



Business Intelligence Solutions in PI AF Quality and Energy Management Applications in MOL production

Presented by László SZABÓ



Agenda

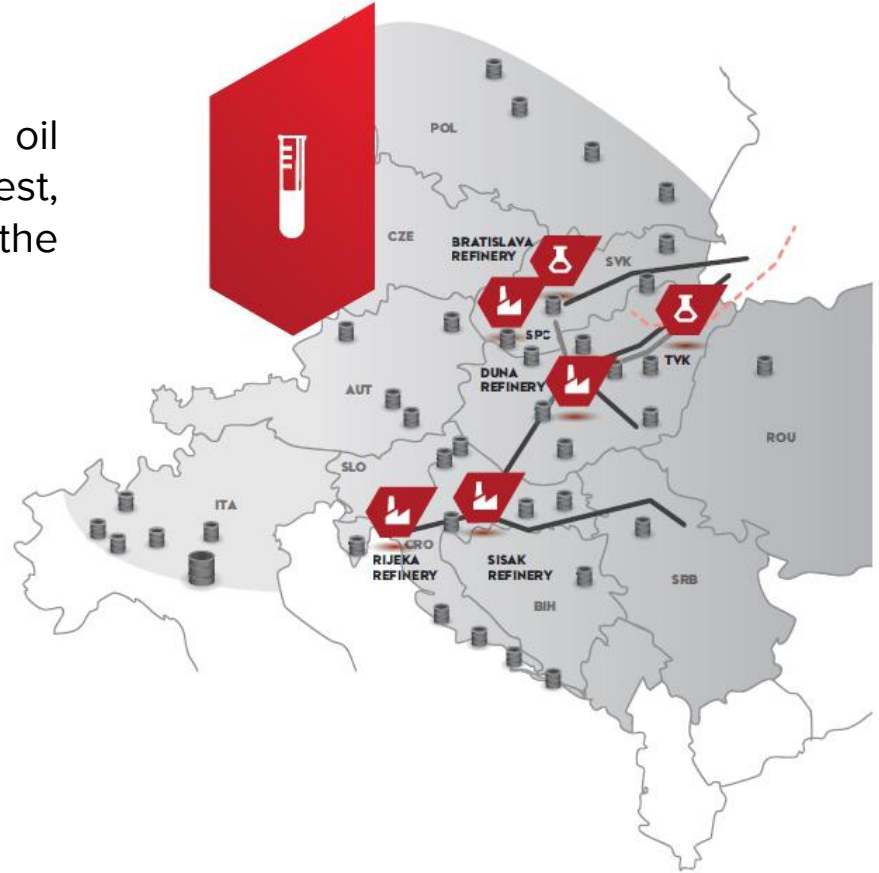
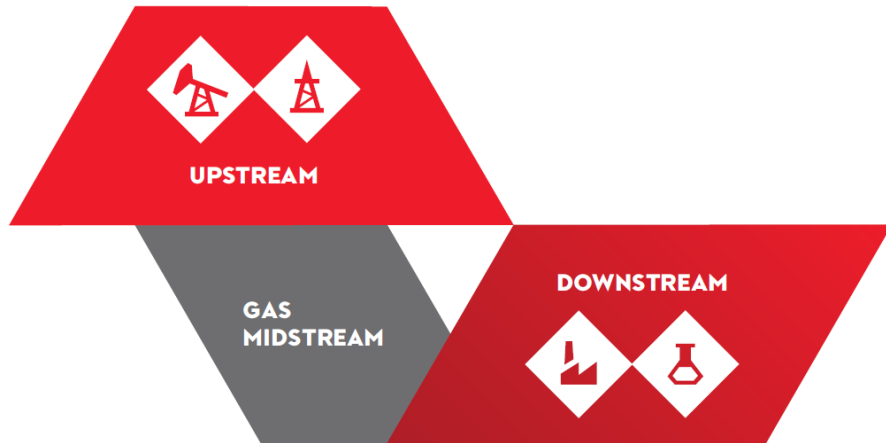
- Introduction
- Statistical Quality Control
- Energy Monitoring System
- Expert System
- Q&A



MOL Group

MOL is an integrated, independent, international oil and gas company, headquartered in Budapest, Hungary with a track record of over 100 years in the industry.

