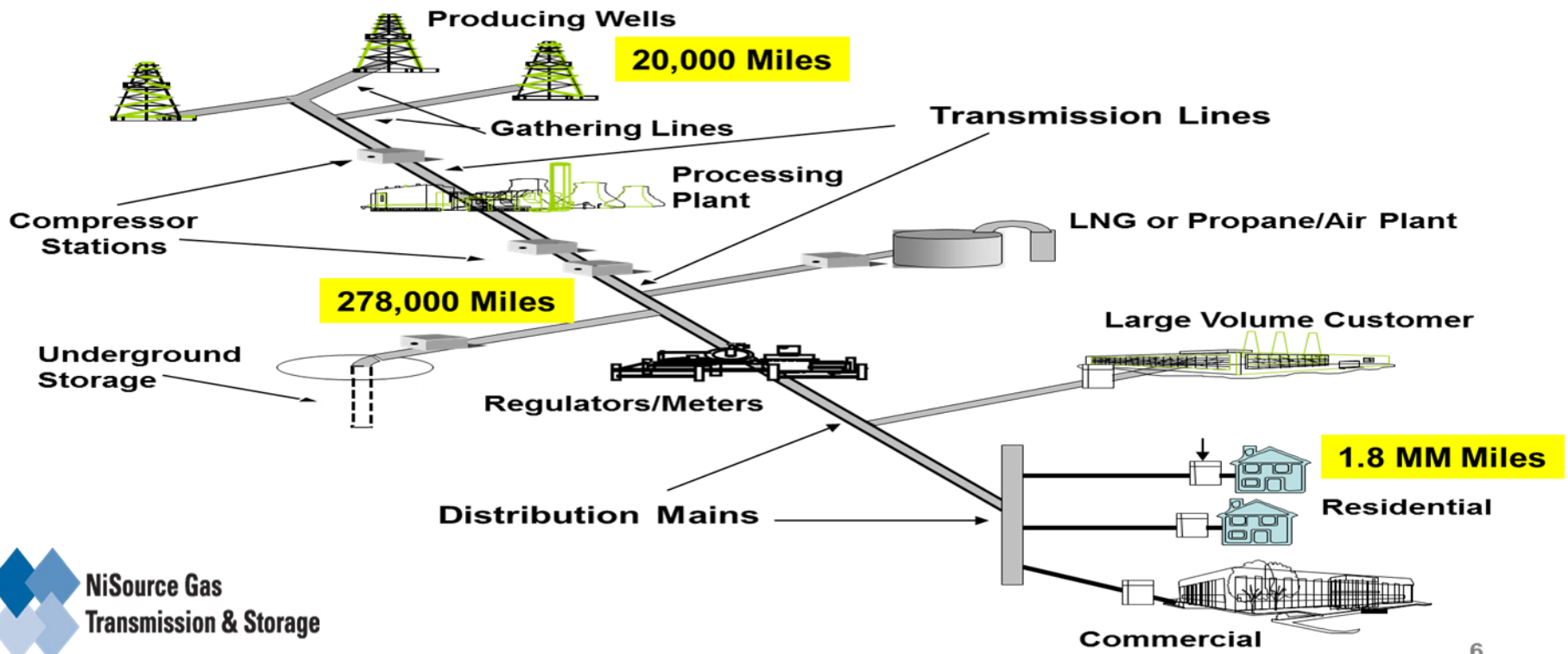
106
Compressor Stations

Horsepower: 1,100,000



-  Columbia Gas Transmission
-  Columbia Gulf Transmission
-  Crossroads Pipeline
-  Hardy Storage Company
-  Millennium Pipeline

“From Well Head to Burner Tip”



PI-AF Templates – Knowledge, Governance, and Leverage

Calculation of Compressor Heat Rate

NGT&S - PI System Explorer

File Edit View Go Tools Help

Database Query Date Back Check In New Template New Attribute Template Search

Library

- NGT&S
 - Categories
 - Templates
 - Element Templates
 - Actual Heat Rate
 - CAT 3616
 - CB_8V-2000 C2 Unit
 - Compressor Station
 - CS
 - GMWA Unit
 - GMWA_Driver
 - Heat Exchanger
 - HSRA-8T Unit
 - Pipeline Efficiency
 - Regulation Station Effi
 - Solar_Driver
 - TLA-8 Unit
 - TLAD-10 Unit
 - Model Templates
 - Transfer Templates
 - Enumeration Sets
 - Reference Types
 - Tables
 - Compressor Unit Info
 - Fuel Gas Cost

HSRA-8T Unit

General Attribute Templates Ports

Search

Name	Description
BMEP	
HeatRateMargin	
Max Heat Rate	
Mfg Recommended Speed	Mfg Rec Spd
Min Heat Rate	
Name	
Target Heat Rate	
Unit Actual Heat Rate	
Unit BHP	
Unit Discharge Pressure	Unit or Stage 1 Discharge Pressure
Unit Flow Rate	Unit Volume Flow Rate
Unit Fuel	Unit Fuel
Unit HR_Diff_Maintenance	Actual/Target
Unit HR_Diff_Operation	Actual/7500
Unit Pressure Differential	Discharge-Suction Pressure
Unit Speed	Unit Speed
Unit SpeedFactor	
Unit Status	Unit Running or Not
Unit Step	
Unit Suction Pressure	Unit or Stage 1 Suction Pressure
Unit Suction Temperature	Suction Temperature
Unit Temperature - Ambient	Ambient temperature at station or u

Group by: Category

Name: Unit Actual Heat Rate

Description:

Configuration Item: Indexed:

Categories:

UOM: BTU(LHV)/BHP-Hr

Value Type: Double

Default Value: 0 BTU(LHV)/BHP-hr

Data Reference: Formula

Settings...

A=Unit BHP;B=Unit Fuel;UOM=MSCF;(if A <=50 then 0 else (B*(1000*1030*0.915))/A)

HSRA-8T Unit Modified:7/26/2010 2:39:08 PM. Sba8135e-7526-4ece-85d2-b11221b28dbc

Element Templates

Element Attributes

PI-AF Integration

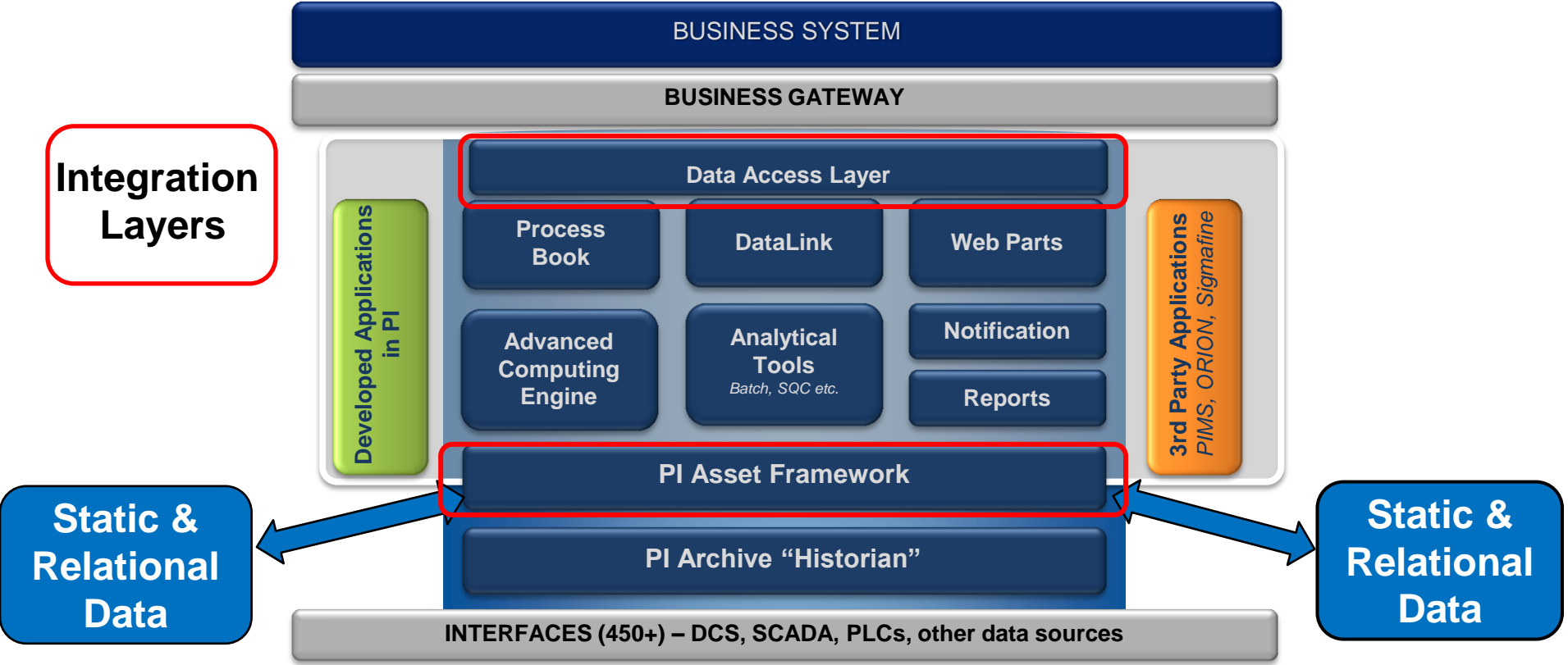
The screenshot displays the NGT&S - PI System Explorer interface. On the left, a 'Library' pane lists various system components and tables. A red circle highlights the 'Tables' section, which includes 'Compressor Unit Info', 'Fuel Gas Cost', 'Gas Spot Market', 'Material Properties', and several solar unit profiles. The main window shows a 'Profiles' table with columns for ID, ambient temperature, HPSL number, fuel rate, Wex, T7, Pcd, T5, Ngp, NptOpt, and T2. A red diagonal watermark 'Static & Relational Data' is overlaid on the table. The bottom status bar shows 'Output set to None Selected', '995x476x24-bit', '0,0 995x476', and '100%'.

