PI System (and PI AF) – Enabling Business Transformation

The Journey from Refinery Business Unit to Group Downstream Level...and the Enterprise

Presented by **Tibor Komróczki (remote)**

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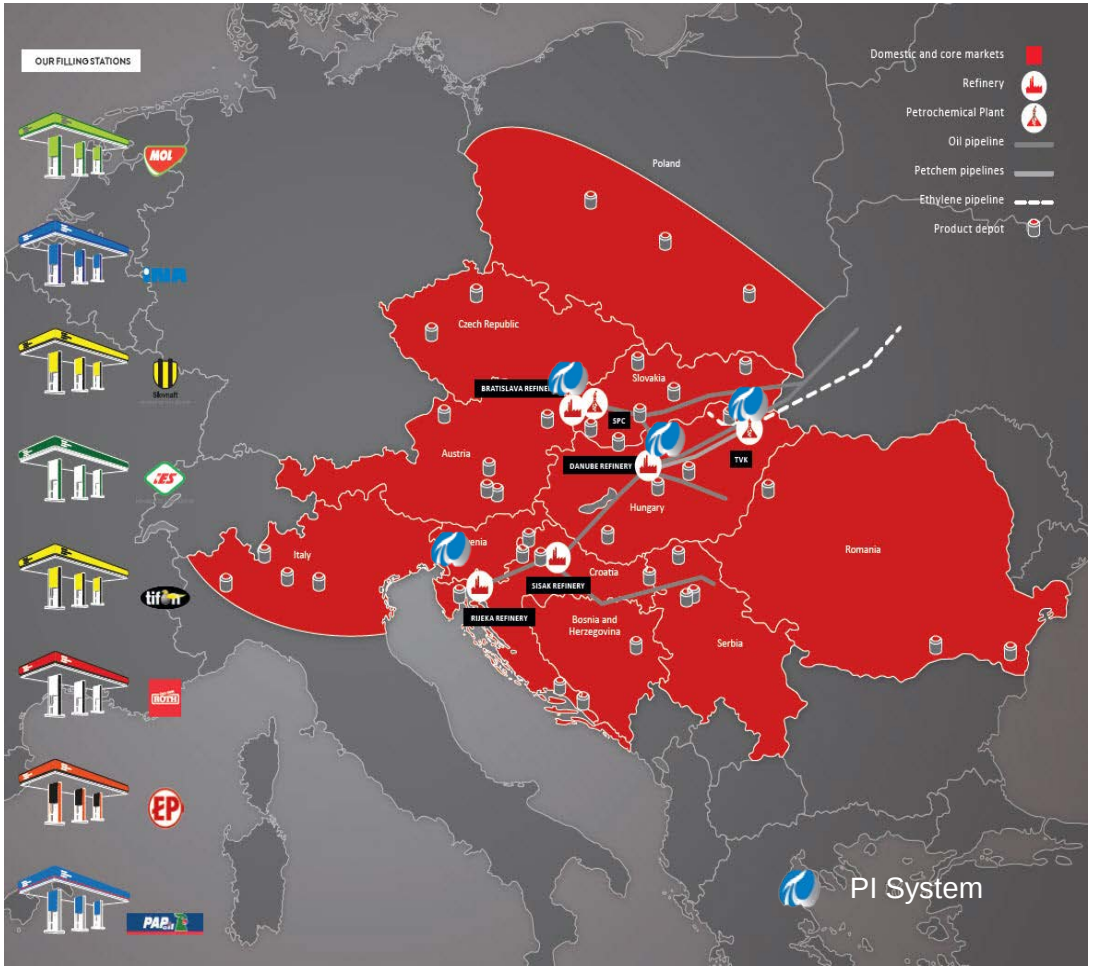
MOL Group Downstream

- 6 production units
- ~500KBPD refining capacity
- 2.1 mtpa petrochemicals capacity
- >1,900 filling stations
- under 8 brands in 11 CEE
- 370 000 PI Tag capacity in 4 PI systems

Extensive use of PI AF

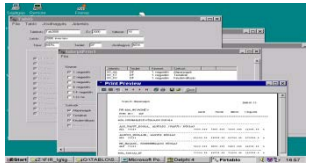
- > 6 500 Elements
- 70 Element templates
- 30 Event Frame templates
- 11 Notification templates
- ~ 105 000 Attributes



PI System Journey

PI System Evolution in MOL

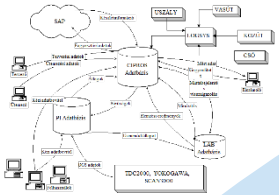
1998



Individual

Team

2002



2006

Division

2010

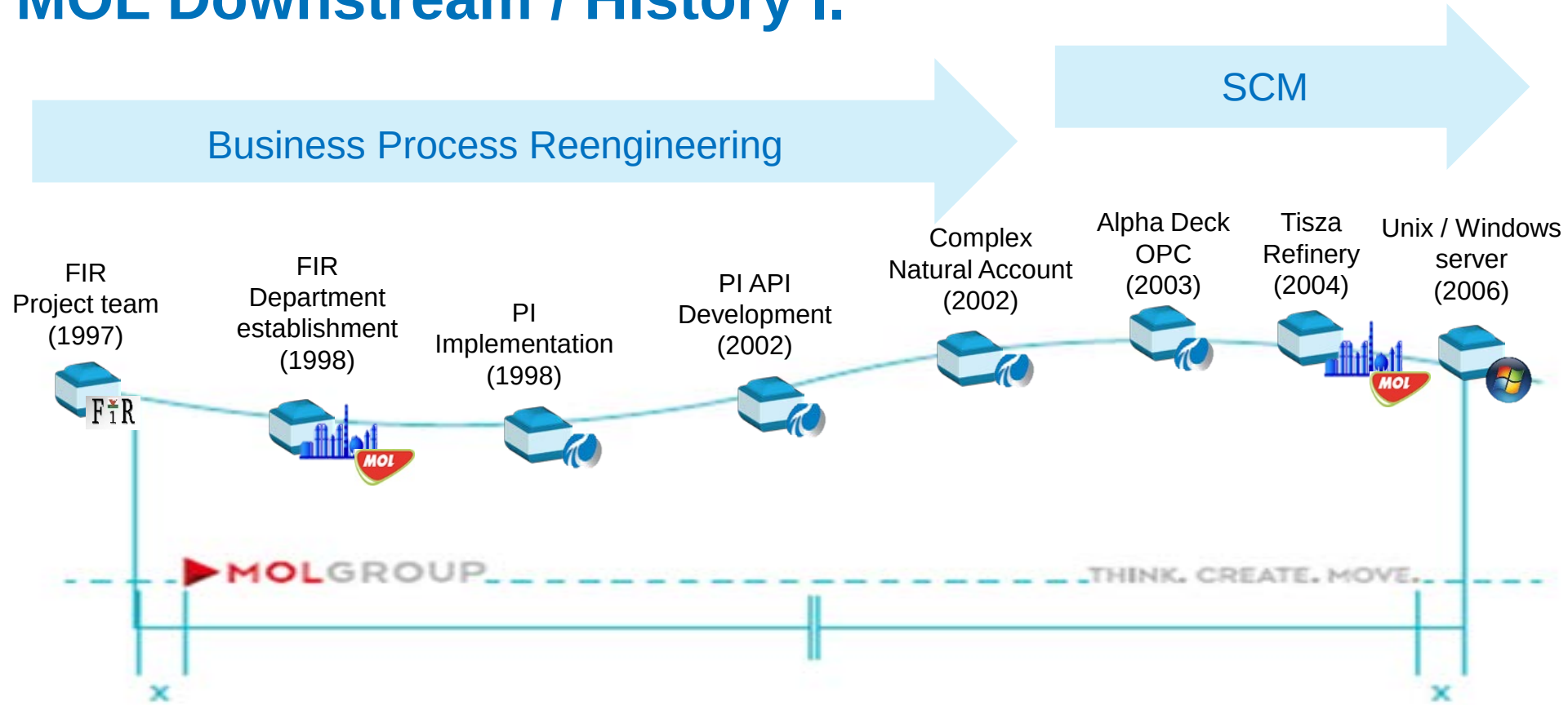
Enterprise

2015+

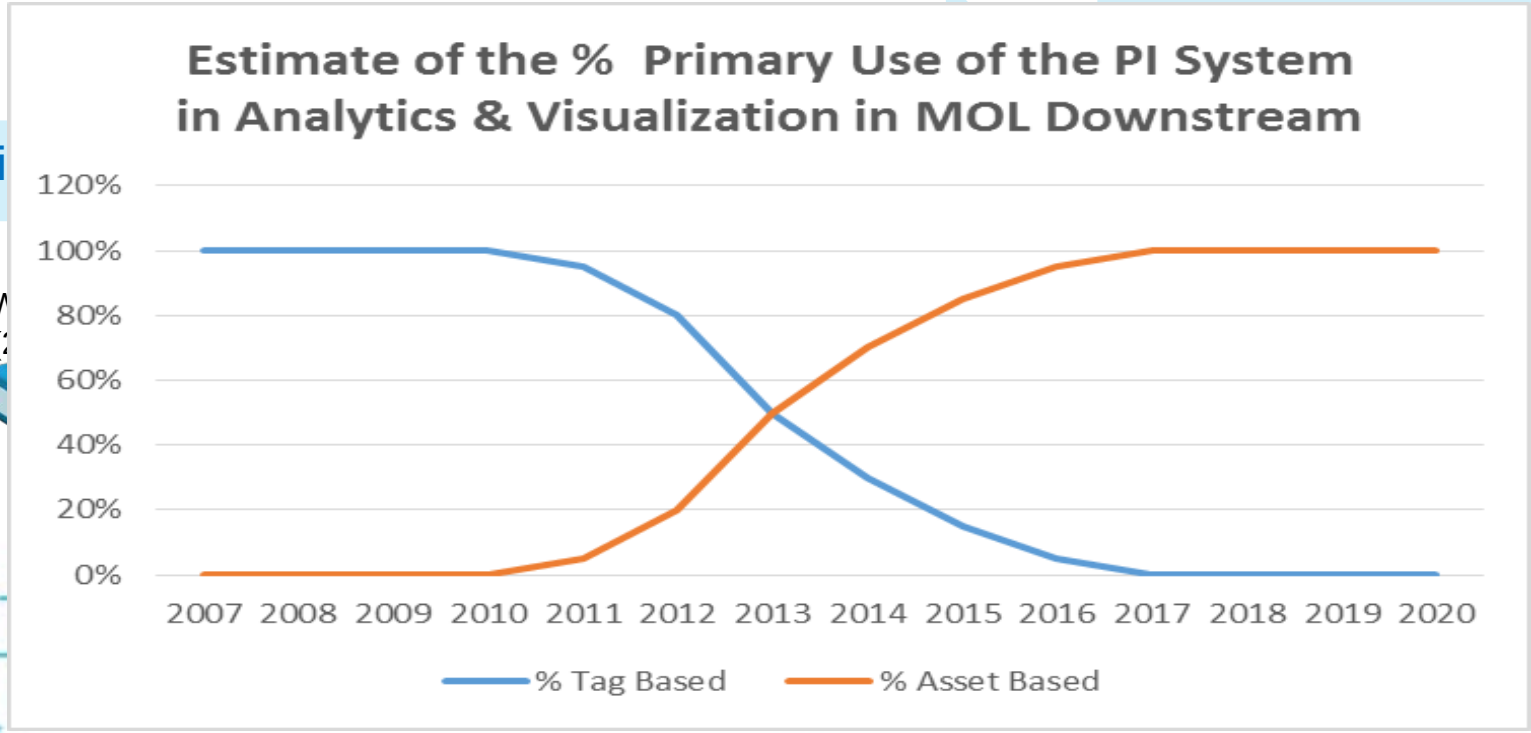
IoT

Machine learning

MOL Downstream / History I.