CORE ACTIVITIES



MOL Group in numbers

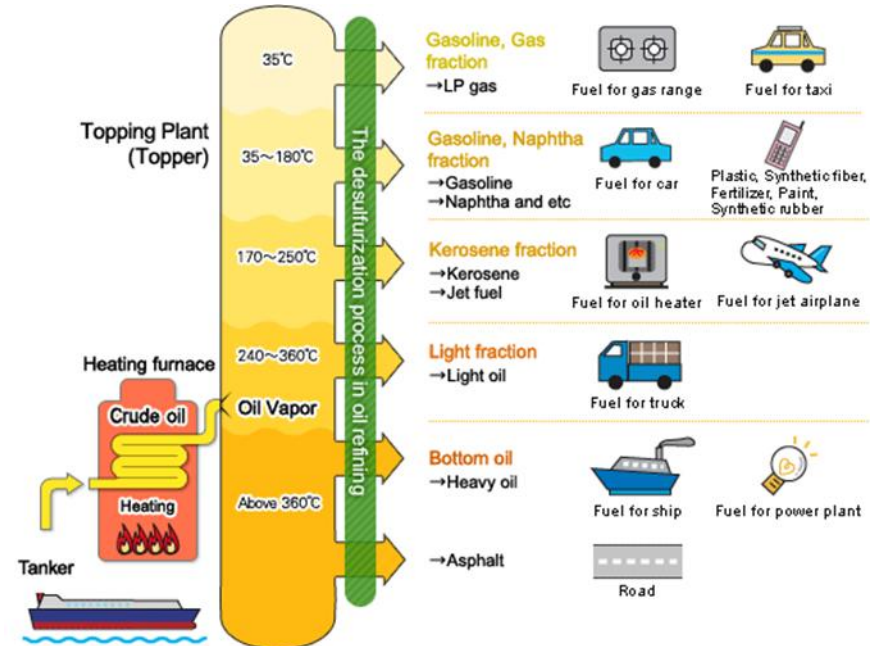


OSISoft and MOL Hungary



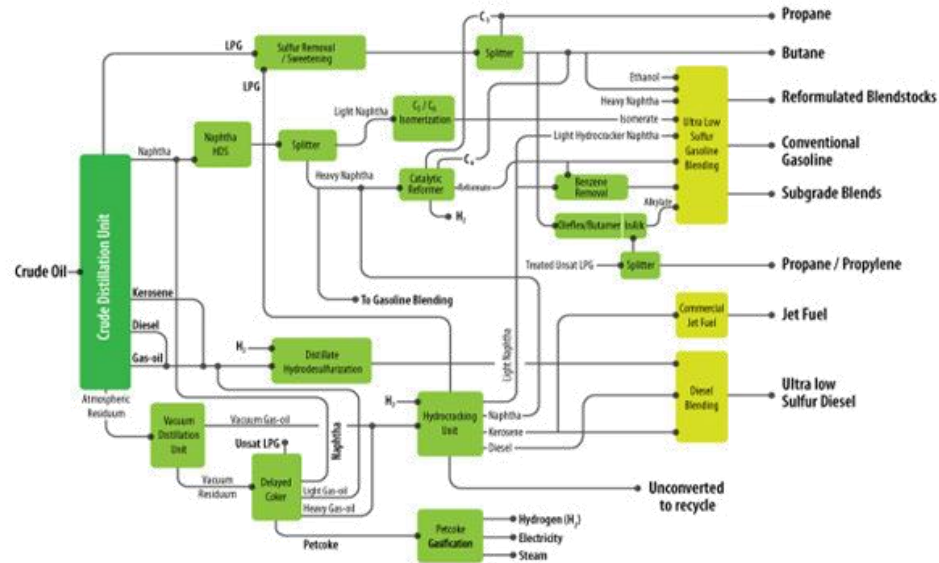
Role of Quality and Energy

- Successful refinery operation means: create on-spec product in the most energy efficient way.
- Product qualities are key parameters, they affect:
 - product yields and
 - energy consumption.



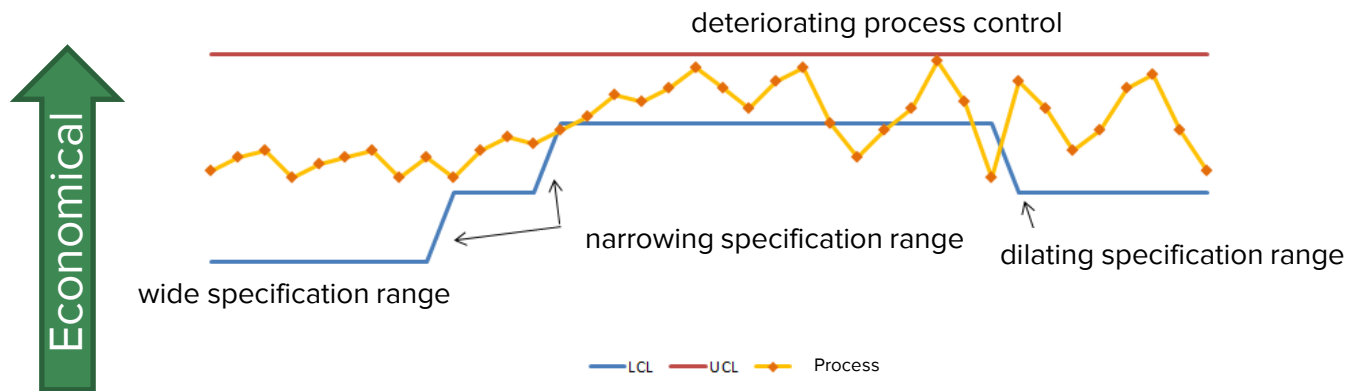
Quality Management in Refining

- There are numerous quality regulations
- Operating mode dependent quality specifications
- Processes must be monitored continuously
- The stability of the processes can change
- Statistical Quality Control (SQC) is a good application to manage quality control