ID	ambientTemperat	HPSL_No	FuelRate	Wex	T7	Pcd	T5	Ngp	NptOpt	T2
1	-60	785	18.596	2563.8394	347.504	64.982	423.67	7707.2	3046.7	244.273
2	-60	1635	25.088	3120.8655	377.98	87.071	492.14	8010	3901.3	293.528
3	-60	2484	31.356	3543.1855	405.85	105.079	551.4	8228.4	4486.6	330.064
4	-60	3334	37.245	3896.3823	428.85	120.726	600.65	8413.8	4956	359.448
5	-60	4184	42.989	4203.3804	448.247	134.839	645.09	8556.3	5345.7	383.984
6	-60	5033	48.552	4489.2214	464.868	148.12	683.95	8692.2	5780.3	405.575
7	-60	5883	53.628	4756.6514	475.431	160.451	714.29	8902.8	6216.7	424.663
8	-60	6733	58.78	5017.699	486.698	172.477	744.13	9104.1	6550.3	442.452
9	-60	7582	63.777	5277.9775	497.225	183.921	772.04	9276.8	6825.4	459.36
10	-60	8432	68.826	5468.7412	508.167	194.812	799.15	9424.7	7053.5	475.038
11	-60	9282	73.925	5687.1289	519.968	205.653	825.83	9554	7245.8	489.805
12	-60	10131	79.225	5880.7393	533.842	215.664	854.37	9680.8	7428.3	503.56
13	-60	10981	84.603	6055.3457	548.908	225.123	884.01	9810	7607.1	517.358
14	-60	11831	90.337	6194.5713	572.478	234.32	922.51	9974.4	7821.6	535.673
15	-60	12680	96.557	6299.3101	602.28	242.866	967.88	10178.3	8070.3	557.219
16	-60	13530	103.26	6359.9141	640.366	250.515	1022.59	10419.3	8336.4	582.847
17	-60	14380	110.251	6392.4424	683.365	257.483	1082.85	10661	8570.5	610.835
18	-60	15230	116.235	6417.052	719.7173	263.1914	1133.00	10840	8744.039	625.43
21	-60	16929	131.165	6466.7368	809.646	276.605	1259.73	11221.6	9178.2	691.577
22	-50	797	18.878	2531.6345	368.296	64.989	445.12	7802.2	3088.2	261.74
23	-50	1661	25.495	3083.3621	399.782	87.145	515.6	8109.6	3956.4	312.285



Infrastructure for MES & Solutions

PI System - an Integration and Applications Infrastructure



ENTERPRISE OPERATIONS MANAGEMENT for Manufacturing

HS&E

Quality Mgmt.

Accounting

Planning

SCM

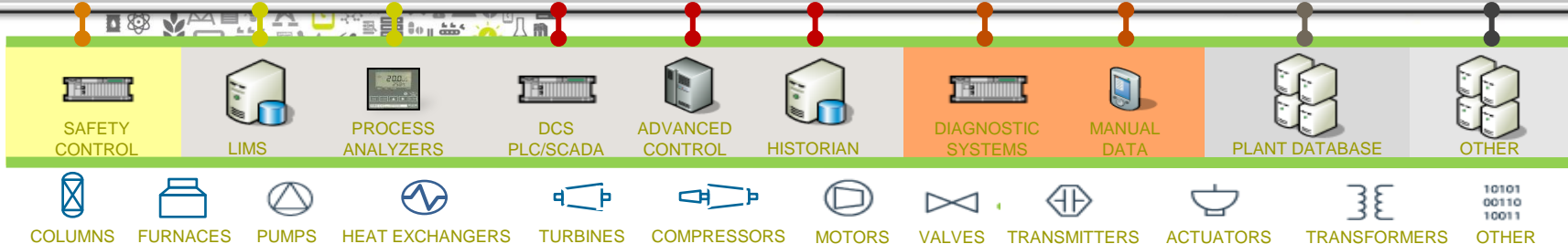
Asset Management

HR

Applications and Solutions “Functionality”

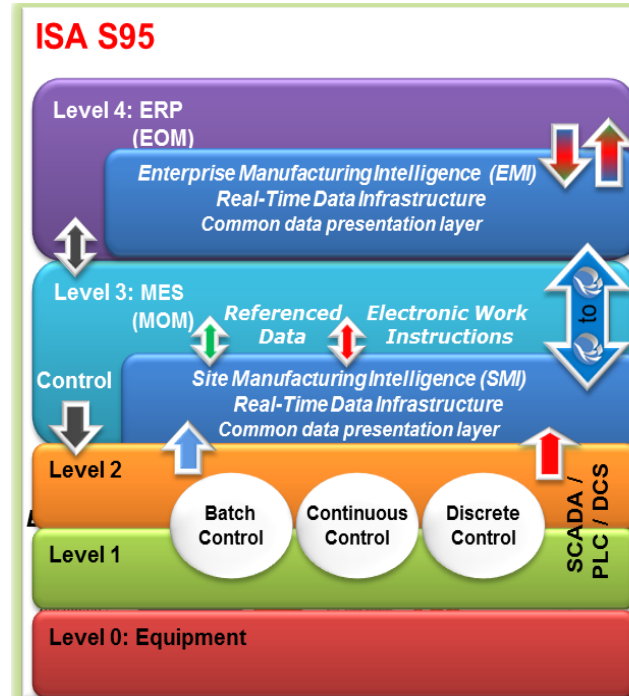


Unified Real-time Infrastructure



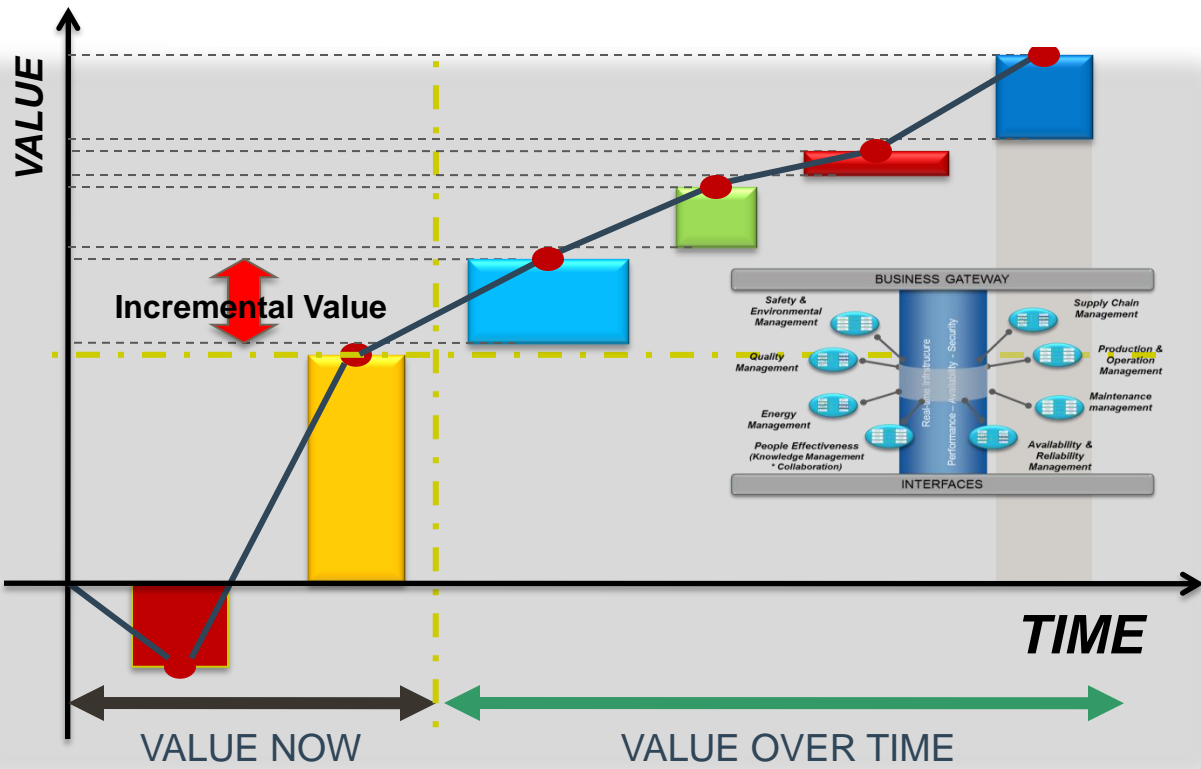
Common Data Presentation Layer

- ✓ Aggregation
- ✓ Normalization
- ✓ Contextualization
- ✓ Analysis
- ✓ Visualization
- ✓ Propagation



Evolutionary Approach to MOM and EOM

Starting with a PI System Infrastructure – „Best of Breed“



- Performance Management
 - Environmental Reporting
 - Equipment Health Mgmt.
 - Operations Management
- Infrastructure Configured Applications**