MOL Downstream / History II.



Visi

ogram

Slovnaft (2007)

Rt W

(

SN Upgrade (2015)

Tag Based

Asset Based

Focus areas of New Downstream Program (NDP)

NDS is targeting $500M-550M EBITDA improvement by 2016

MOL Downstream PI AF Based Applications

Safety and Asset Integrity

- Interlock statuses
- Operating envelopes
- Corrosion control (HTHA)
- Alarm management
- Control rooms' temperature

Energy

- Energy Monitoring and Management
- Energy KPI breakdown (6 tiers)
- Column Energy Efficiency Dashboards
- Hydrogen, Utilities, and Energy balances
- Flaring

Yields

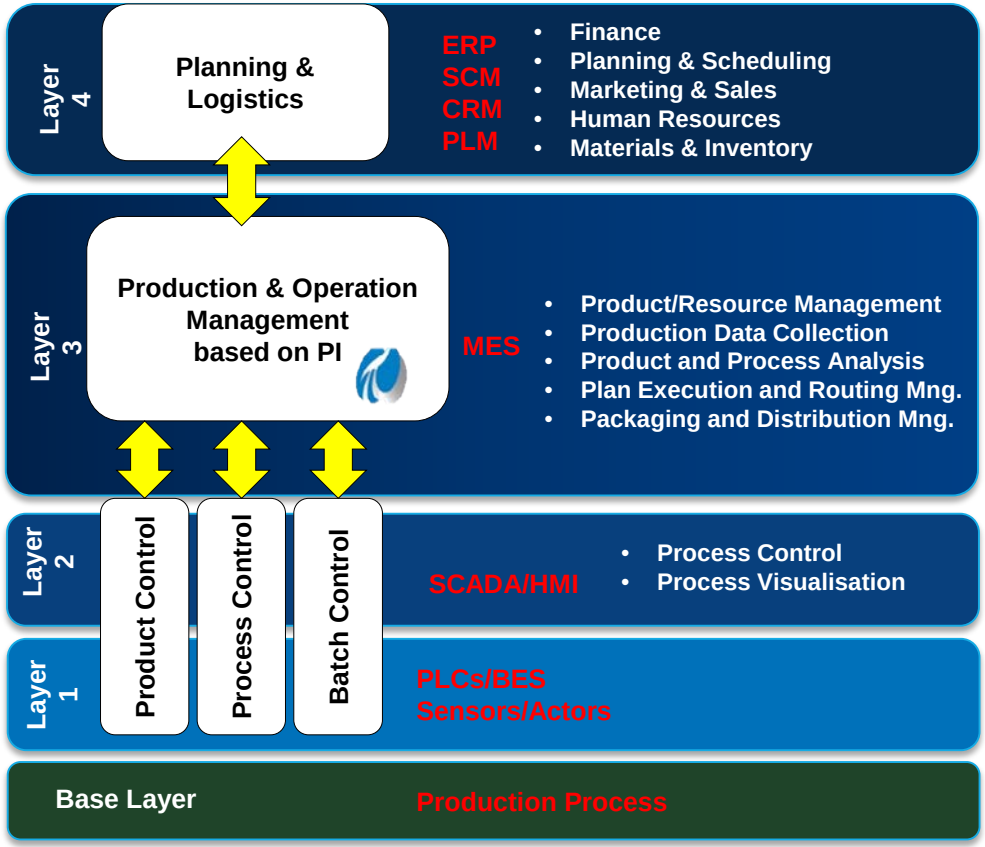
- Crude Blending Control
- Yield Optimization/Reporting
- Product Quality
- Analyser Reliability

Operational Optimization

- Plan vs Actual Analytics with Future Data
- NG and Fuel Demand gas forecasting
- Peak Electrical forecasting
- Normal mode of control loops
- APC monitoring
- PI AF and Sigmafine (PI AF) used for yield accounting & Material Movement

Integration

MES Standardization in MOL Group level



Separate group and local level responsibility

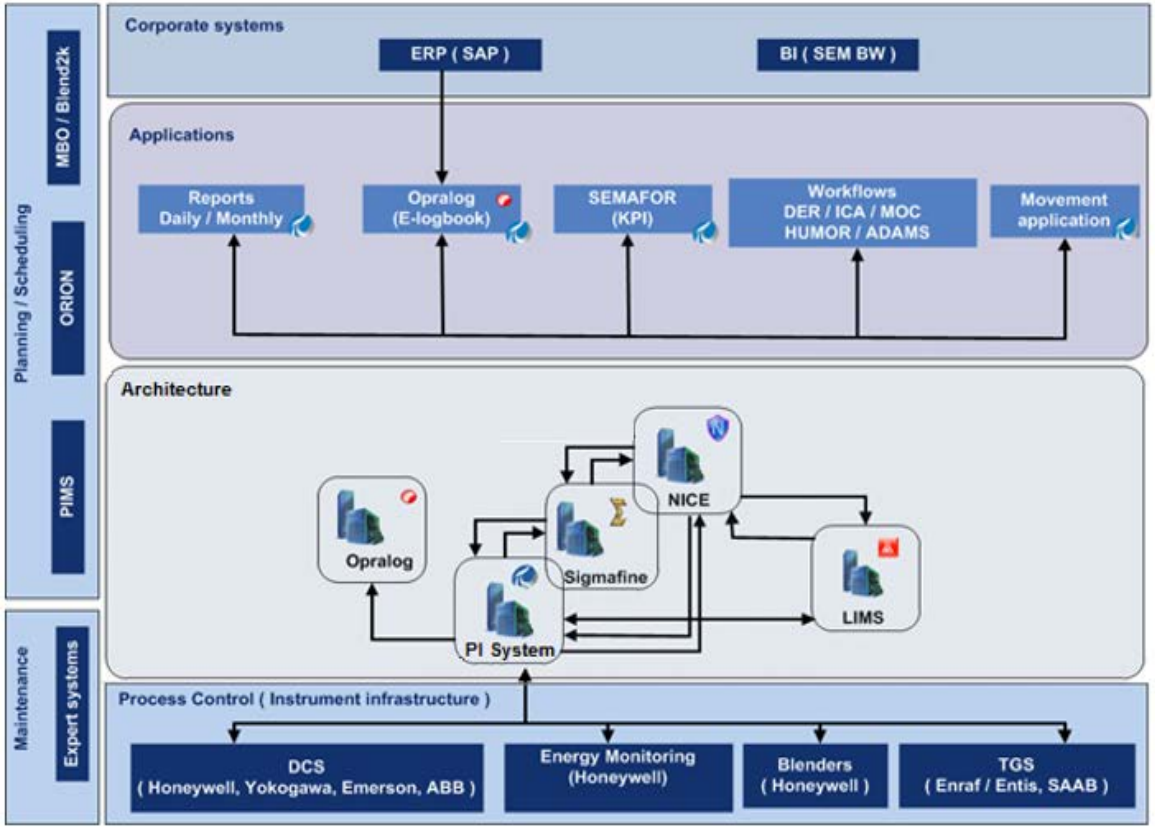
Determine standardization goals according to common principles

Establish unified software architecture based on PI system

Ensure equivalent PI system structure in MOL Group refineries

Create efficient contract management system with vendors (PI System as an Infrastructure)

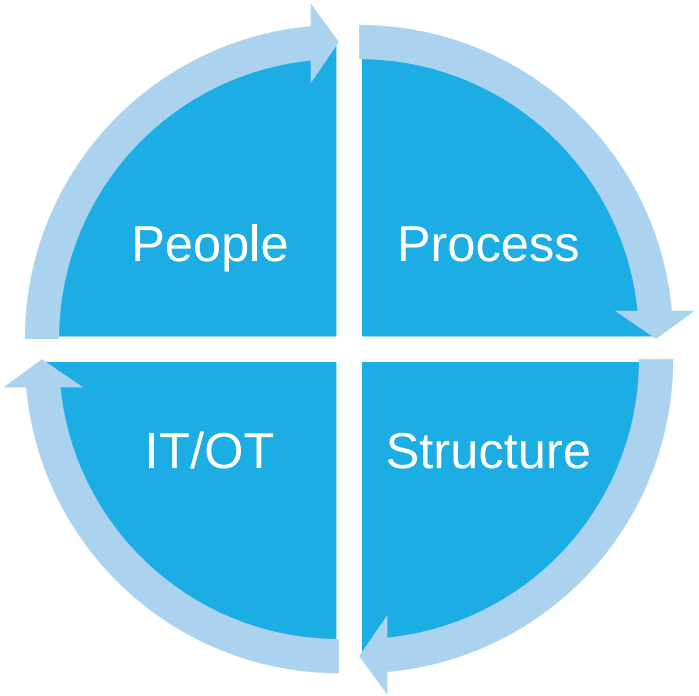
Danube Refinery MES portfolio



Software components

- PI System – **(PI AF is key)**
- Sigmafine(PI) (Reconciliation)
- LIMS (Laboratory)
- Opralog (E-logbook)
- SEMAFOR (KPI system)
- NICE (Natural Info –center)