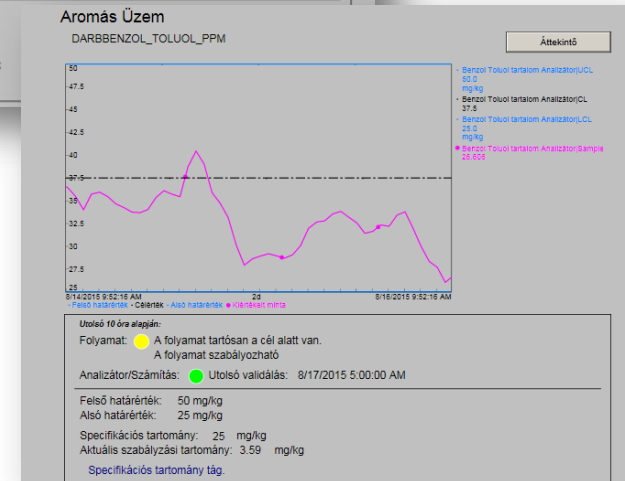
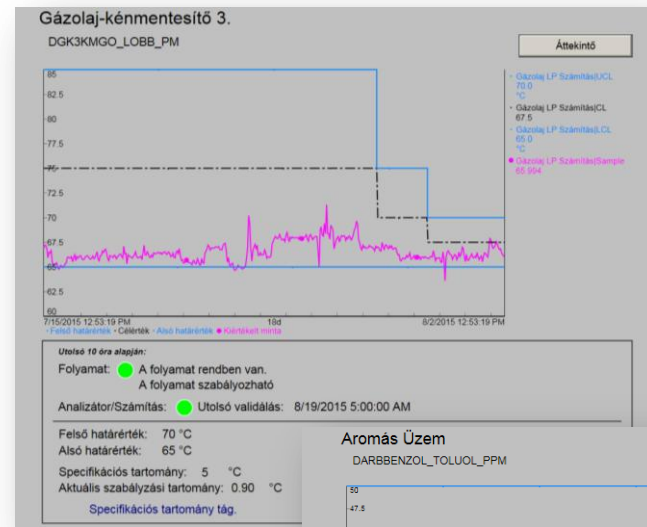
Statistical Quality Control

- Statistical tool to highlight the problematic quality specification
- Process evaluation based on Western Electric rules
- Dynamic limits increase flexibility
- Analyzer or soft-sensor based quality calculation



Visualization

- The SQC displays are created in PI ProcessBook
- The displays are published on-line in the PI Coresight
- The final output of the process evaluation is a simple, understandable recommendation in a text format



Calculation

- 14 units - 41 quality
- Templates based structure - PI Asset Framework (AF)
 - Easy rollout
 - Automatic visualization
- (element relative and template based displays)
- Complex calculation - PI Asset Analytics

The screenshot displays the OSIsoft PI System Explorer interface. The left pane shows a tree view of the 'PI Asset Framework' (AF) structure, with 'AF - AF Elements' selected. The right pane shows a detailed view of the 'AF - AF Elements' template, listing various attributes and their values. Below this, a table displays the 'Sample Data' for the 'AF - AF Elements' template, showing columns for 'Name', 'Expression', 'Value', and 'Output Attribute'. The table lists various attributes like 'AF - AF Elements', 'AF - AF Elements', 'AF - AF Elements', etc. The bottom pane shows the 'AF - AF Elements' template details, including the 'AF - AF Elements' template name, description, and categories.

Calculation details – AF Element Template

Category: Auxiliary Calculations

Analyzer Validation	Analizátor validálás áll
Control Indicator	Szabályozhatósági indik
Control Indicator ID	Szabályozhatósági indik
Process State ID	Folyamat állapot azono
Sigma Num	Aktuális sigma sáv
Specification Interval Range	Specifikációs tartomány
Validity Check	

Category: General Attributes

Analyzer Desc	Elemző leírása
Block Desc	Üzemszoport leírása
Block ID	Üzemszoport azonosító
Limit Name	Limit tagek azonosítója
Product Name	Üzém azonosítója
Quality Name	Mínőség adat neve
Unit Desc	Üzém leírása
Unit ID	Termék neve

Category: Limits

CL	Célérték
EngUnits	Limiték mértékegysége
LCL	Alsó határérték
UCL	Felső határérték

Category: Product Quality

Analyzer	Analizátor eredményei
Laboratory	
Sample	Kértékelt minta

Category: Results

Avg Quality Value	
Avg Quality Value - Gaben	
Control Indicator Desc	Szabályozhatósági indik
KPI	Tejteljemeny mutató
Last Validation	Utolsó validálás
P95 Confidence Interval Range	95 konfidencia intervall
Process State Desc	Folyamat állapot
Quantification Intervention	

Properties: <None>

Categories: Auxiliary Calculations

Default UOM: <None>

Value Type: Double

Default Value: 0

Data Reference: PI Point

Settings...