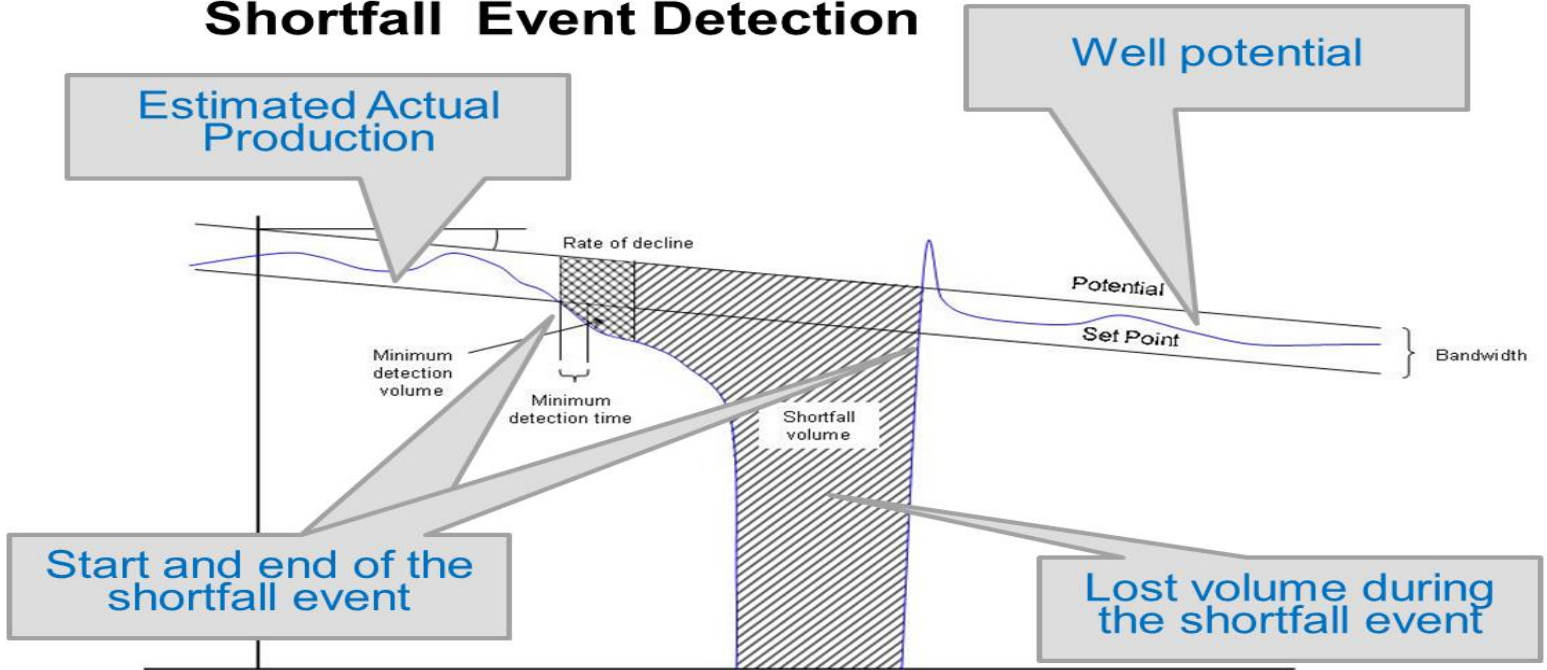
Infrastructure „Out of the box“ value

Infrastructure Installation

Lower Risk
Lower Cost

Application - Production Shortfall Event Detection

Shortfall Event Detection



Infrastructure for Applications

mu-Pilot - PI System Explorer

File Edit View Go Tools Help

Database Query Date Back Check In New Element New Attribute

Elements

1002

General Child Elements Attributes Ports Version

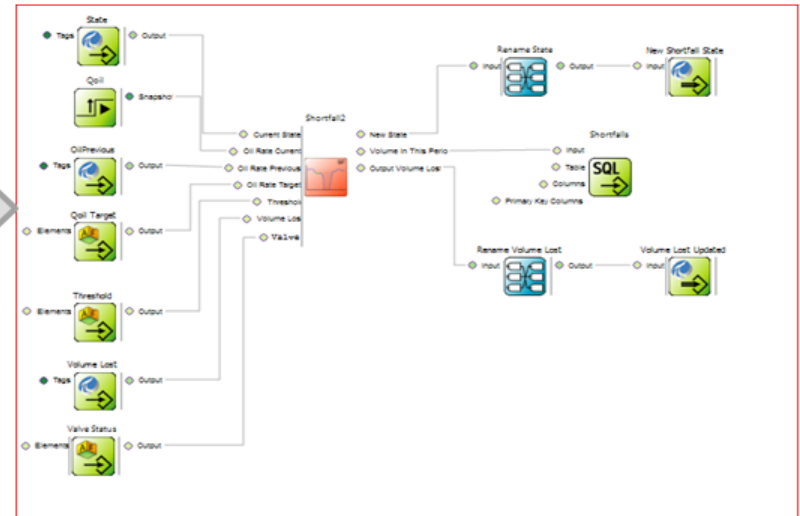
Group by: Category

Search

Name	Value
<None>	
Last Shortfall	
Poly Setting	
Production	
Qgas	1387.13721818932 KNm3/day
Qliq	3671.94795227888 Nm3/day
Qoil	2827.39992325474 Nm3/day
Qwater	5312.04728910328 Nm3/day
Shortfall	
Delta Qoil	-0.824131292981995 m3
Qoil Target	600 Nm3/day
Shortfall Status	Normal
Threshold	1.2 m3
Threshold Factor	0.2 %
Volume Lost	0 m3

Potential is retrieved from production database.

Shortfall calculation is a state machine triggered with each rate estimation.





Asset Safety, Reliability, and Performance Management

Evolutionary Asset Reliability Strategies

Strategic

- Internal Collaboration
- External Collaboration

Predictive

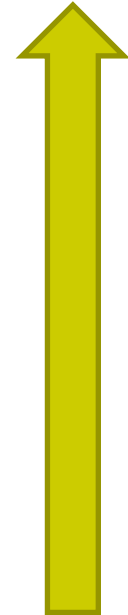
- Alert & notification
- Predictive analytics

Proactive

- Operations Equipment Effectiveness(OEE)
- Conditioned Based Maintenance (CBM)

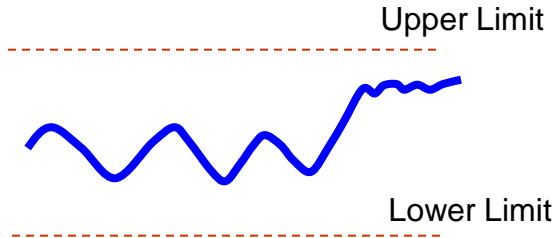
Reactive

- Improved Response
- Incident Investigation

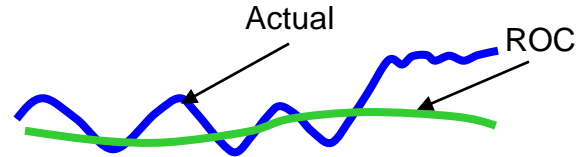


The PI System infrastructure enables an evolutionary approach to asset maintenance model based on budgets & organizational readiness

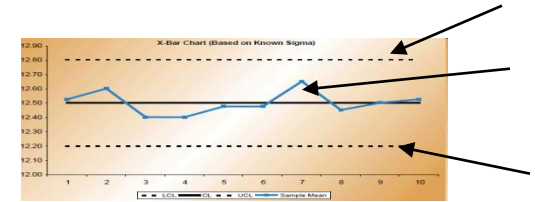
Traditional Conditioned Base Maintenance



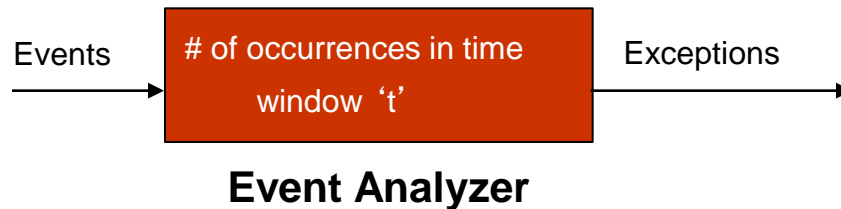
Engineering Limits



Rate Of Change (ROC)



Statistical Quality Control (SQC)



Data Used

- Trends
- Fluid analysis raw data
- Events (frequency of events)
- Real time streaming data (if available)

Decomposition of a Conditioned Based Maintenance Solution

Asset Management CBM "Solution"

Gather Asset Information

- Temperature
- Flow
- Pressure
- Vibration
- # of start/stops, etc.

Transform into "Condition" Information

- Efficiency (%)
- Design vs Actual
- Rate of Change
- Cycles per period

Perform Analysis Rules - CBM

- Time in Service
- Total Volume
- Performance DvA
- Max T or Vib

Perform analytics, visualization, propagation:

- KPIs
- Visuals
- Reports
- Applications

Integrate into work flow Systems

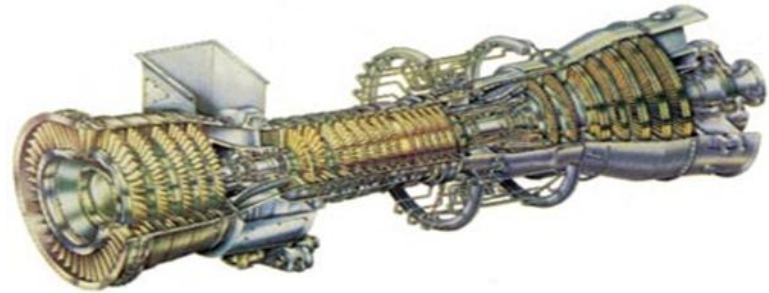
- (ie Maximo, SAP, Meridian)

Functionality Done in the PI System Infrastructure (Manufacturing Intelligence)