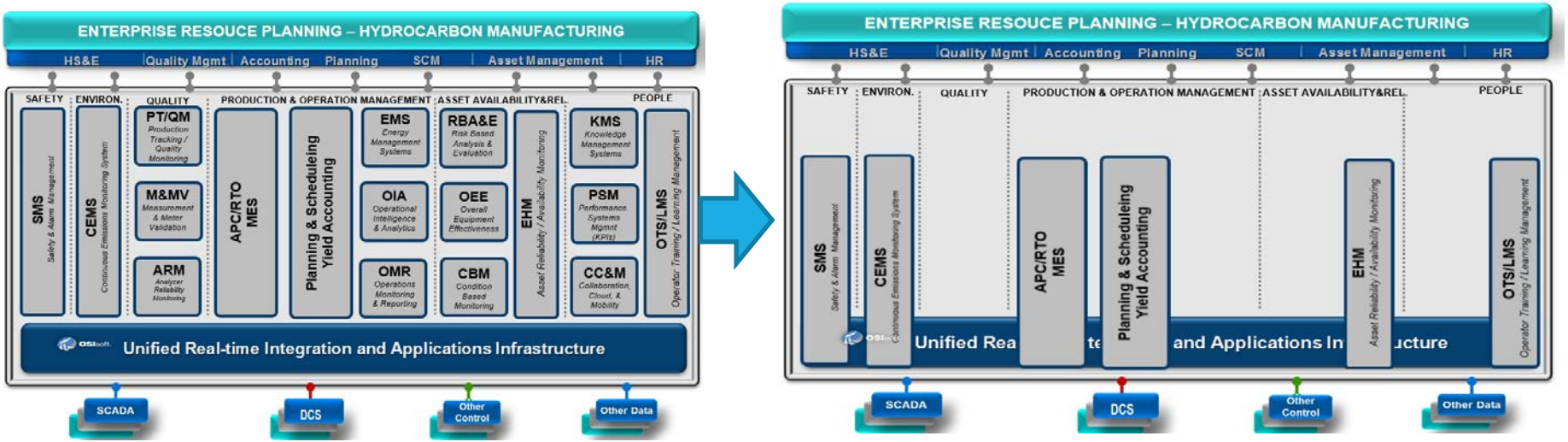
MES integration efforts - A Change Management Effort



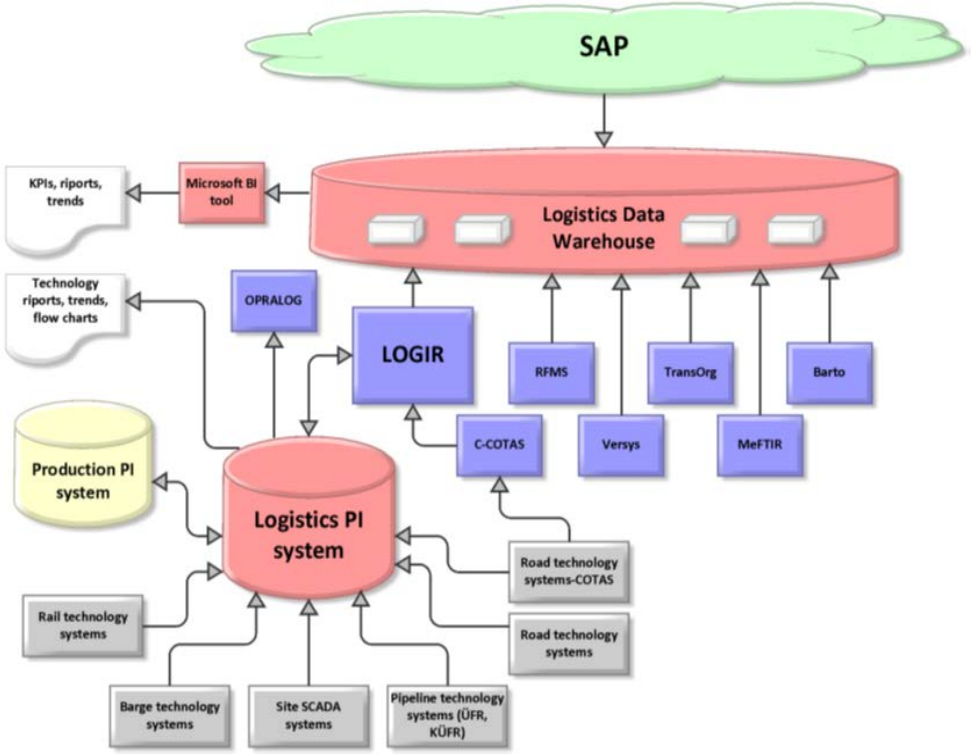
Main objectives

- Shape the strategy via four domains
- Merge Business and IS project goals
- Share ideas and resources
- Create long term plan
- Involve the following areas:
  Downstream, SCM, HSE, Logistic

Production (Refinery & Petchem) & Logistic standardization



MOL Logistics - Fuels Value Chain Integration



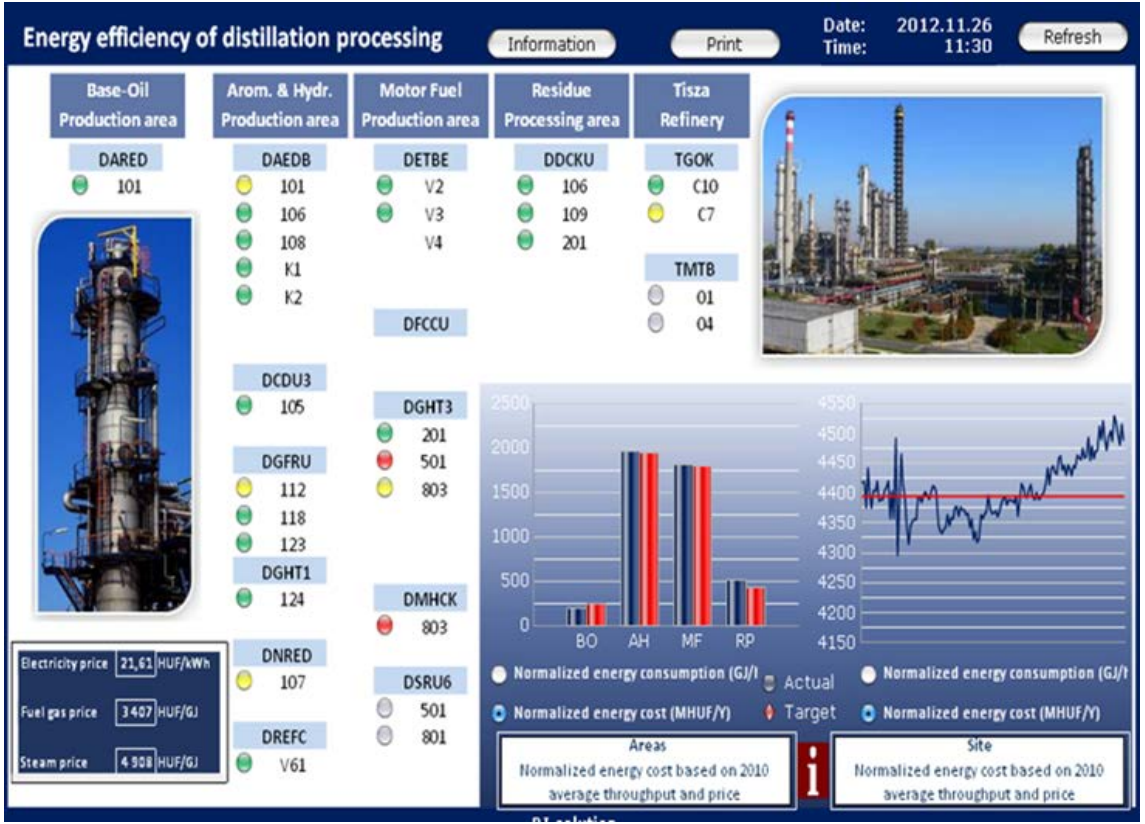
Project initiations

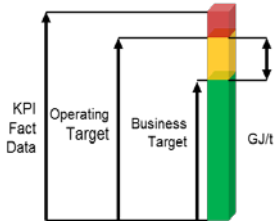
- Visualizing and monitoring logistics outside of SCADA
- Supporting preventive maintenance and asset reliability
- Ensuring KPI measurement across the fuels value chain
- Notification of events
- Holistic Inventory management and Optimization including MBDT*

*** MBST = Make-Buy-Sell-Trade Decision support**

Business Value Leveraging the PI System & PI AF

1- Energy Monitoring & Reporting



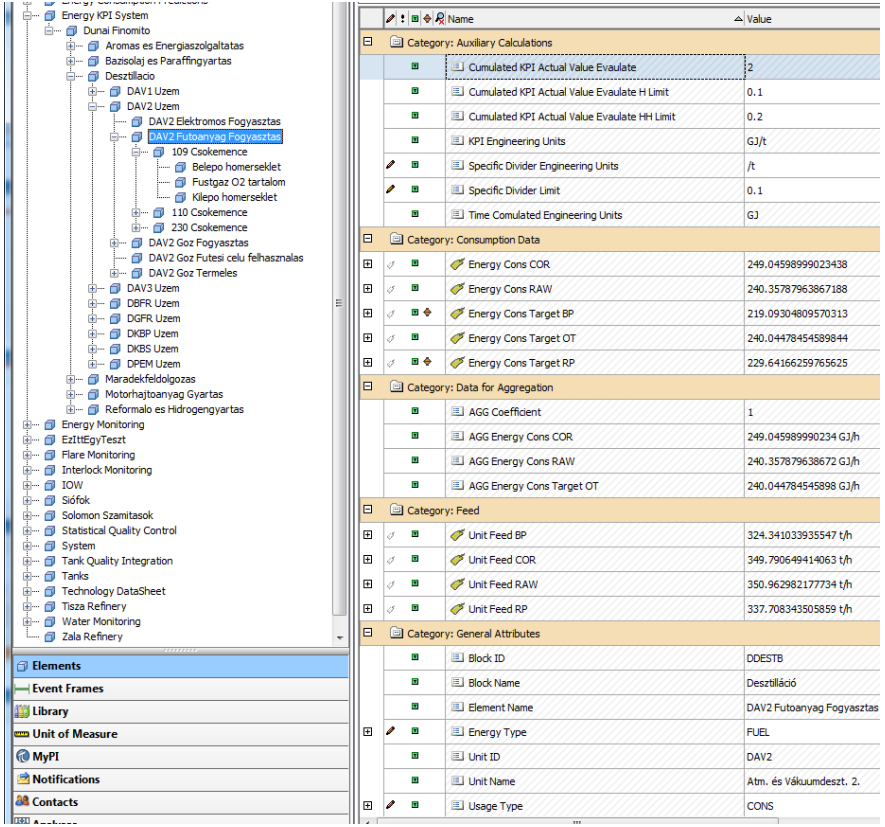


Benefits

- Continuous monitoring of the parameters
- Normalized, unified, and quality information leveraging PI AF
- Easy maintenance and Governance of the PI AF templates
- Structured format
- **Increased production** as a result of improved energy and environmental constraint visibility and forecasting