\\%Server%\%ElementDescription
%CIND;ptclassname=classic;pointtype=Float32
%comdev=0;%comdevpercent=0;%compressing=0
%datasetsecurity=padmin: A(f,w) | piadmins: A(f,w) |
PI_Read: A(f) | Group_Client_NICE: A(f) |
DUFI_Admin: A(f,w) | PIWorld: A
(f);descriptor=Szabályozhatósági
faktor;excddev=0;excddevpercent=0;pointsources
=ANA_SPC;security=padmin: A(f,w) |
piadmins: A(f,w) | PI_Read: A(f) |
Group_Client_NICE: A(f) | DUFU_Admin: A(f,w) |
PIWorld: A(f);shutdown=0;typicalvalue=1



Category: Auxiliary Calculations

Analyzer Validation	0
Control Indicator	0.11175203323364258
Control Indicator ID	1
Process State ID	0
Sigma Num	3
Specification Interval Range	25
Validity Check	0

Category: General Attributes

Analyzer Desc	Benzol Toluol tartalom Anal
Block Desc	Aromás és Energiaszolgáltató
Block ID	AROM
Limit Name	DARBBENZOL_TOLUOL_PPI
Product Name	
Quality Name	
Unit Desc	Aromás Üzém
Unit ID	DARB

Category: Limits

CL	37.5
EngUnits	mg/kg
LCL	25
UCL	50

Category: Product Quality

Analyzer	37.7
Laboratory	PI Point not found \\MOLSI
Sample	37.596363067626953

Category: Results

Avg Quality Value	38.156512618250318
Avg Quality Value - Gaben	38.222312368285031
Control Indicator Desc	A folyamat szabályozható
KPI	1
Last Validation	9/28/2015 5:00:00 AM
P95 Confidence Interval Range	2.7938008308410645
Process State Desc	A folyamat rendben van.
Quantification Intervention	Quantifikációs tartomány tár

Properties: <None>

Categories: Auxiliary Calculations

Default UOM: <None>

Value Type: Double

Value: 0

Data Reference: PI Point

Settings...