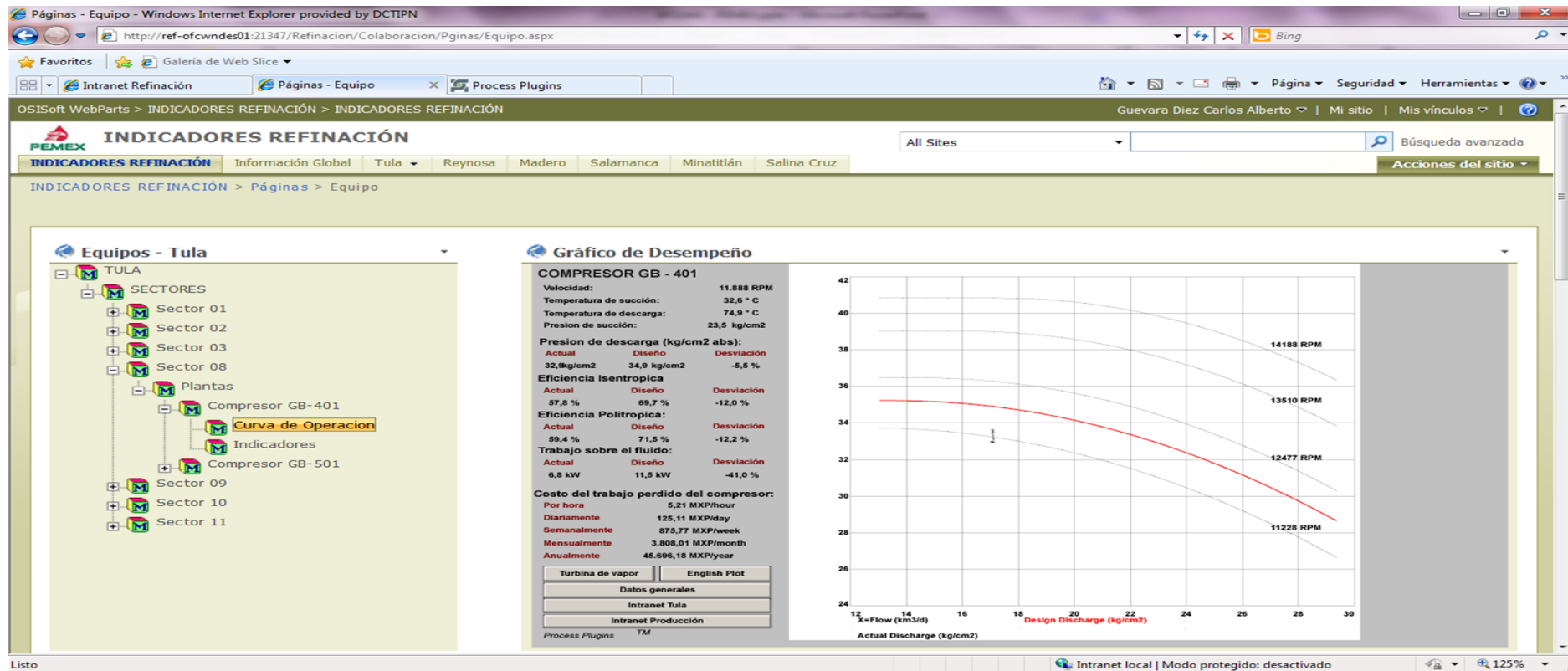
Leveraging the PI System for Asset Reliability

Thermodynamic Performance Monitoring of:

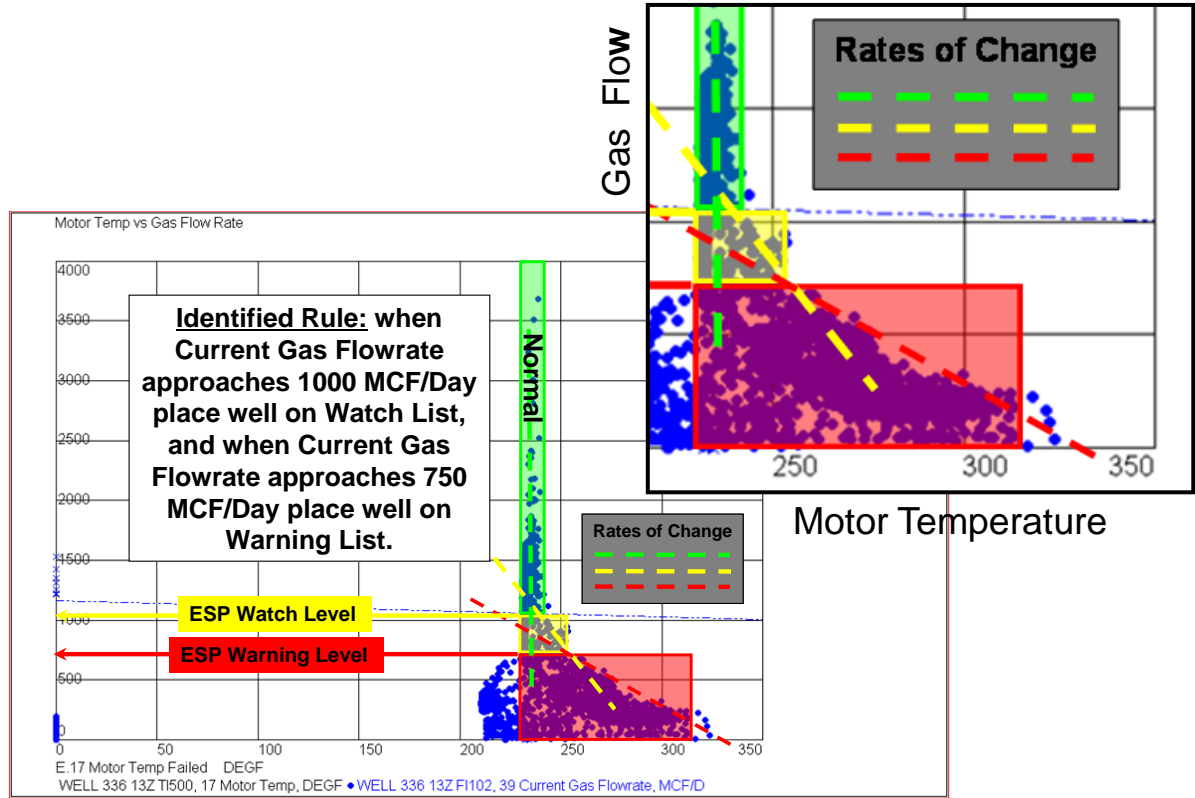
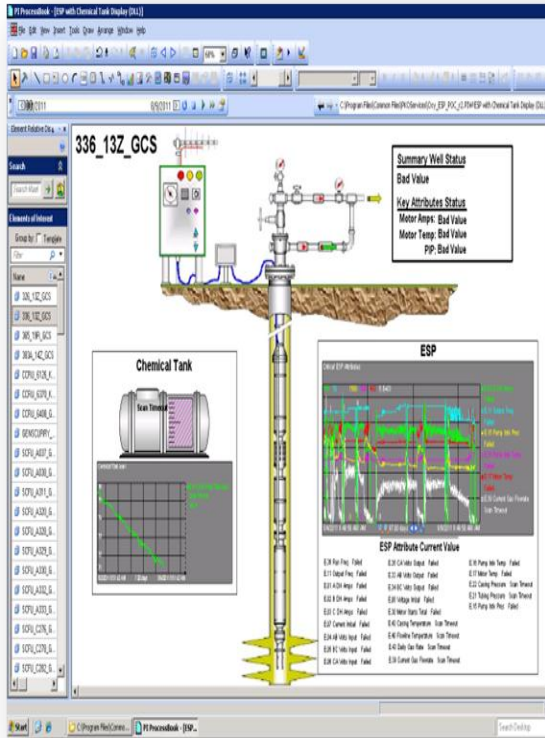
- Steam Turbines
- Gas Turbines
- Towers
- Compressors
- Heat exchangers
- Furnaces
- Pumps
- Wells



Real-Time Compressor Performance Monitoring



Electrical Submersible Pumps - CBM

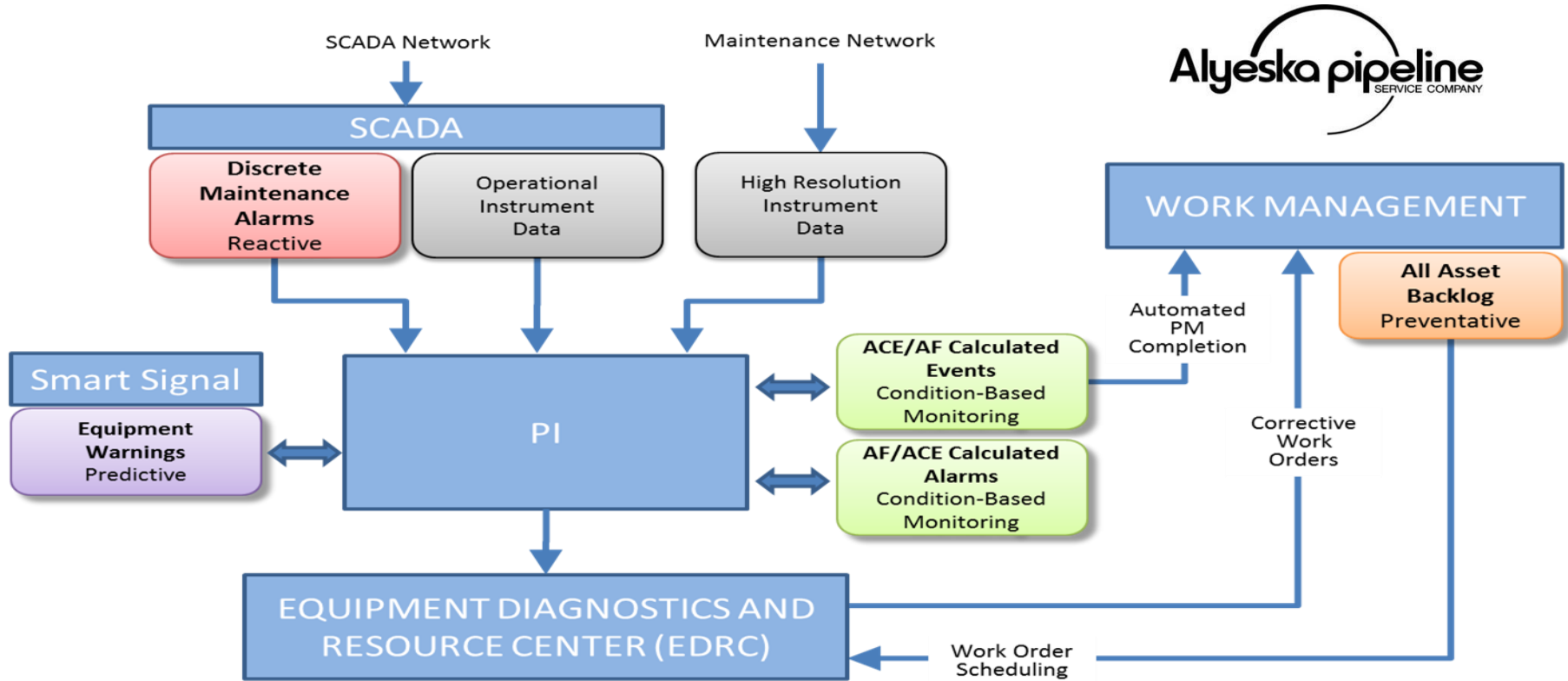


ALYESKA PIPELINE



- 800 miles long
- 48" diameter pipe
- 5 Pump Stations
- Marine Terminal
- 1.4 Million bpd operating capacity
- Logistics & Operations centers in Valdez, Anchorage, and Fairbanks