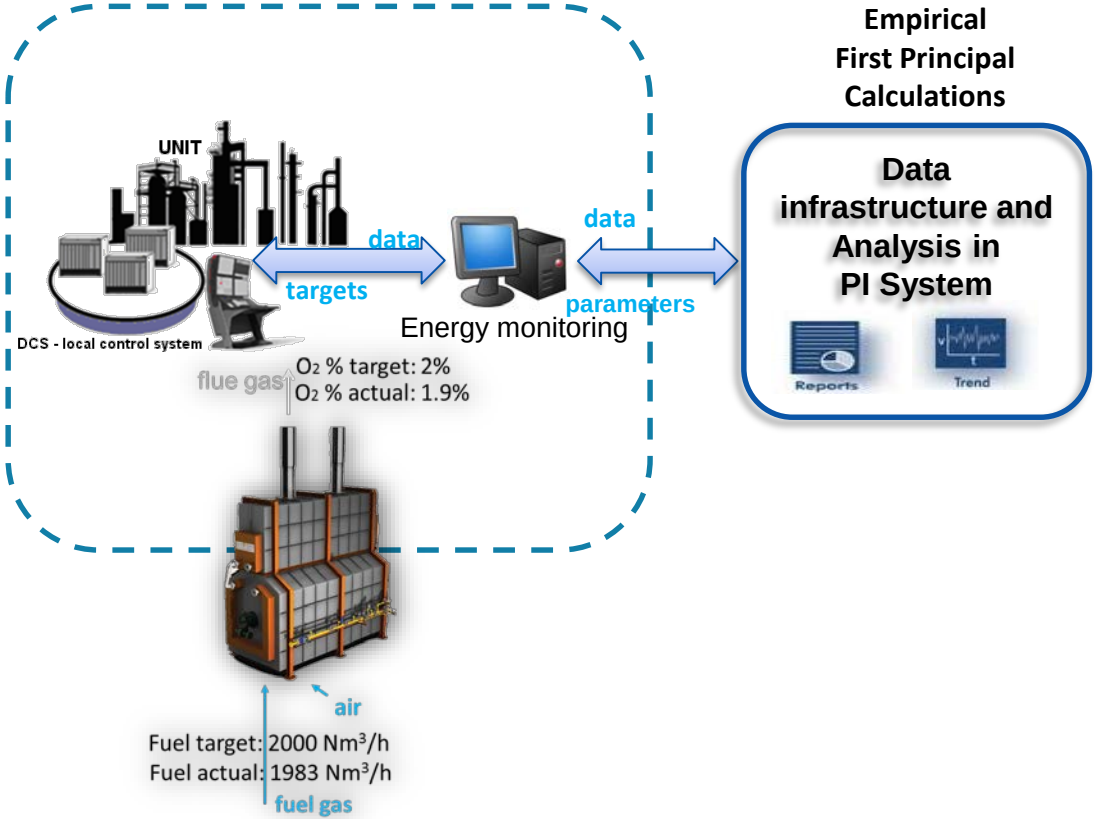
Templates of the Energy KPI System

- The structure of the Energy KPI System is based on element templates
- The parent and child elements are linked to each other
- The templates include the basic energy calculation

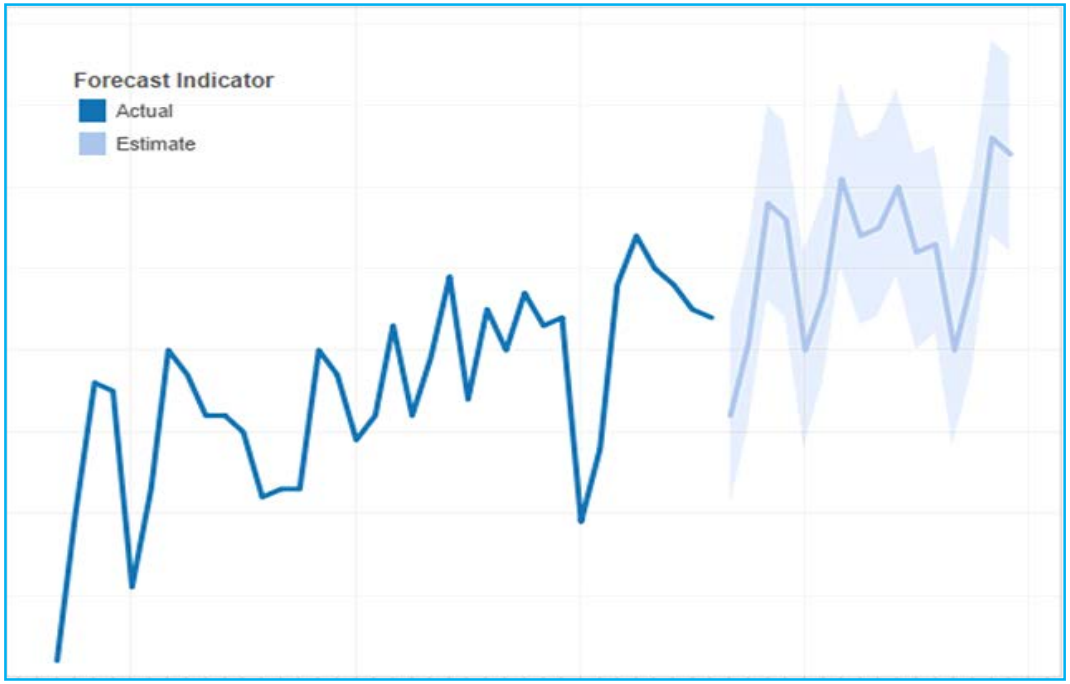


#2 Energy Monitoring & Management System (EMMS)

- On-line, open loop, model based (PI AF Based) EMMS system
- Calculates targets for assets, unit, and plant
- Detects excess energy consumption, and advises corrective interventions to the operators.
- The EMMS system helps to evaluate the operation of the units.



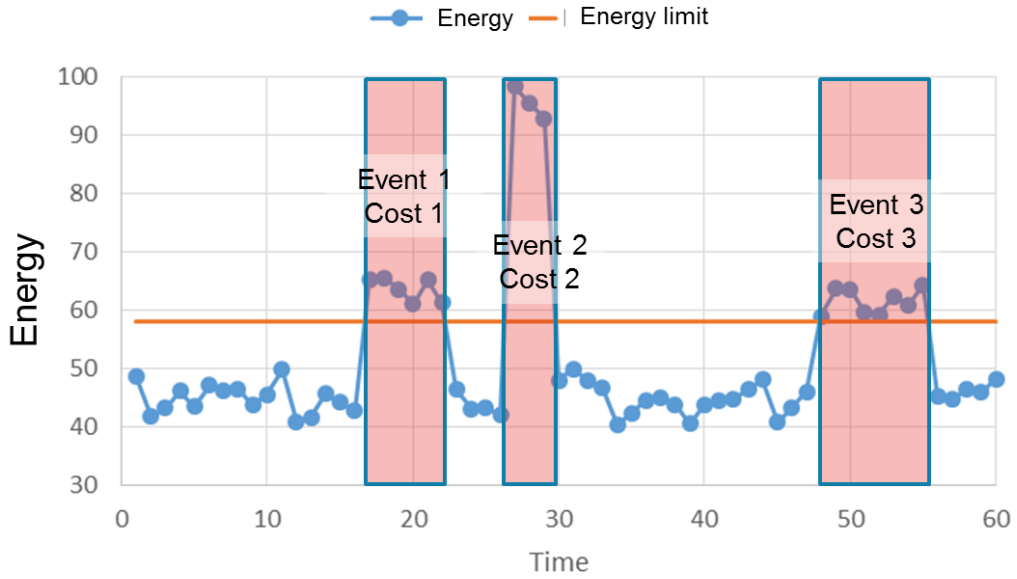
Energy Demand Forecasting with Future Data

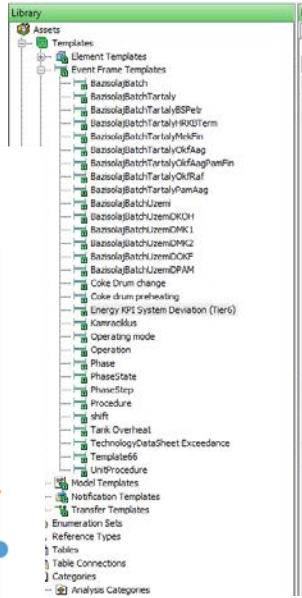


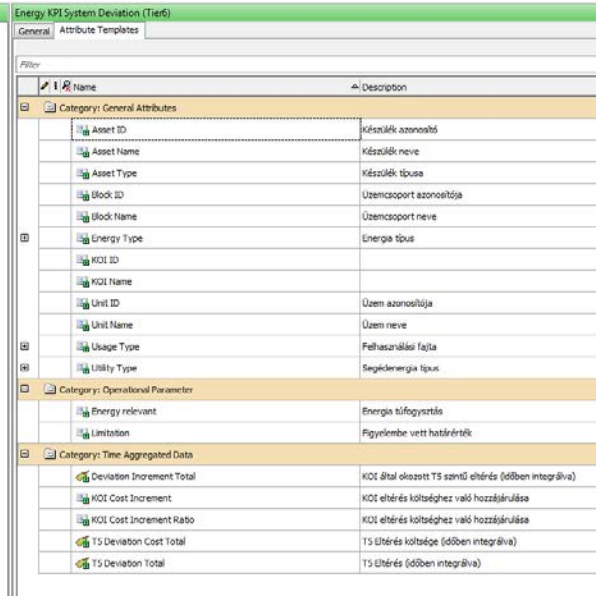
Improve energy trading by

- Collect real-time data
- Train energy consumption models
- Predict energy consumption based on production plan
- Monitor and update models

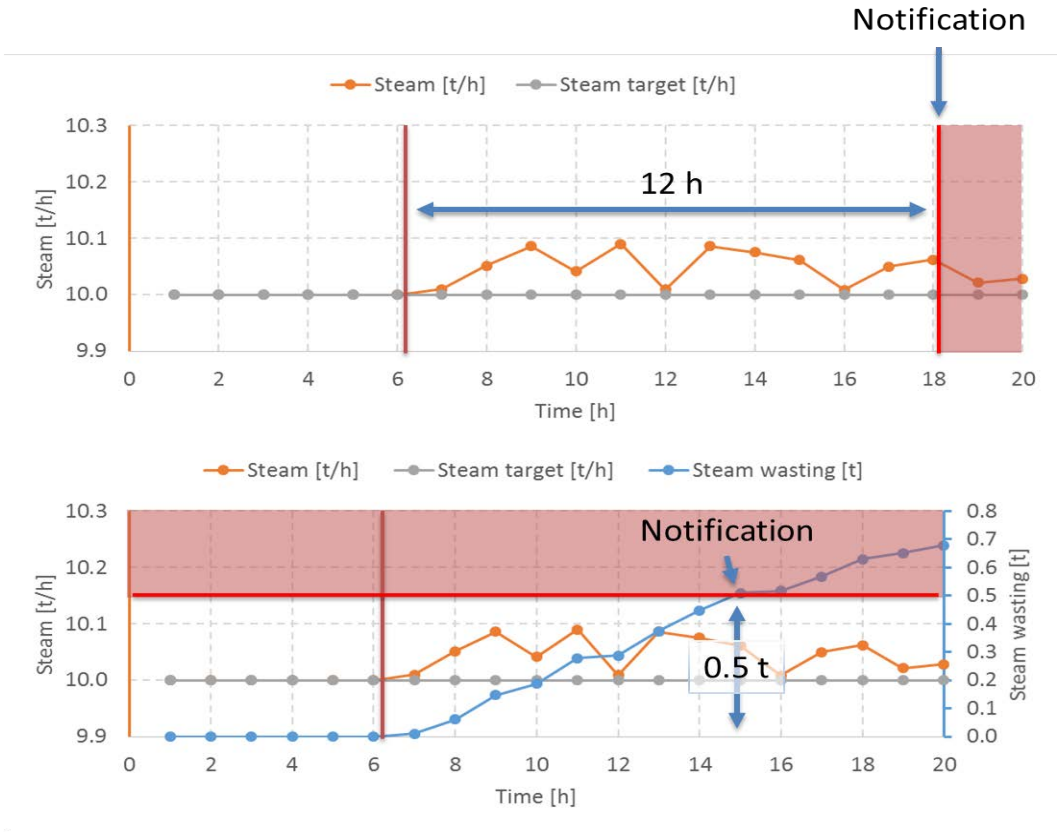
PI Event Frames - Over consumption events