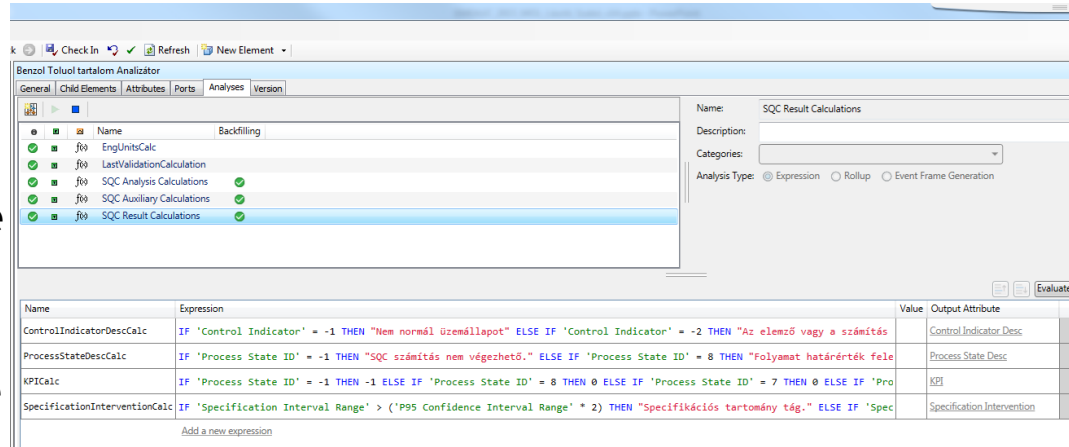
\\MOLSI\BPI\DARB\Q10118.Validation

Element template

Element

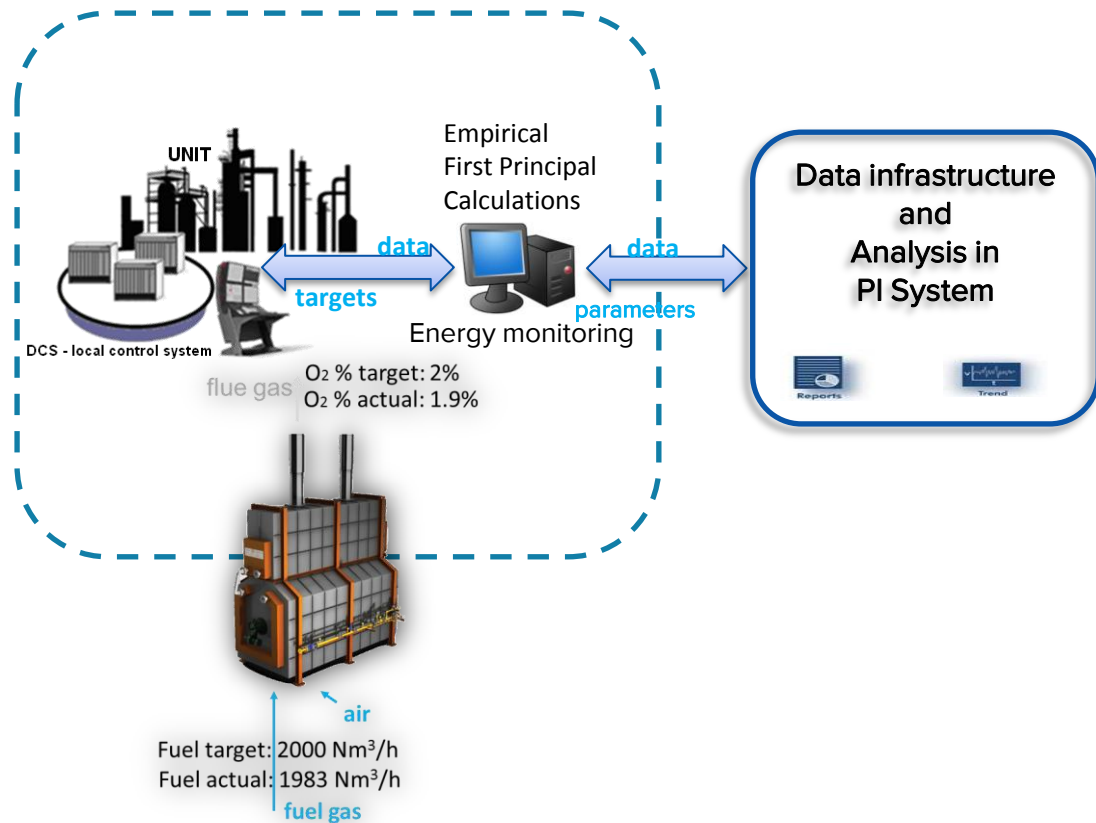
Calculation details – Asset Analytics

- Calculation based on the attributes of the template
- The results of the calculation are written in attributes
- The different Asset Analytics are scheduled



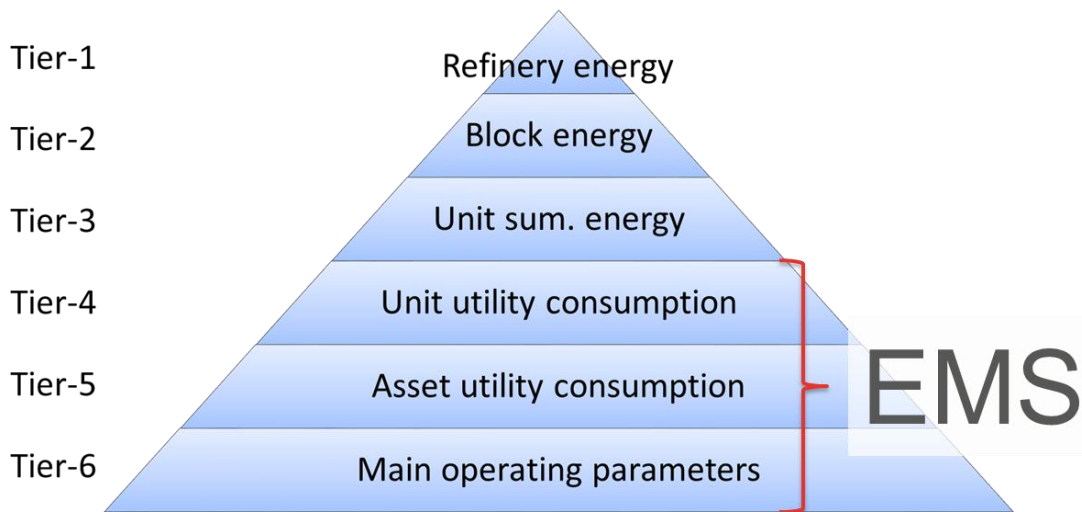
Energy Monitoring System (EMS)

- On-line, open loop, model based control system. Detects excess energy consumption, and advises corrective interventions to the operators.
- The expert system helps to evaluate the operation of the units.



Position of EMS in the KPI system

- The Energy KPI System of the refinery collect the energy consumption into a hierarchical system
- The EMS calculates the target values of the Tier 4-6
- The calculations are implemented in PI Asset Framework



Templates of the EKPI

- 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 calculation

The screenshot displays the EKPI software interface. On the left, a hierarchical tree structure shows the organization of energy KPI elements. The tree starts with 'Energy KPI System' and branches into various units and processes, including 'Dunai Finomító', 'Aromas és Energiaszolgáltatás', 'Bázisok és Paraffinnyártás', 'Desztilláció', 'DAV1 Üzem', 'DAV2 Üzem', 'DAV2 Elektromos Fogyasztás', 'DAV2 Fűtőanyag Fogyasztás', '109 Cookemence', 'Belepo homerséklet', 'Füstgáz O2 tartalom', 'Klepo homerséklet', '110 Cookemence', '230 Cookemence', 'DAV2 Gőz Fogyasztás', 'DAV2 Gőz Fűtési célú felhasználás', 'DAV2 Gőz Termeles', 'DAV3 Üzem', 'DGFR Üzem', 'DGFR Üzem', 'DKBS Üzem', 'DKBS Üzem', 'DKPM Üzem', 'Maradékfeldolgozás', 'Motorhájtányag Gyártás', 'Reformáló és Hidrogengyártás', 'Energy Monitoring', 'EzItEgyTeszt', 'Flare Monitoring', 'Interlock Monitoring', 'IOW', 'Siófok', 'Solomon Számítások', 'Statistical Quality Control', 'System', 'Tank Quality Integration', 'Tanks', 'Technology DataSheet', 'Tisza Refinery', 'Water Monitoring', and 'Zala Refinery'.

On the right, a table titled 'Name' and 'Value' displays various calculations and their results. The table is organized into categories: Auxiliary Calculations, Consumption Data, Data for Aggregation, Feed, and General Attributes.