Strategic Use of the PI System - RCM





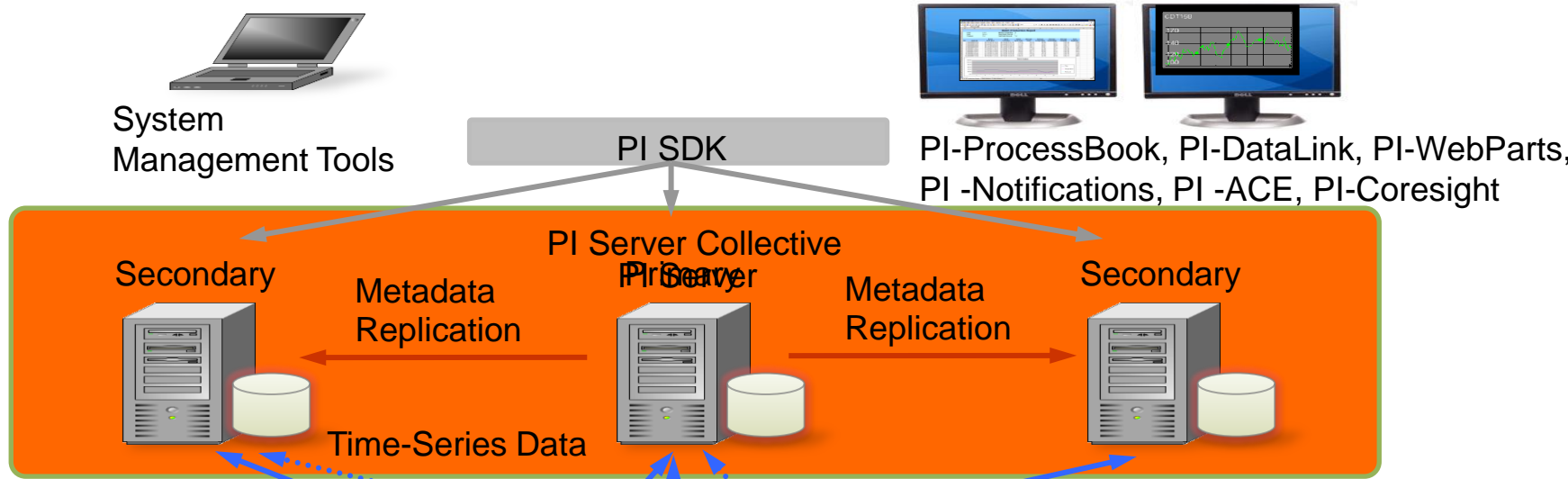
Cyber Security

Cyber Security Threats Are Growing

- Iran Nuclear Program (Stuxnet)
- Shamoon virus Aramco & RasGas
- Growing Momentum for critical infrastructure “protection”
- IT and OT “Ownership” Exacerbate Response
- PI System - provide “safe harbor” for real-time data & events

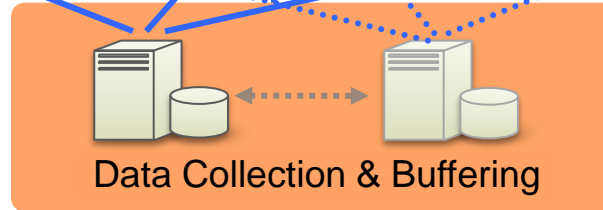


PI System High Availability Architecture



Flexibility to Address:

- Availability & Reliability
- Cyber Security
- Backup Strategy
- PI System "Ownership"
- Augmentation of DCS & SCADA

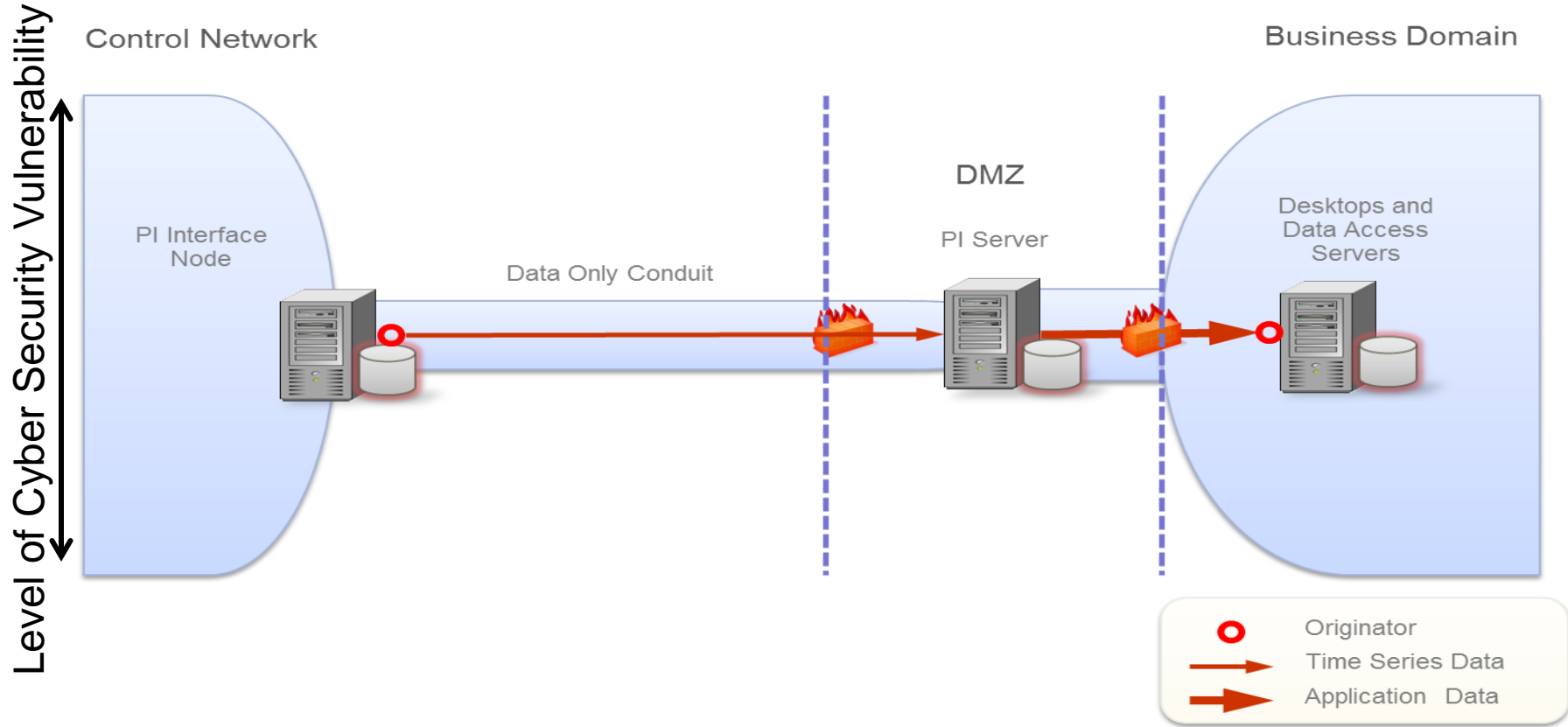


PINET3 Protocol

- Design for purpose interface
- Not a control protocol (no reliance on DCOM vulnerabilities)
- Inherently more reliable than OPC
- Simplifies firewall rules

Pattern 1: PI Server in DMZ

(Pattern 0 is no DMZ or Firewall –minimally recommended)