PI Notifications - EMMS Notifications triggers

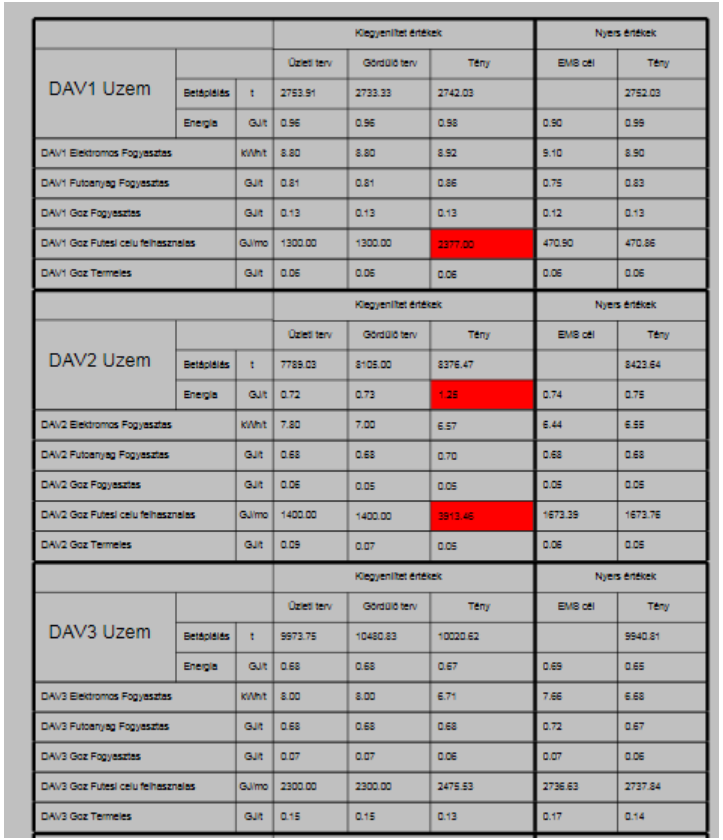


Types of Notification:

1. Period time of the event
2. Cost of the event

PI Coresight screens based on AF template

- PI ProcessBook (PI PB) graphics linked to AF templates
- The AF structure was converted easily into PI PB display
- The display is published in PI Coresight

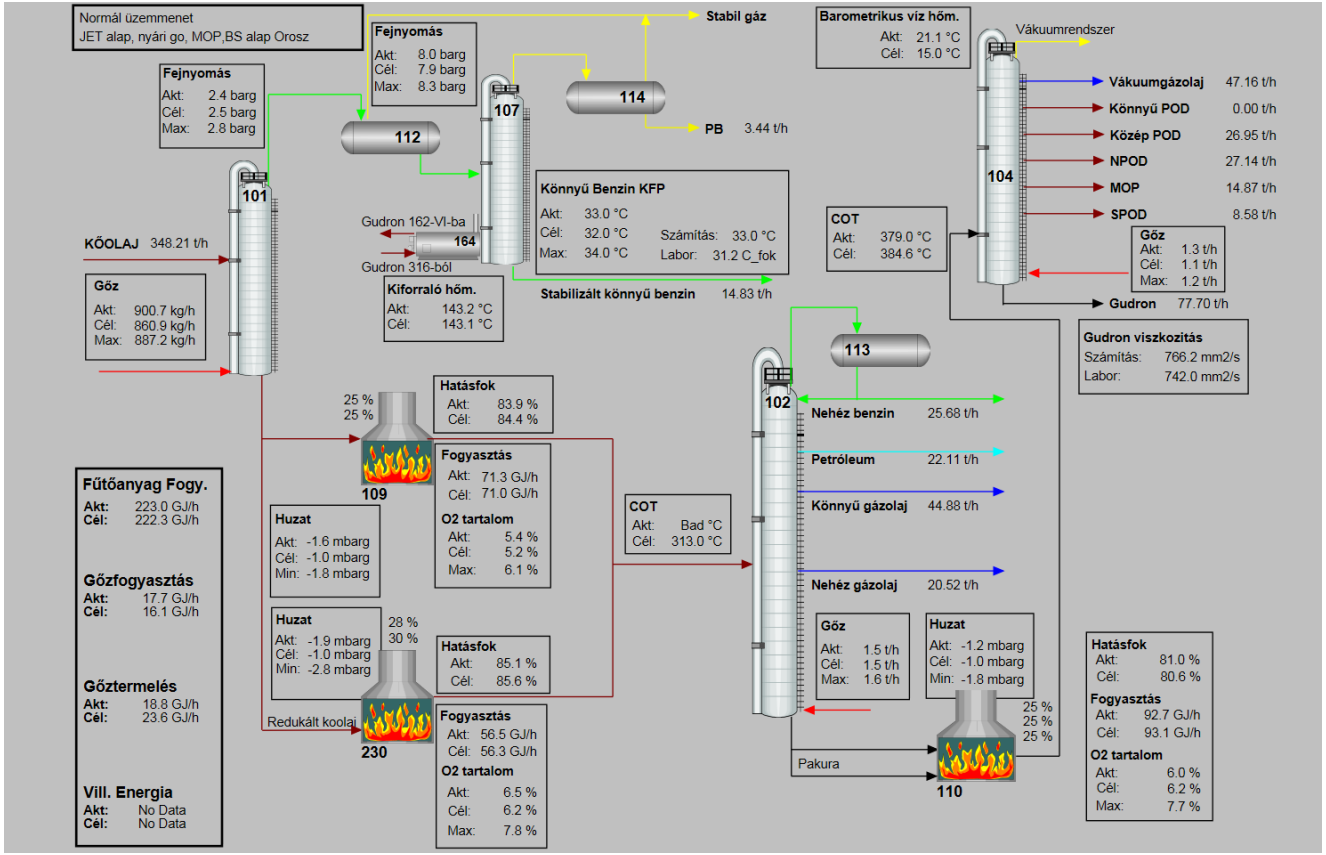


			Kiegyenlített értékek			Nyers értékek	
DAV1 Uzem			Üzleti terv	Gördülő terv	Tény	EMS cél	Tény
	Betáplálás	t	2753.91	2733.33	2742.03		2752.03
	Energia	GJ/t	0.96	0.96	0.98	0.90	0.99
DAV1 Elektromos Fogyasztas		kWh/t	8.80	8.80	8.92	9.10	8.90
DAV1 Futoanyag Fogyasztas		GJ/t	0.81	0.81	0.86	0.75	0.83
DAV1 Goz Fogyasztas		GJ/t	0.13	0.13	0.13	0.12	0.13
DAV1 Goz Futesi celu felhasznalas		GJ/mo	1300.00	1300.00	2377.00	470.90	470.86
DAV1 Goz Termeles		GJ/t	0.06	0.06	0.06	0.06	0.06

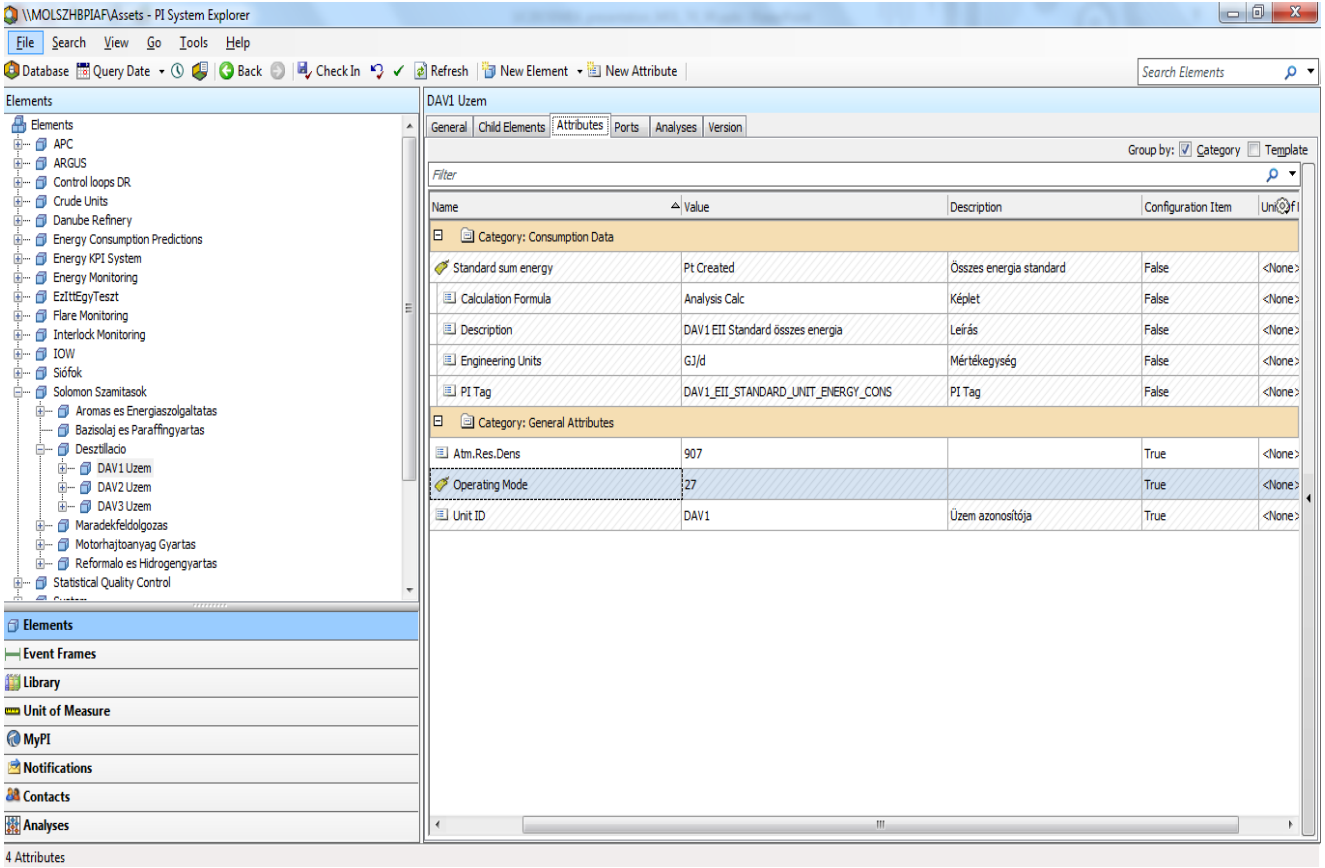
			Kiegyenlített értékek			Nyers értékek	
DAV2 Uzem			Üzleti terv	Gördülő terv	Tény	EMS cél	Tény
	Betáplálás	t	7789.03	8105.00	8376.47		8423.64
	Energia	GJ/t	0.72	0.73	1.25	0.74	0.75
DAV2 Elektromos Fogyasztas		kWh/t	7.80	7.00	6.57	6.44	6.55
DAV2 Futoanyag Fogyasztas		GJ/t	0.68	0.68	0.70	0.68	0.68
DAV2 Goz Fogyasztas		GJ/t	0.06	0.05	0.05	0.05	0.05
DAV2 Goz Futesi celu felhasznalas		GJ/mo	1400.00	1400.00	3913.46	1673.39	1673.76
DAV2 Goz Termeles		GJ/t	0.09	0.07	0.05	0.06	0.05