Name	Value
Category: Auxiliary Calculations	
Cumulated KPI Actual Value Evaluate	2
Cumulated KPI Actual Value Evaluate H Limit	0.1
Cumulated KPI Actual Value Evaluate HH Limit	0.2
KPI Engineering Units	GJ/t
Specific Divider Engineering Units	/t
Specific Divider Limit	0.1
Time Cumulated Engineering Units	GJ
Category: Consumption Data	
Energy Cons COR	249.04598999023438
Energy Cons RAW	240.35787963867188
Energy Cons Target BP	219.09304809570313
Energy Cons Target OT	240.04478454589844
Energy Cons Target RP	229.64166259765625
Category: Data for Aggregation	
AGG Coefficient	1
AGG Energy Cons COR	249.045989990234 GJ/h
AGG Energy Cons RAW	240.357879638672 GJ/h
AGG Energy Cons Target OT	240.044784545898 GJ/h
Category: Feed	
Unit Feed BP	324.341033935547 t/h
Unit Feed COR	349.790649414063 t/h
Unit Feed RAW	350.962982177734 t/h
Unit Feed RP	337.708343505859 t/h
Category: General Attributes	
Block ID	DDESTB
Block Name	Desztilláció
Element Name	DAV2 Fűtőanyag Fogyasztás
Energy Type	FUEL
Unit ID	DAV2
Unit Name	Atm. és Vákuumdeszt. 2.
Usage Type	CONS

Example for PI Point generation

Category: Consumption Data		
	Energy Cons COR	249.04598999023438
	Energy Cons RAW	240.35787963867188
	Energy Cons Target BP	219.09304809570313
	Calculation Formula	Analysis Calc (Table Lookup)
	Description	DAV2 Fűtőanyag felhasználás (üzleti terv)
	Engineering Units	GJ/h
	Lookup Date	9/30/2015 1:21:00 PM
	Lookup Formula	157747
	PI Tag	DAV2_EKPI_UNIT_FUEL_CONS.BP
	Energy Cons Target OT	240.04478454589844
	Energy Cons Target RP	229.64166259765625
Category: Data for Aggregation		
Category: Feed		
Category: General Attributes		
	Block ID	DDESTB
	Block Name	Desztilláció
	Element Name	DAV2 Fűtőanyag Fogyasztás
	Energy Type	FUEL
	Unit ID	DAV2
	Unit Name	Atm. és Vákuumdeszt. 2.
	Usage Type	CONS

Categories:

Default UOM: <None>

Value Type: String

Value: '2_EKPI_UNIT_FUEL_CONS.BP

Data Reference: String Builder

Settings...

'.(Unit Id';*_EKPI_UNIT_*;|Energy Type';*_*;| Usage Type';*_BP*;

EMS expert system in PI System

- On-line trends

On-line and archive values can be displayed on PI Coresight screens

- Reports

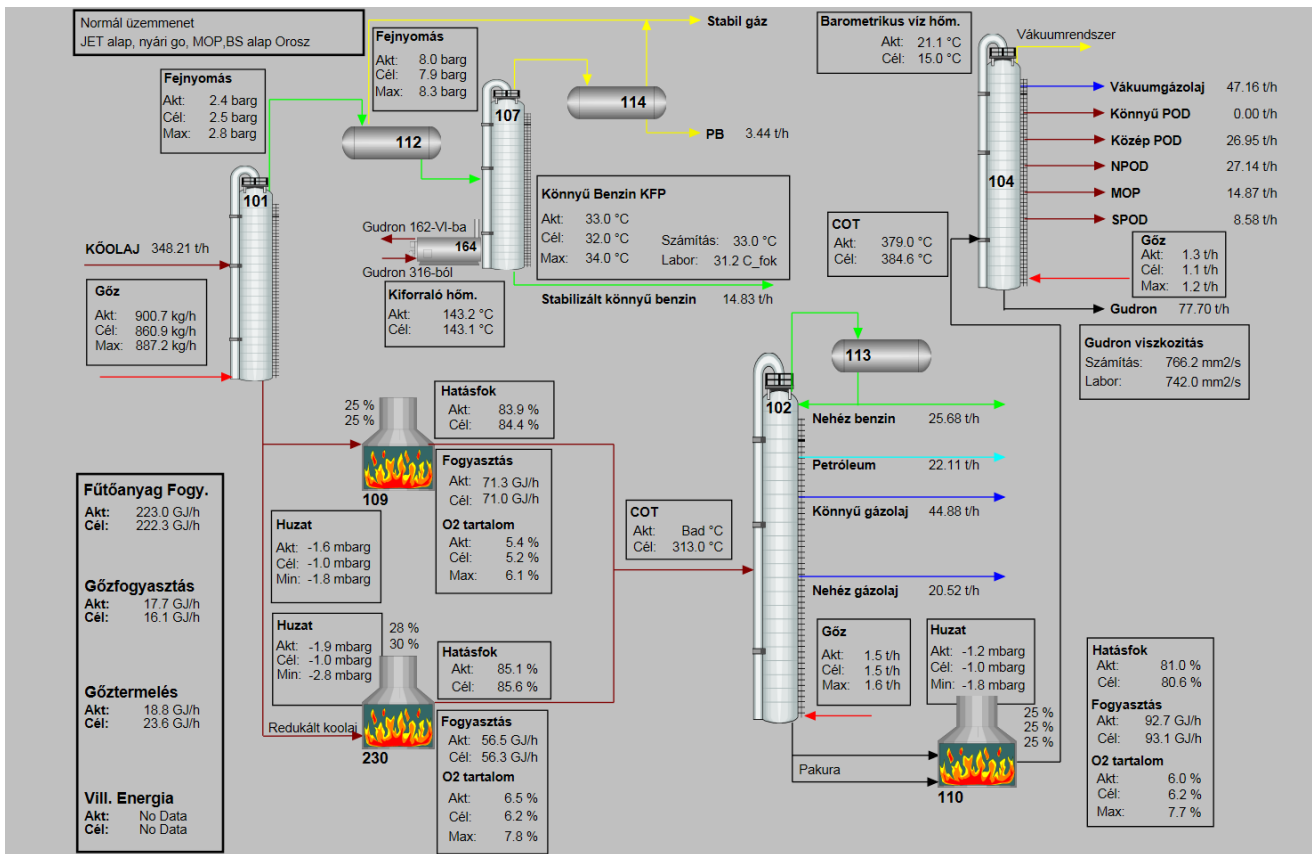
The performance of assets and units are evaluated based on Event Frames calculation