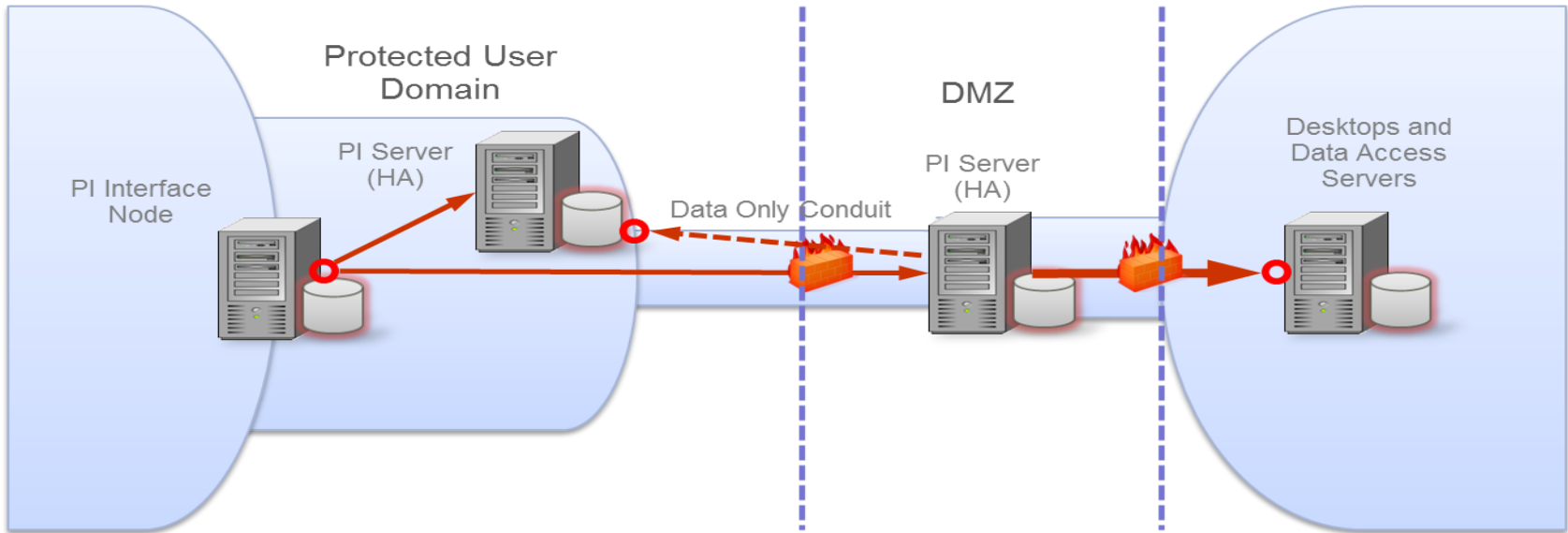


Pattern 2: PI High Availability

Recommend move to Pattern 2 or 3 once the system is mission critical to the business

Control Network

Business Domain



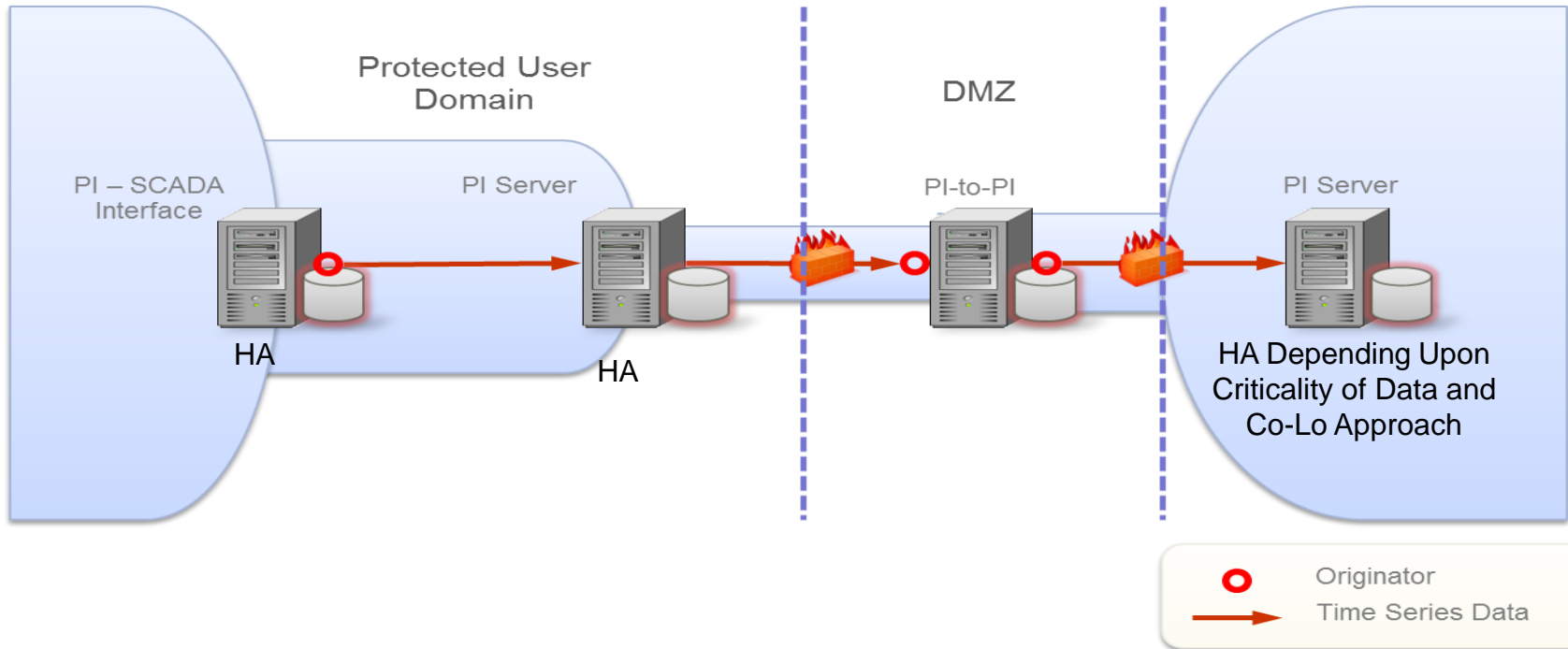
- ← - - - Configuration Data
- Time Series Data
- Application Data