			Kiegyenlített értékek			Nyers értékek	
DAV3 Uzem			Üzleti terv	Gördülő terv	Tény	EMS cél	Tény
	Betáplálás	t	9973.75	10480.83	10020.62		9940.81
	Energia	GJ/t	0.68	0.68	0.67	0.69	0.65
DAV3 Elektromos Fogyasztas		kWh/t	8.00	8.00	6.71	7.66	6.68
DAV3 Futoanyag Fogyasztas		GJ/t	0.68	0.68	0.68	0.72	0.67
DAV3 Goz Fogyasztas		GJ/t	0.07	0.07	0.06	0.07	0.06
DAV3 Goz Futesi celu felhasznalas		GJ/mo	2300.00	2300.00	2475.53	2736.63	2737.84
DAV3 Goz Termeles		GJ/t	0.15	0.15	0.13	0.17	0.14

PI Coresight screens



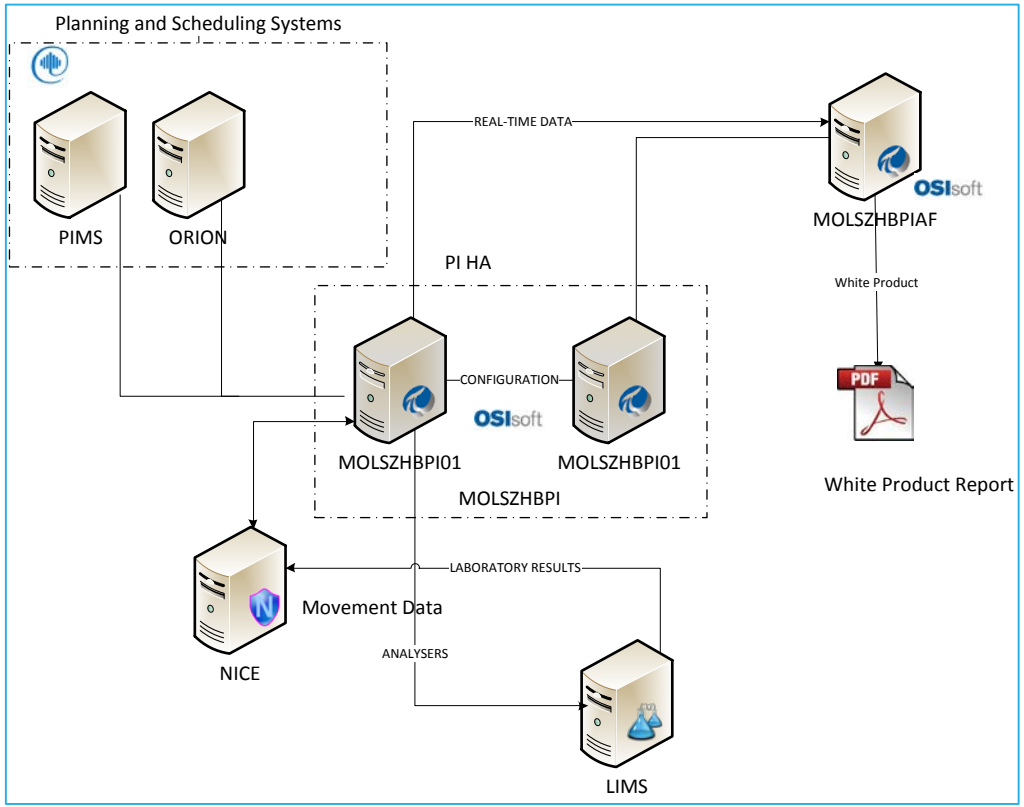
3 – Energy Intensity Index (EII) and Solomon Index



New PI AF structure & workflow to calculate key SOLOMON indicators:

- Energy Intensity Index (EII)
- Utilized Equivalent Distillation Capacity (UEDC)
- Complexity-Weighted Barrel

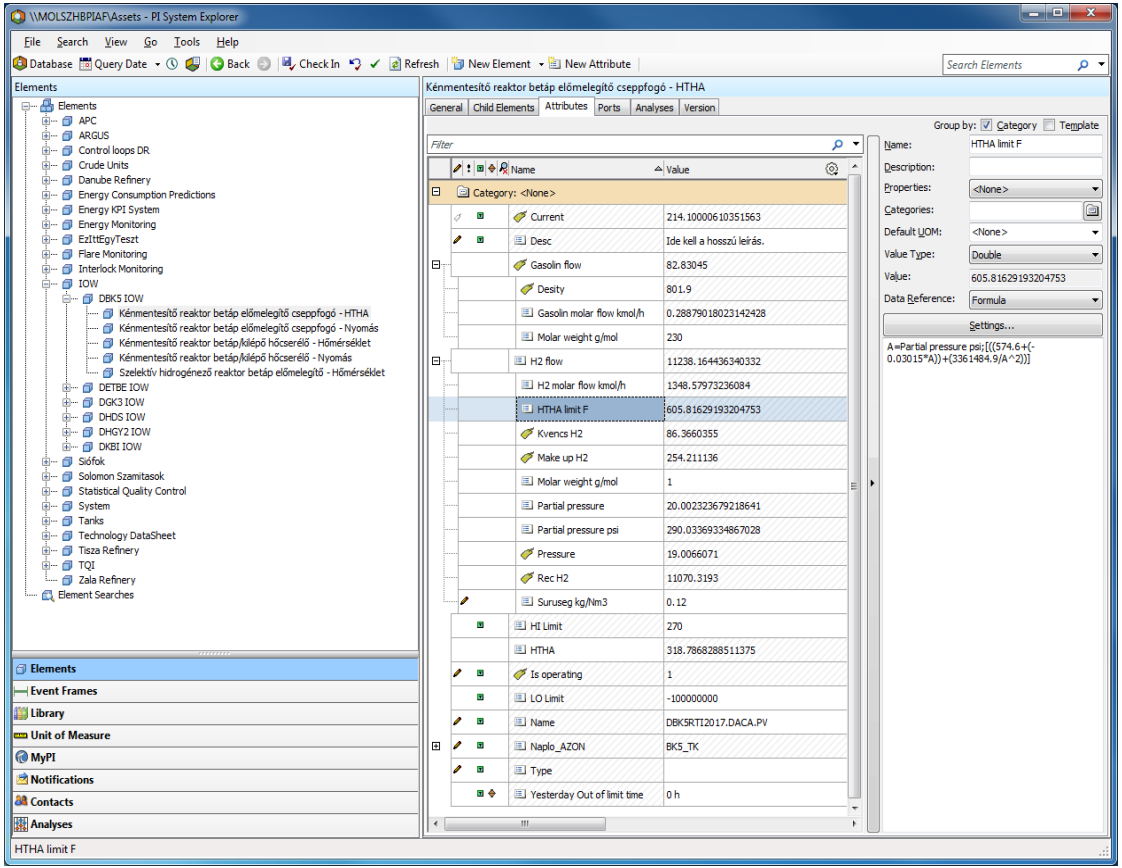
4 – White Product (Yield) Analytics & Reporting



Report content

- Future data from Business Plan
- Future Scheduling data
- Calculated movement data from PI AF Analyses Rules
- Forecast data used in PvA analytics
- Integrated $/loss from deviation from PvA summed over periods of time

5 - Improving Asset Integrity with Advanced Corrosion Analytics

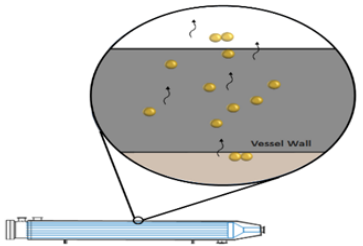


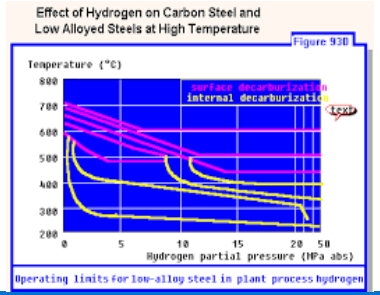
- High Temperature Hydrogen Attack (HTHA)
- f^x (metallurgy, temperature, hydrogen partial pressure(PP), length of exposure)

Developed PI AF template that:

- Determine partial pressure
- Attribute of pipe class
- Temperature and length of exposure limits
- Total time above Temp and PP
- Alerts/notification/event frame

- Tested and rolled out in 6 units < 1 week
- Expanding to all plants in 2015.