- Notifications

Alert system is created in Notifications to indicate the significant energy wastes

Manager	Real-time trend SEMAFOR	Managerial summary	
Energy experts	PI Coresight EMS screens	Excel BI reports for drill down analysis	Notifications from the energy waste
Experts		Asset Team Excel reports for the economic analysis	
Unit experts			
Shift leaders	Excel sheet whiteboard maker	Daily Opralog reports	
Operator	DCS screen	DCS SEMAFOR	DCS alarms
	Real-time trends	Reports	Notifications

PI Coresight screens

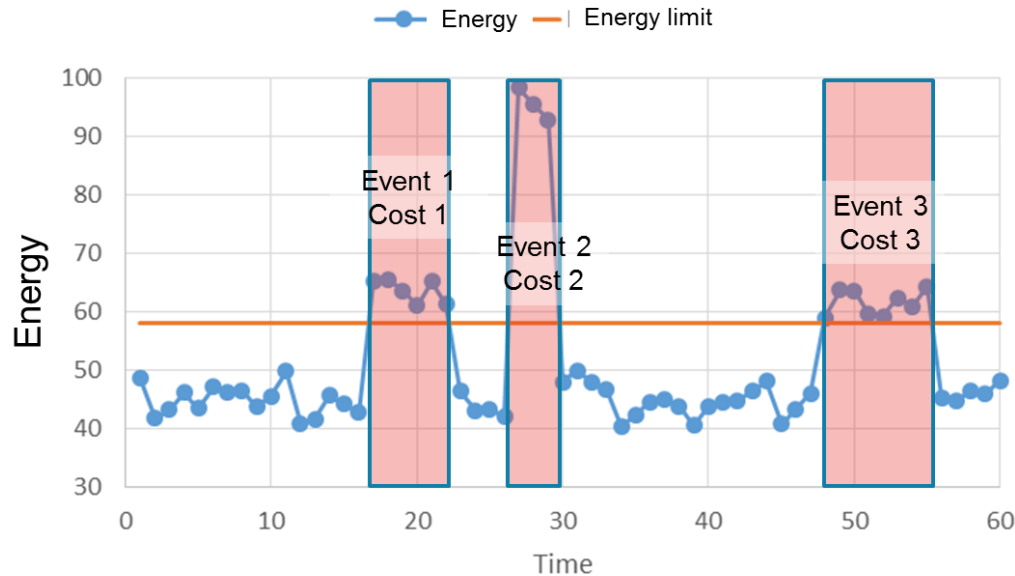


PI Coresight screens based on AF template

- 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	0.96	0.90	0.99
DAV1 Elektromos Fogyasztás		kWh/t	8.80	8.80	8.92	9.10	8.90
DAV1 Fűtőanyag Fogyasztás		GJ/t	0.81	0.81	0.86	0.75	0.83
DAV1 Gáz Fogyasztás		GJ/t	0.13	0.13	0.13	0.12	0.13
DAV1 Gáz Fűtési célú felhasználás		GJ/mo	1300.00	1300.00	2377.00	470.90	470.86
DAV1 Gáz Termelés		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	7769.03	8105.00	8376.47		8423.64
	Energia	GJ/t	0.72	0.73	1.25	0.74	0.75
DAV2 Elektromos Fogyasztás		kWh/t	7.80	7.00	6.57	6.44	6.55
DAV2 Fűtőanyag Fogyasztás		GJ/t	0.68	0.68	0.70	0.68	0.68
DAV2 Gáz Fogyasztás		GJ/t	0.06	0.06	0.06	0.06	0.06
DAV2 Gáz Fűtési célú felhasználás		GJ/mo	1400.00	1400.00	3813.48	1673.39	1673.76
DAV2 Gáz Termelés		GJ/t	0.09	0.07	0.06	0.06	0.06
		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 Fogyasztás		kWh/t	8.00	8.00	6.71	7.66	6.68
DAV3 Fűtőanyag Fogyasztás		GJ/t	0.68	0.68	0.68	0.72	0.67
DAV3 Gáz Fogyasztás		GJ/t	0.07	0.07	0.06	0.07	0.06
DAV3 Gáz Fűtési célú felhasználás		GJ/mo	2300.00	2300.00	2475.53	2736.63	2737.64
DAV3 Gáz Termelés		GJ/t	0.15	0.15	0.13	0.17	0.14