Pattern 3: PI to PI Interface

Very popular and proven for compliance, fleet deployments

Control Network

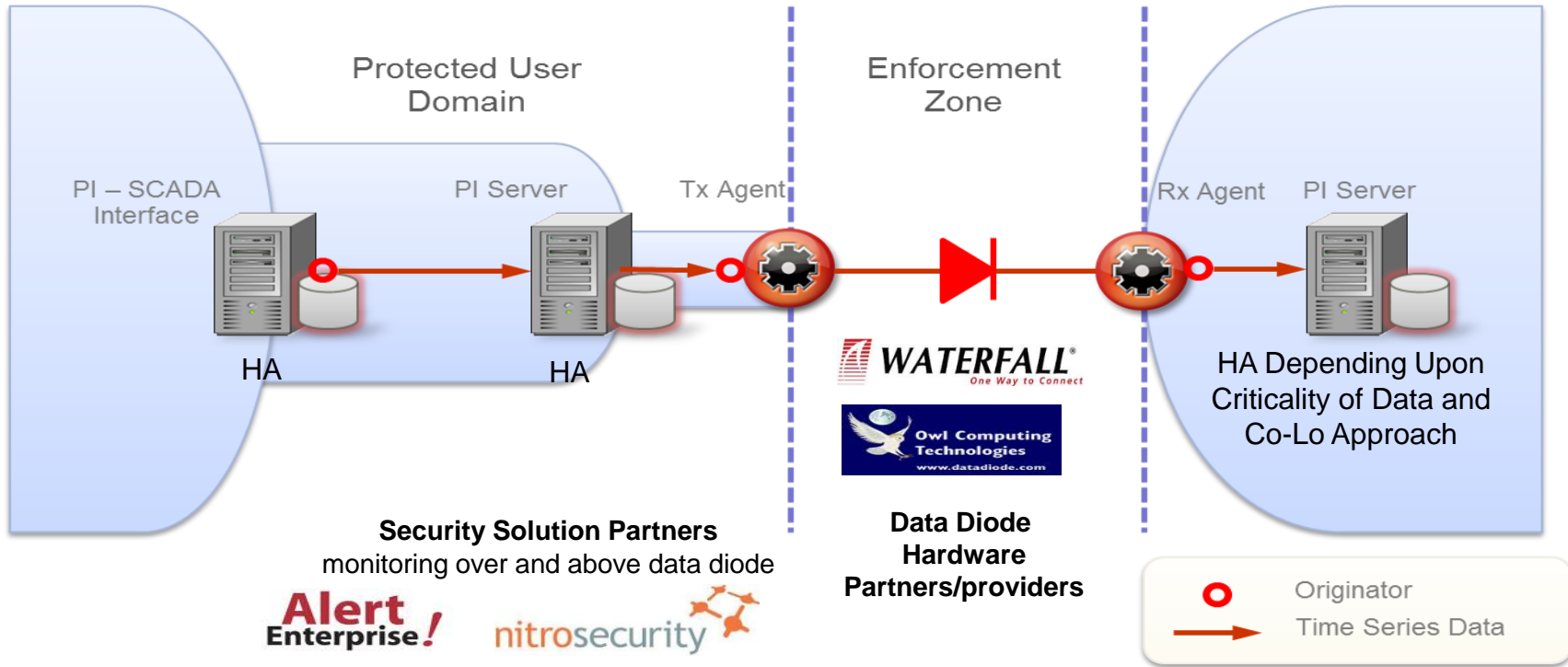
Business Domain



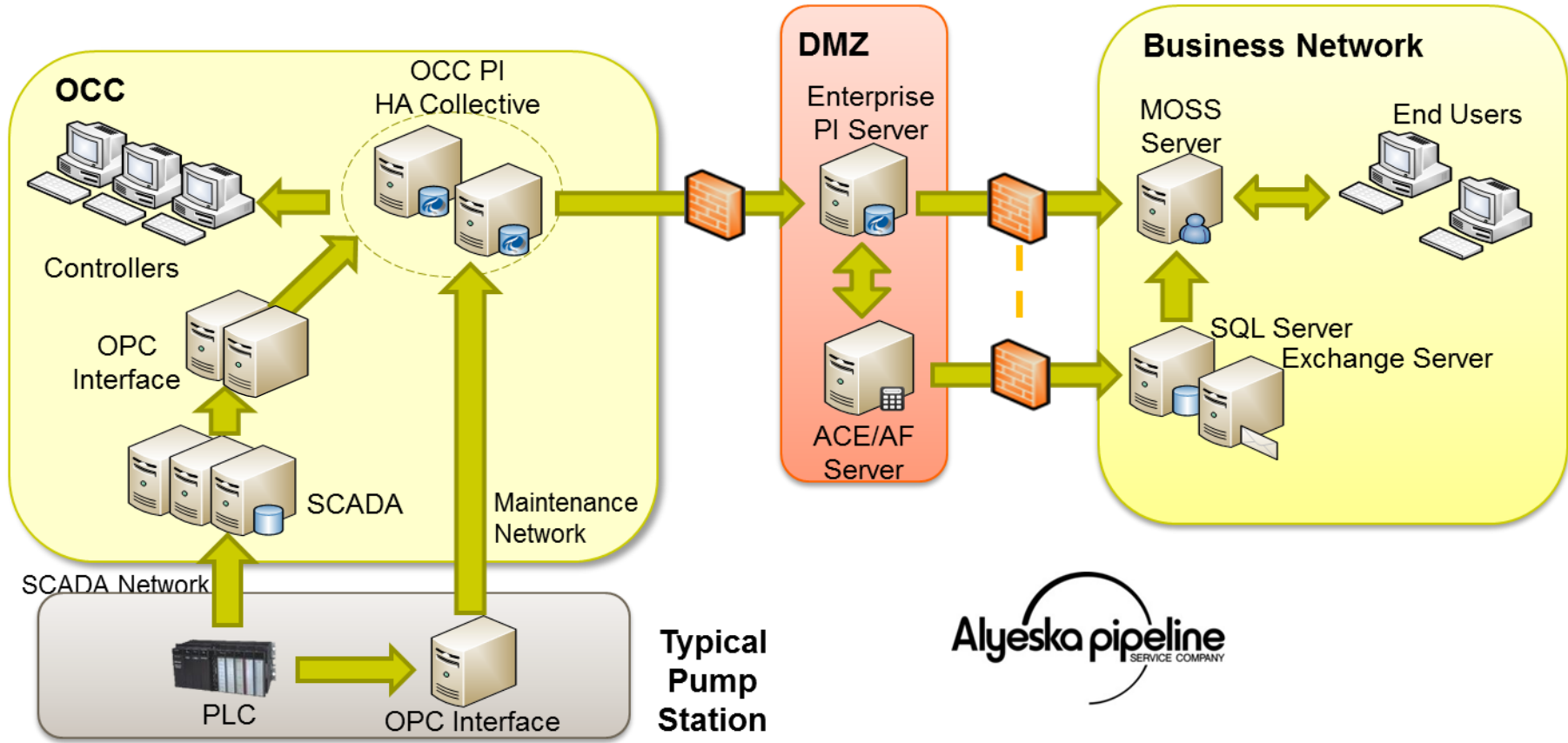
Pattern 3+: Absolute Enforcement

Control Network

Business Domain



PI System and Cyber Security (Pattern 2)



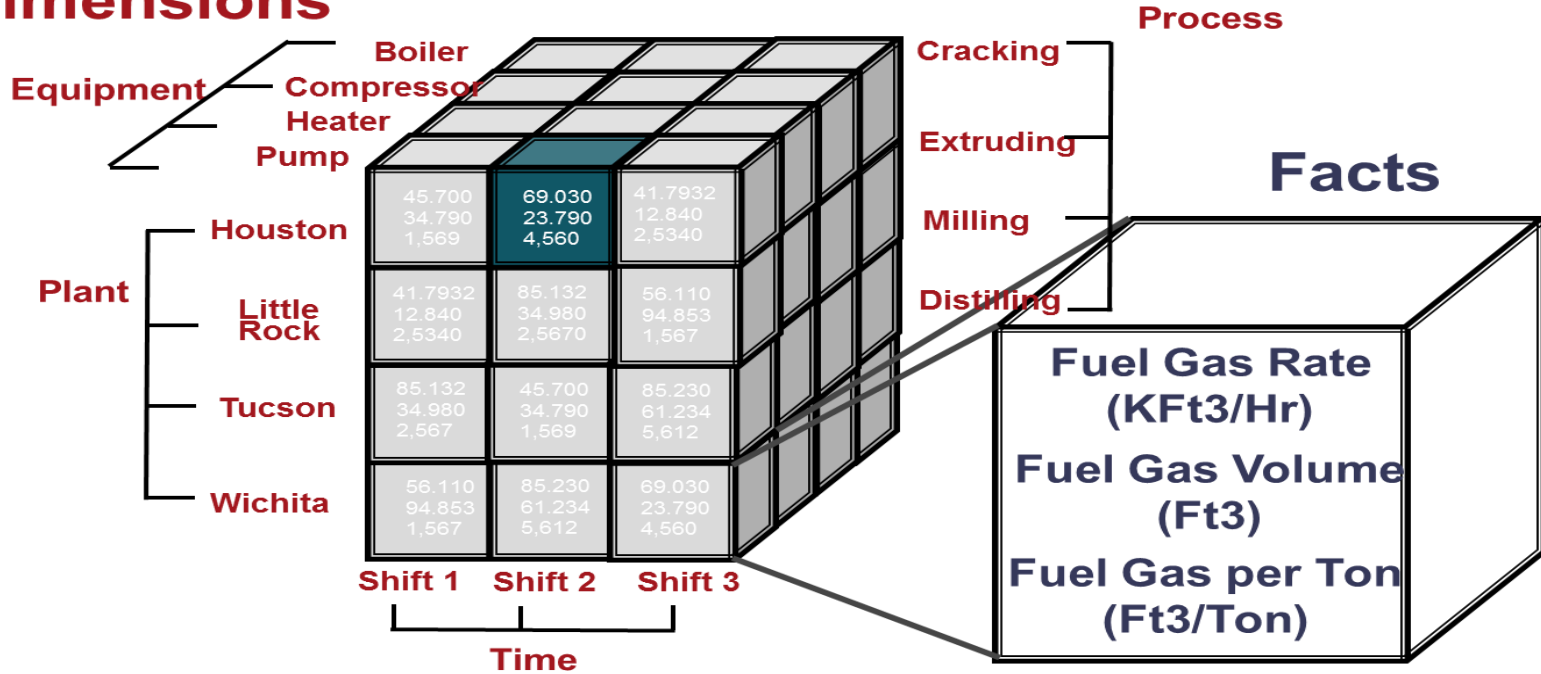


Business Integration and Intelligence (BII)