#6 - Natural Gas Consumption Predictive Analytics

BackGround

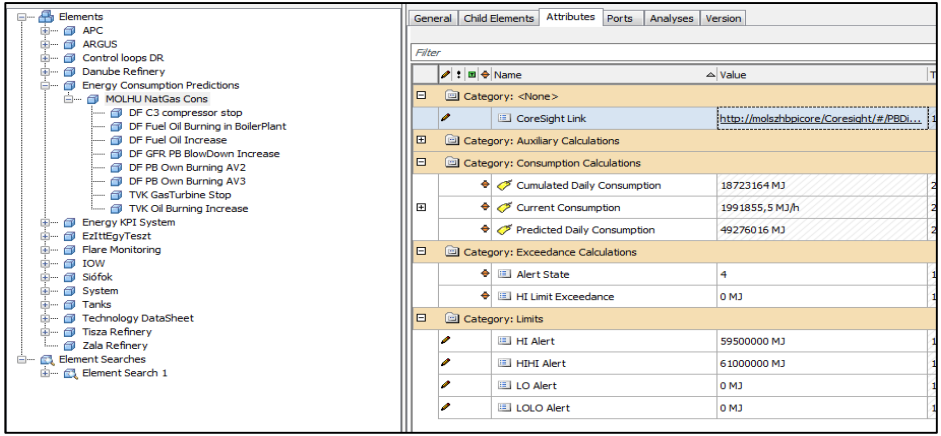
- Huge saving possibilities in the decrease of contracted natural gas daily maximum amount across the 6 production units in multiple countries.
- High penalty on daily amount exceedance
- Alerting system was needed

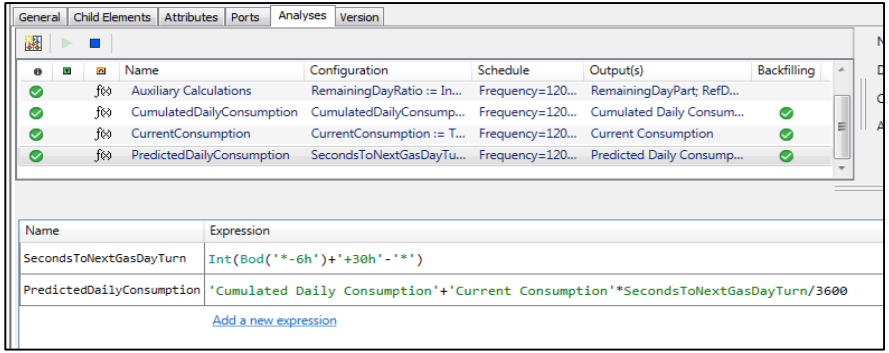
Approach

- Built PI AF demand forecasting model (first principle)
- PI AF was used aggregate, normalize, and perform data validation
- Used to project NG demand across multiple time horizons
- Developed analysis rules with notifications

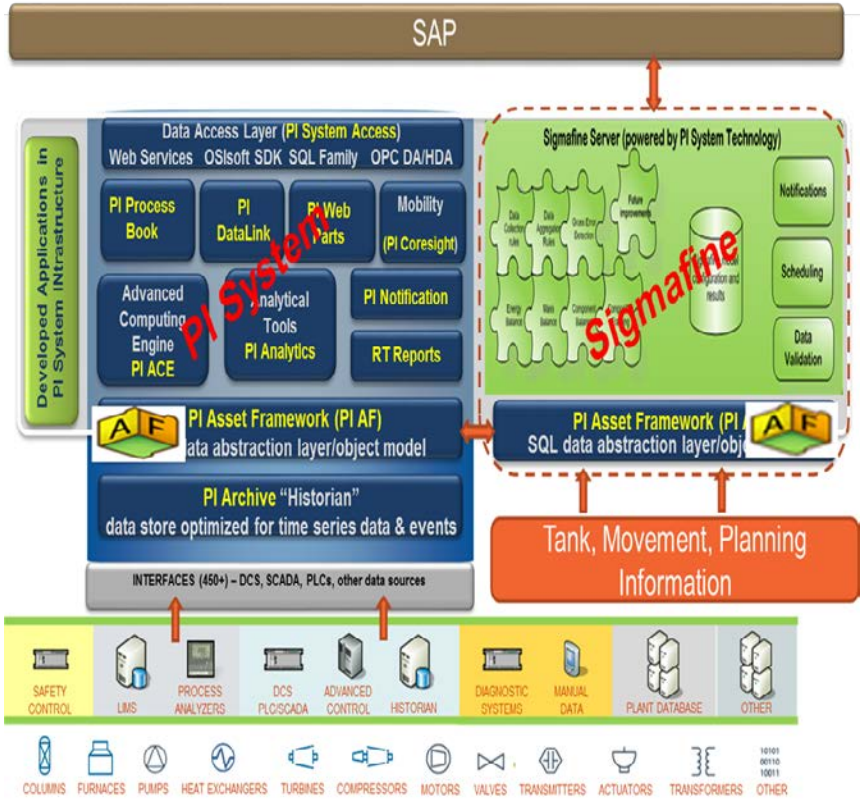
Solution

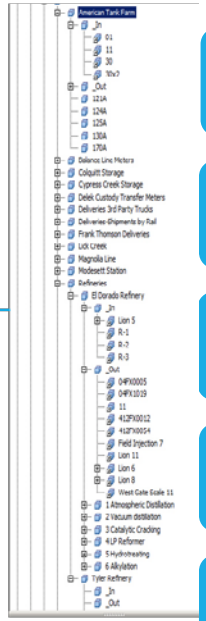
- Demand prediction calculations in PI Analysis
- Alerts based on demand vs contracted peak to enable proactive action
- Detailed information on PI Coresight display (about consumption, prediction, contacts of decision makers)
- E-mail alerting system in Notifications





7- Yield and Production Accounting

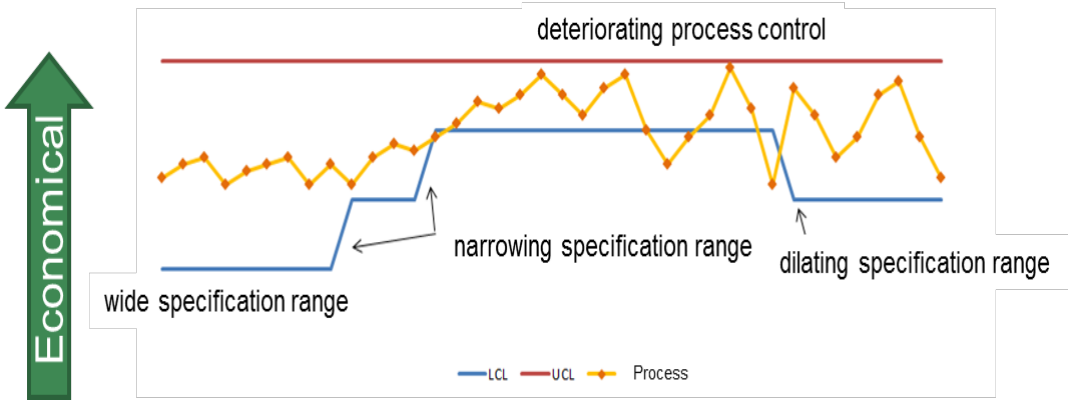


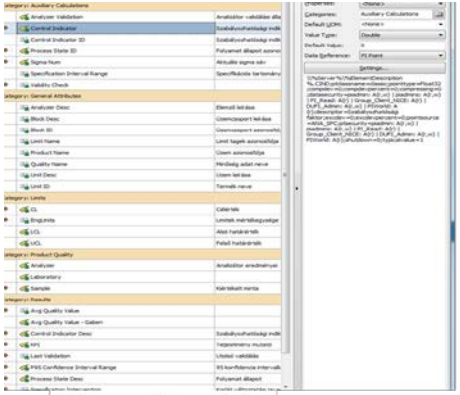


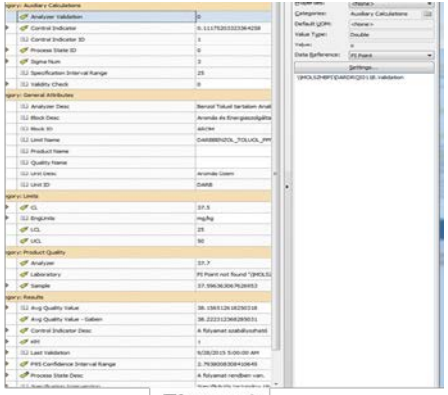
Benefits

- Deep integration at the PI AF Level
- Integrated approach to meter and data accuracy – PI AF and Sigmafine
- Enables a hierarchical material balance approach
- Brings in movement capabilities into the "PI/Sigmafine" system
- **Improved data quality, yield accounting, & operational peformance**

8 – Product Quality Assurance



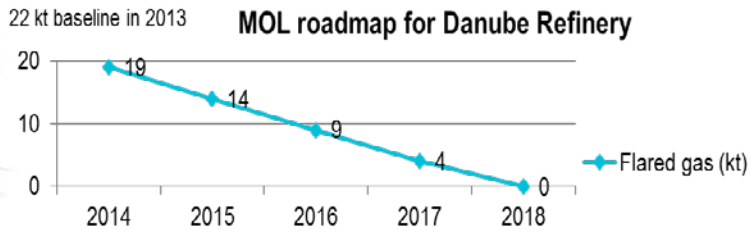

Element template

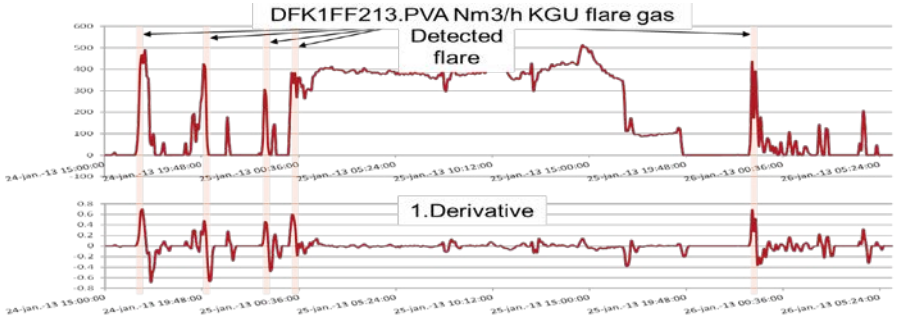

Element

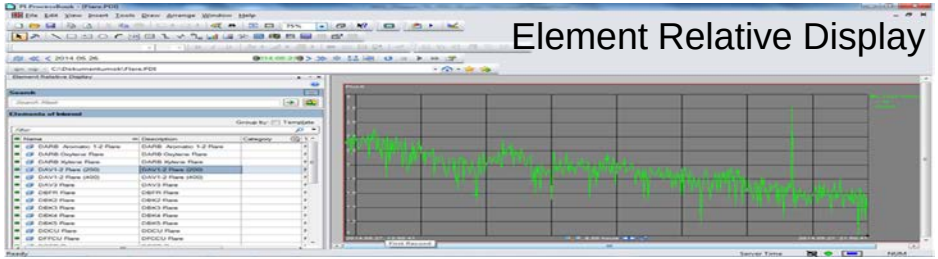
Methodology

- Key parameter affecting yields and energy consumption
- PI SQC provides an excellent capability to highlight issues
- Using dynamic limits increased the robustness and value
- Used on 14 units and 41 critical quality specifications – expanding
- PI AF & PI Analytics used extensively parameter including write back
- Quality parameters & associated information are displayed in Coresight

9 – eFlare – Flaring Management System



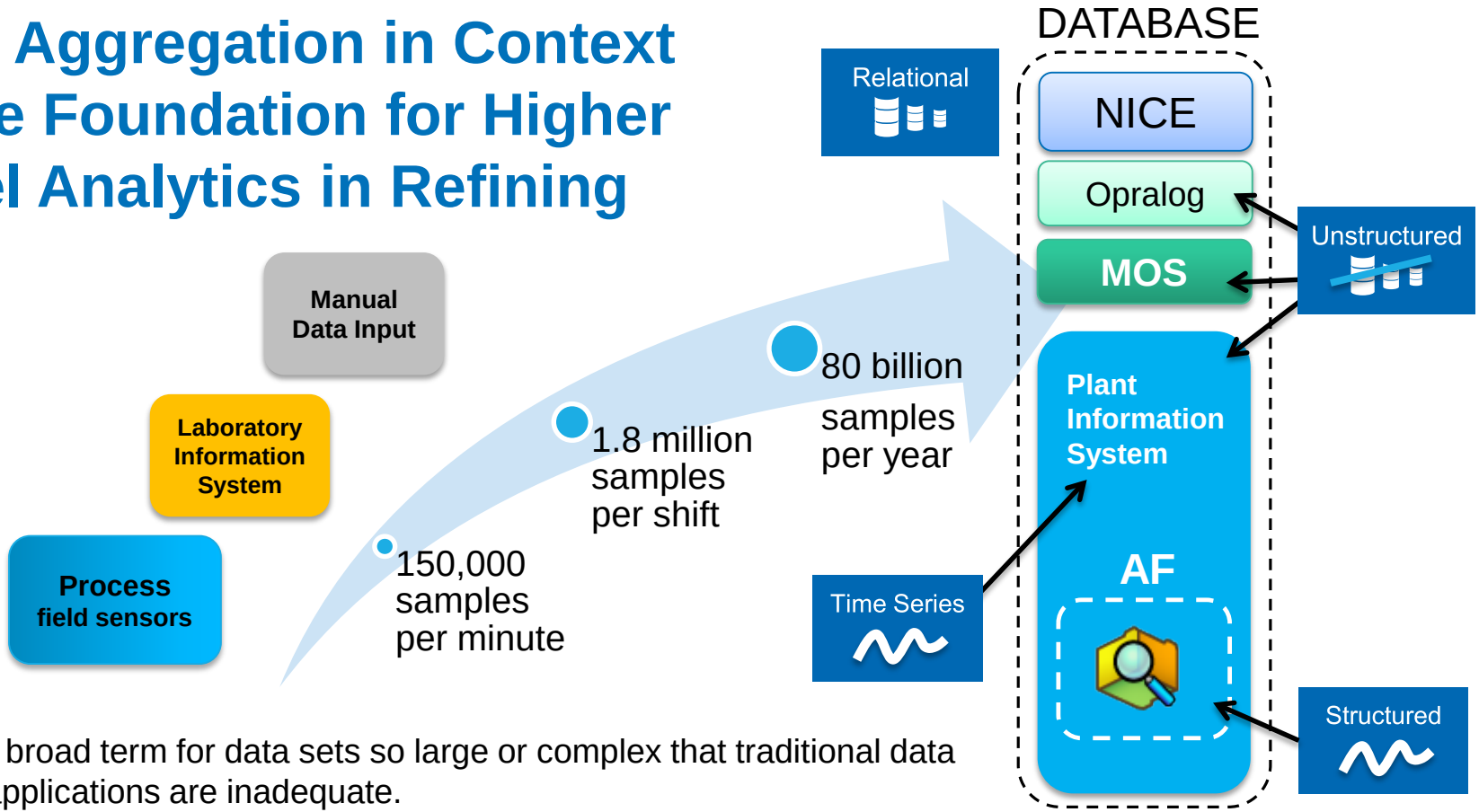




- Goal is to reduce the amount of flaring from improved data and information
- Critical to be able to take a “systems approach” to understand sources and root causes of flaring
- “what gets measured gets managed”
- PI AF/EF based
- Calculations, analytics, and events are integral to the system
- Integrated with workflow
- Displays information in context to stakeholders

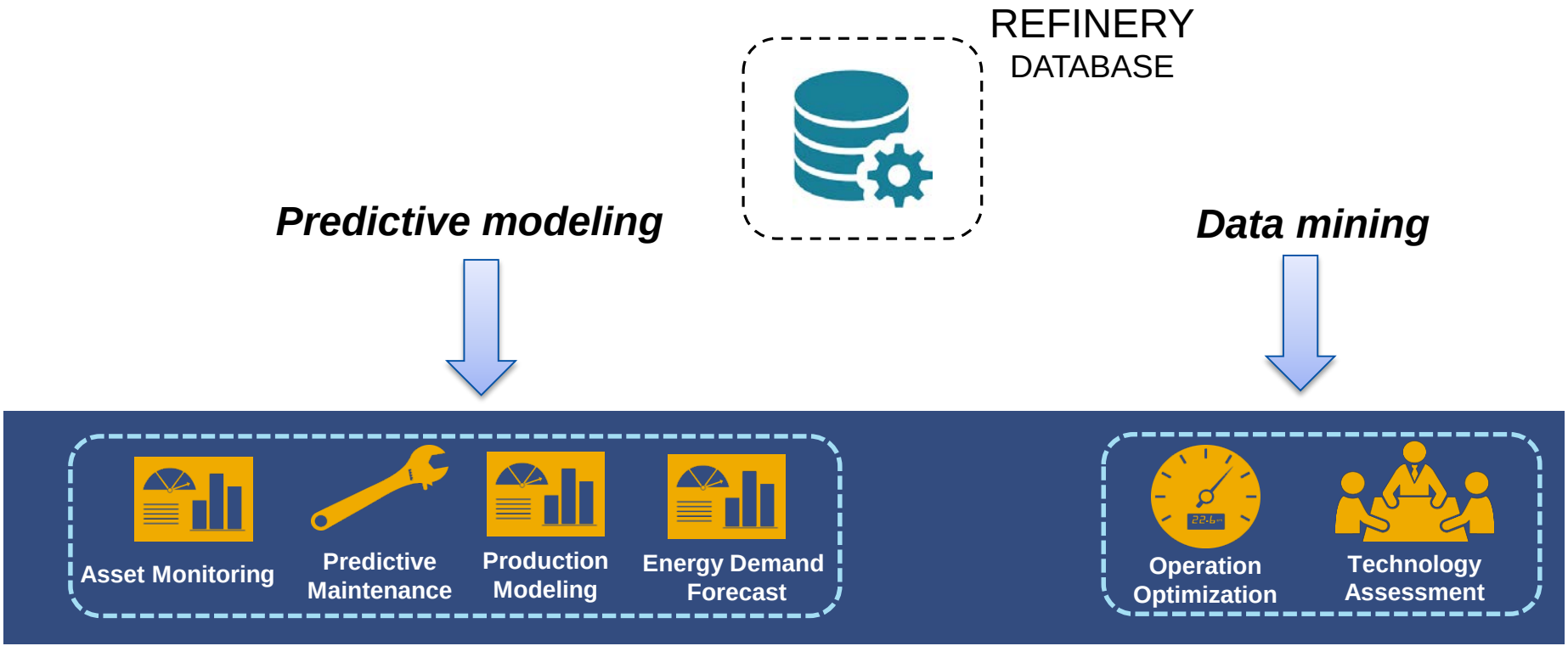
Innovations & Trends

PI AF and Real-Time Data Aggregation in Context is the Foundation for Higher Level Analytics in Refining



Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate.

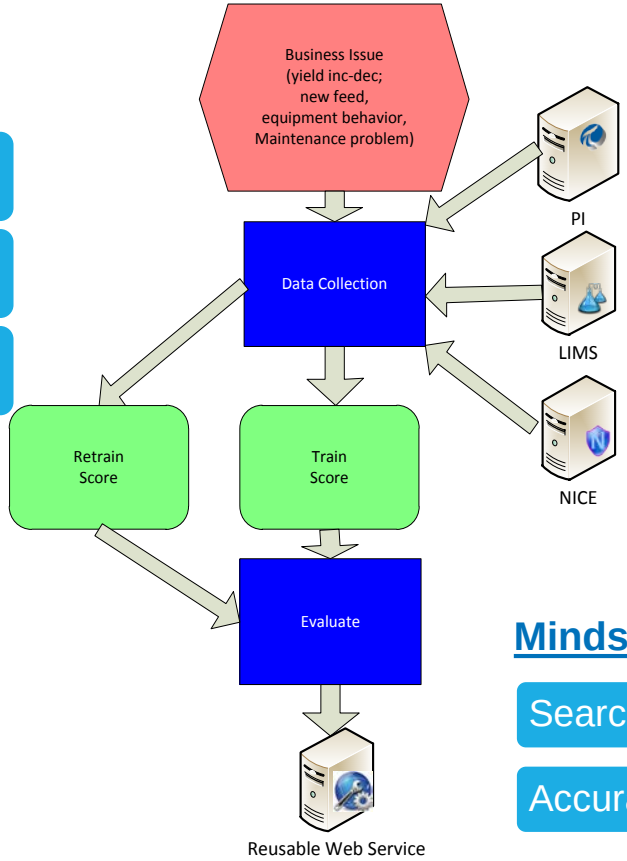
Advanced Analytic Possibilities



Azure Machine Learning

Business impact

- Increase efficiency
- Identifying development opportunities
- Specific development proposal



Better understanding operation & processes

- Identifying efficiency gains /losses reduction opportunities
- Understanding operation optimum

Mindset changes

- Searching possibilities
- Accurate business reasons

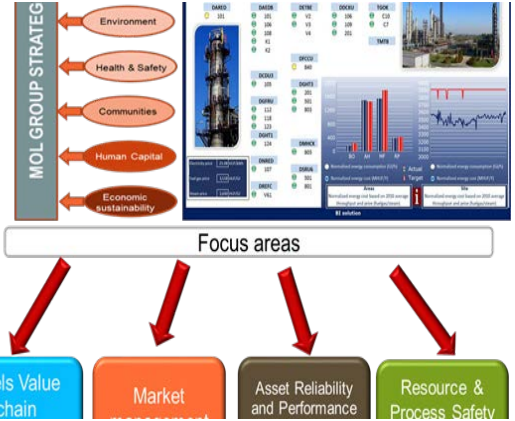
Conclusion

$500M-550M EBITDA improvement

MOL (Global Integrated O&G Company – Hungary)

"Installing the **PI System infrastructure across our fuels value chain** *was fundamental to our New Downstream Program and the* **significant performance and sustainability improvement** *we have seen."*

Tibor Komróczki Head of Process Information & Automation



CHALLENGES

Need to significantly improve performance of a portfolio of 6 processing facilities & related value chain

- Low cultural alignment, standardization, and use of best practices
- limited data based and proactive decision making

SOLUTION

Implemented a "New Downstream Program – NDP" based on a new data and information PI System centric strategy

- Installed the PI Systems across the full value chain
- Developed new PI System based applications in critical areas including energy & reliability

RESULTS

Significant Improvement in the fuels value chain performance in all key areas – energy, reliability, safety, & compliance

- Increased Yield – 5%
- Decreased energy consumption – 2% YOY
- Reduced HC loss: -30%
- Utilization: 1.1%

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

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Спасибо

Obrigado

Köszönöm!

Děkuji

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