Multidimensional Analysis

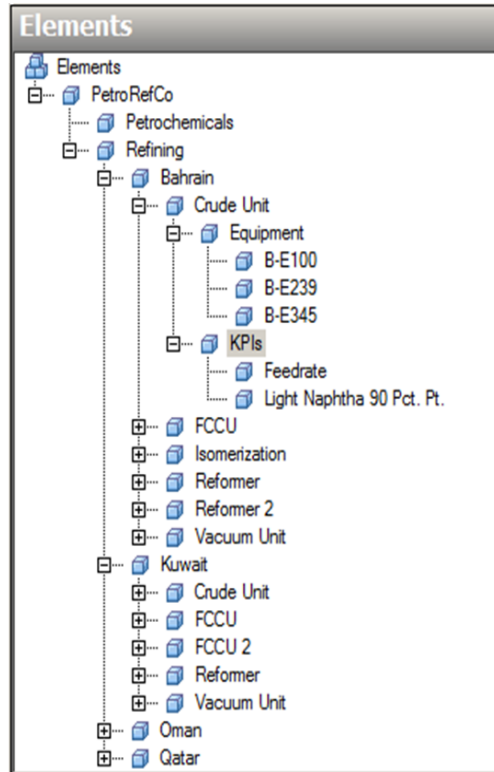
Dimensions



Operational Context

Asset Hierarchy

- Refinery
- Process
- Equipment
- KPI's



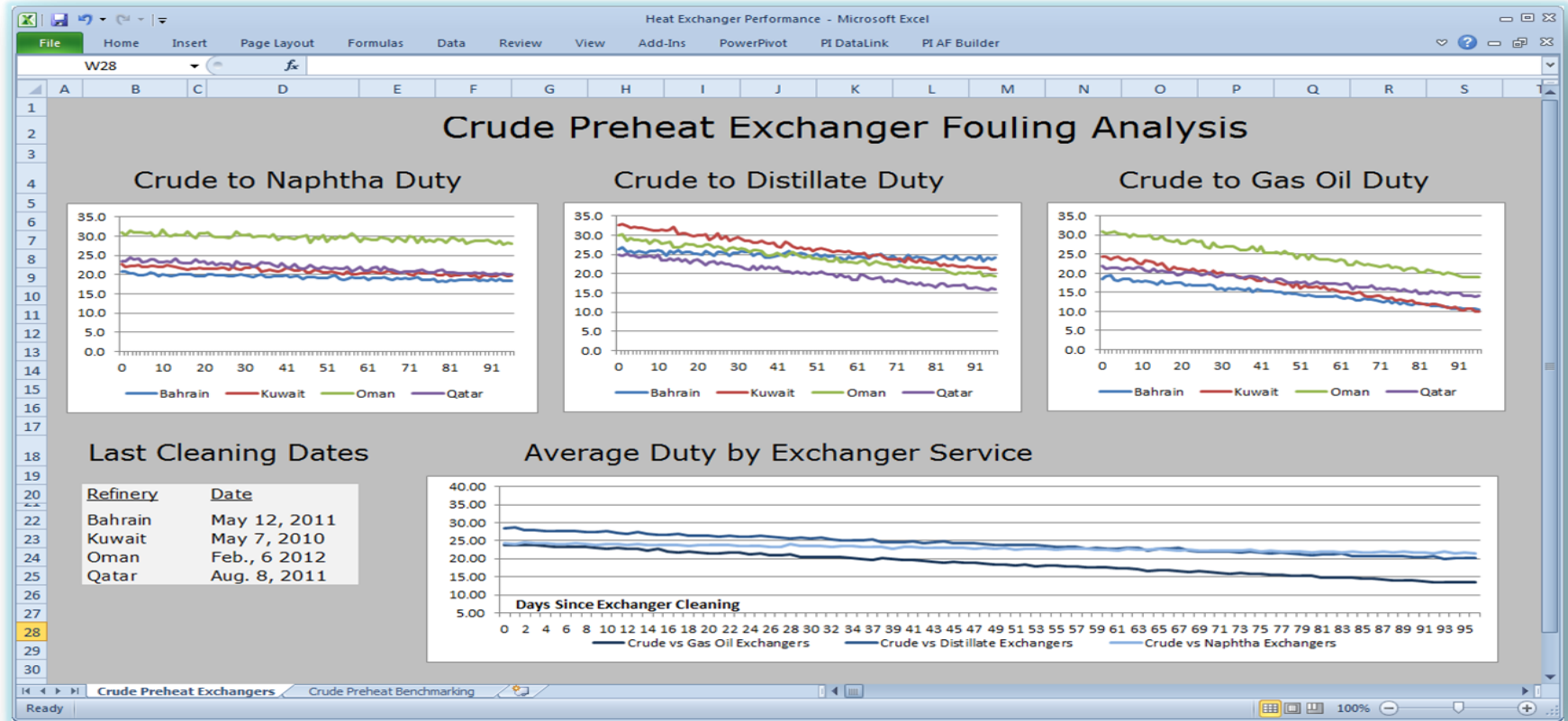
Asset Attributes

- Process Data
- Calculations
- Equipment Specifications

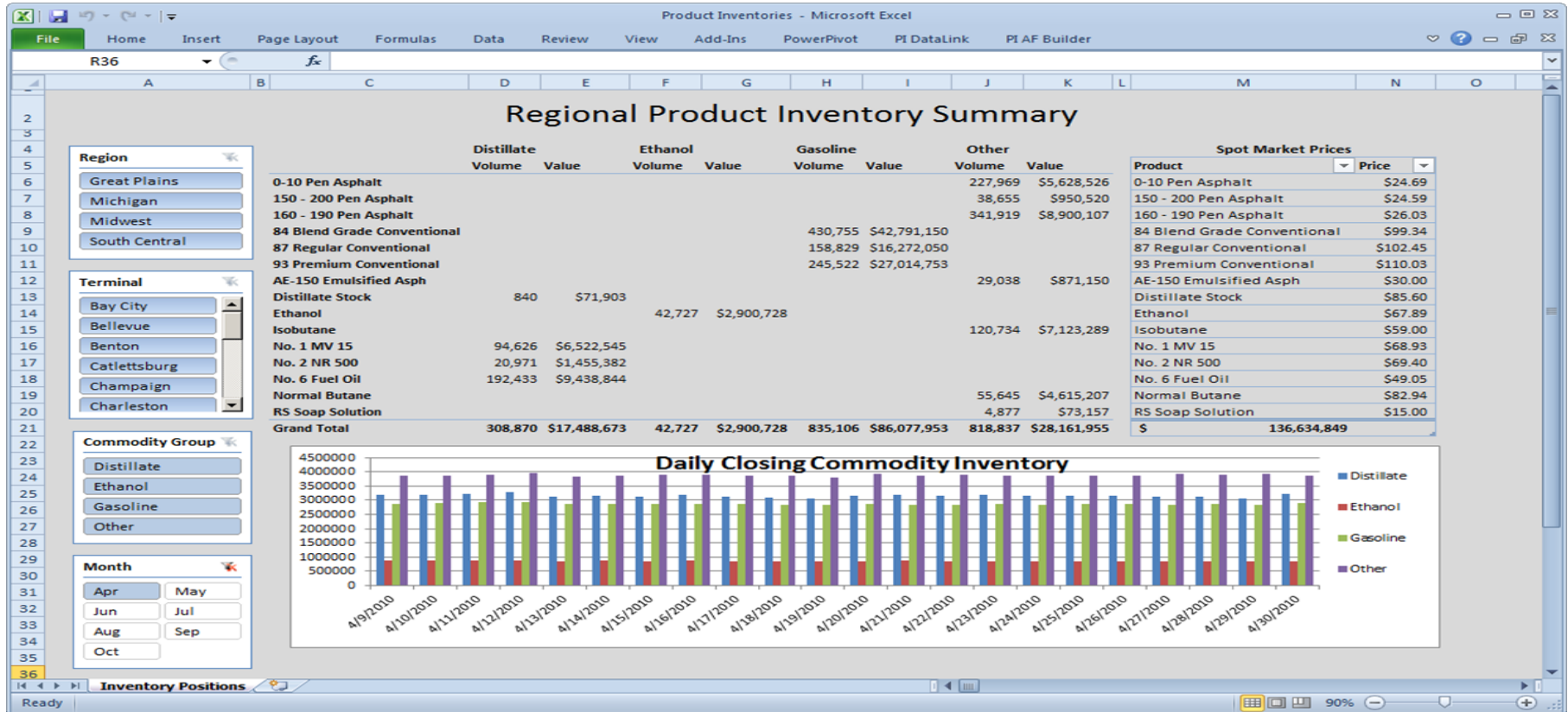
Elements

- Elements
 - PetroRefCo
 - Petrochemicals
 - Refining
 - Bahrain
 - Crude Unit
 - Equipment
 - B-E100
 - B-E239
 - B-E345
 - KPI's
 - Feedrate
 - Light Naphtha 90 Pct. Pt.
 - FCCU
 - Isomerization
 - Reformer
 - Reformer 2
 - Vacuum Unit
 - Kuwait
 - Crude Unit
 - FCCU
 - FCCU 2
 - Reformer
 - Vacuum Unit
 - Oman
 - Qatar

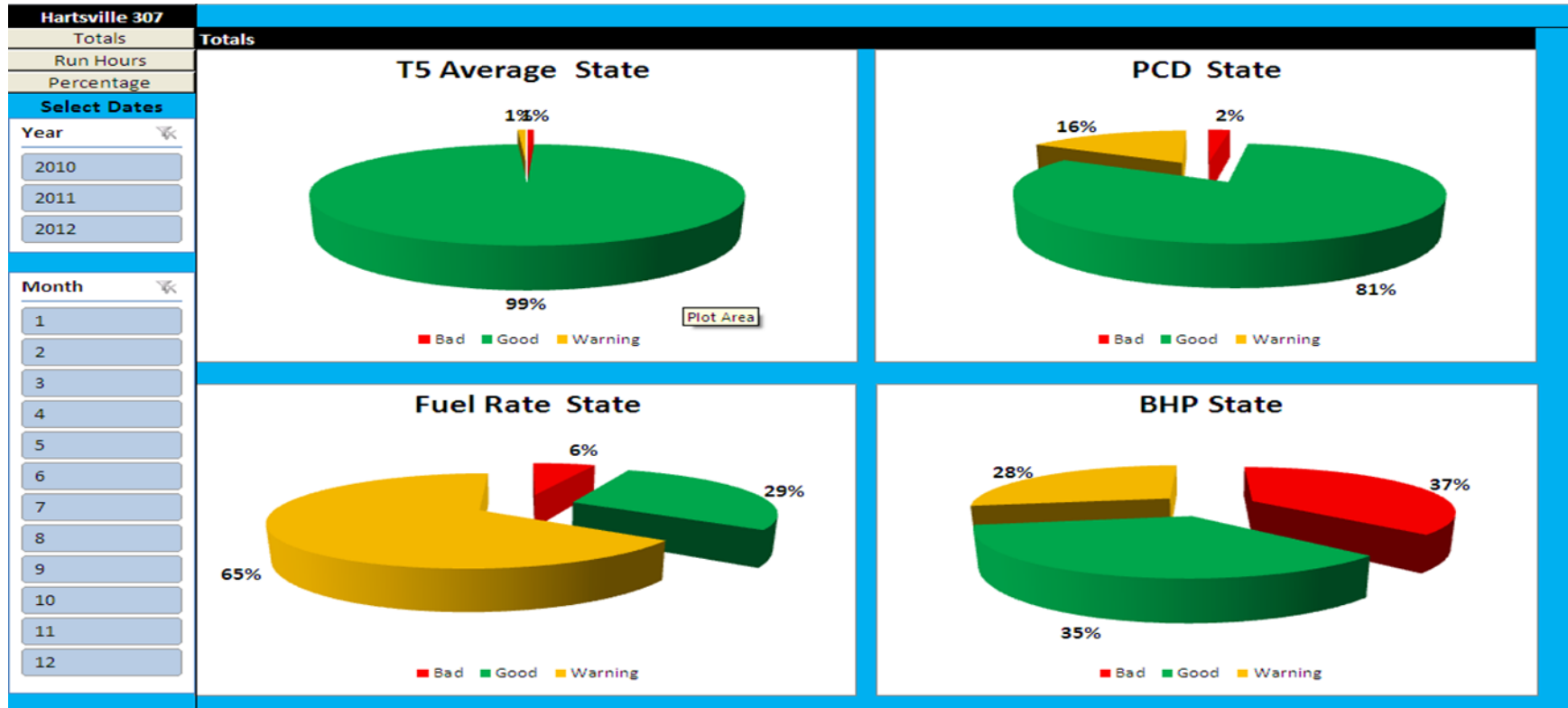
Crude Preheat Exchanger Fouling Analysis



Product Inventory BI

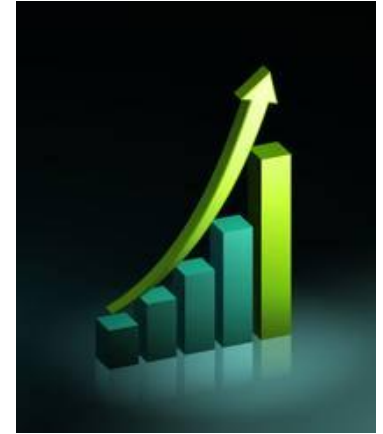


NiSource Example of PI-AF Based BI



From Tactical to Strategic

- Global O&G Issues and Response Themes
- Strategic PI System Value Trends in O&G
 1. Value Chain integration
 2. Infrastructure for MES/Solutions
 3. Asset reliability and Performance Management
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- Concluding Remarks





THANK YOU

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