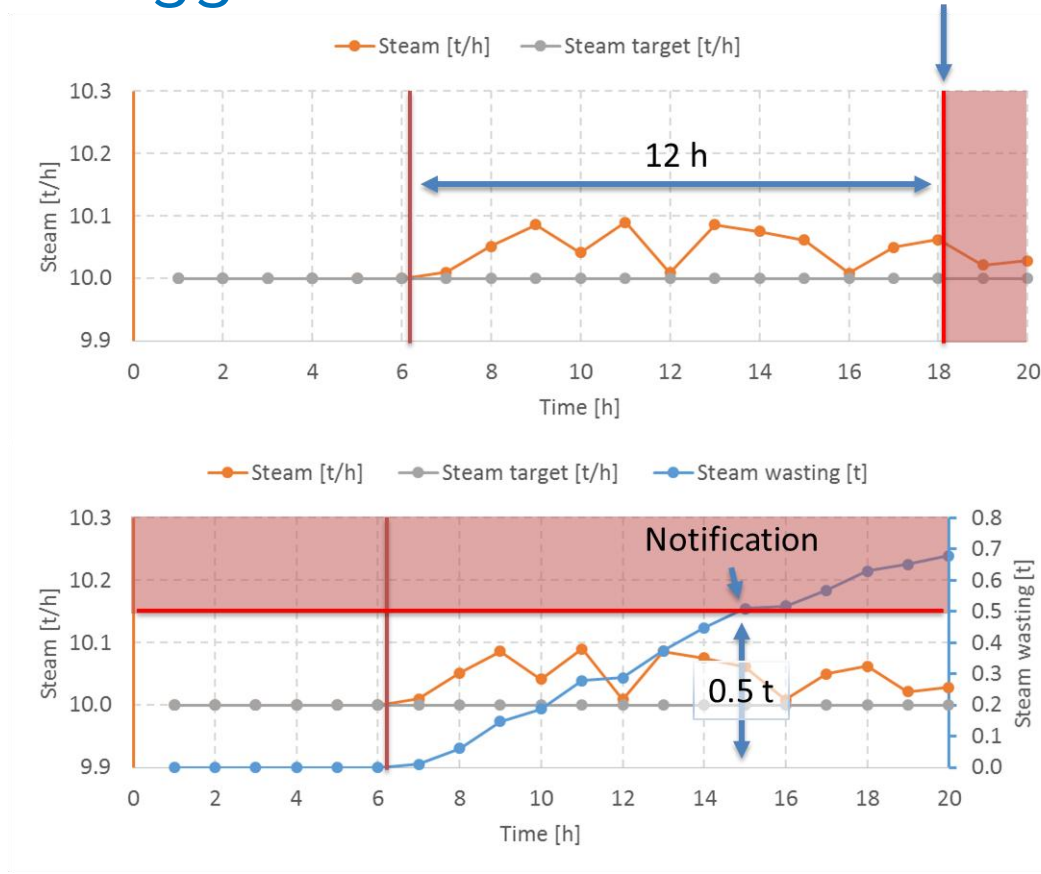
Over consumption events



Library	
Assets	
Templates	
Element Templates	
Event Frame Templates	
BazsolaBatch	
BazsolaBatchTartaly	
BazsolaBatchTartalySGPetr	
BazsolaBatchTartalyRKSTerm	
BazsolaBatchTartalyMekFin	
BazsolaBatchTartalyOkAag	
BazsolaBatchTartalyOkAagPamFin	
BazsolaBatchTartalyOkRaf	
BazsolaBatchTartalyPamAag	
BazsolaBatchUzem	
BazsolaBatchUzemDKOH	
BazsolaBatchUzemDMK1	
BazsolaBatchUzemDMK2	
BazsolaBatchUzemDKOF	
BazsolaBatchUzemDPAM	
Coke Drum change	
Coke drum preheating	
Energy KPI System Deviation (Tier6)	
Kamracklus	
Operating mode	
Operation	
Phase	
PhaseState	
PhaseStep	
Procedure	
shift	
Tank Overheat	
TechnologyDataSheet Exceedance	
Template66	
UnitProcedure	
Model Templates	
Notification Templates	
Transfer Templates	
Enumeration Sets	
Reference Types	
Tables	
Table Connections	
Categories	
Analysis Categories	

Energy KPI System Deviation (Tier6)	
General	Attribute Templates
Filter	
1 2 Name	Description
Category: General Attributes	
Asset ID	Készülék azonosító
Asset Name	Készülék neve
Asset Type	Készülék típusa
Block ID	Üzemcsoport azonosítója
Block Name	Üzemcsoport neve
Energy Type	Energia típus
KOI ID	
KOI Name	
Unit ID	Üzem azonosítója
Unit Name	Üzem neve
Usage Type	Felhasználás fajta
Utility Type	Segédenergia típus
Category: Operational Parameter	
Energy relevant	Energia fogyasztás
Limitation	Figyelembe vett határérték
Category: Time Aggregated Data	
Deviation Increment Total	KOI által okozott TS szintű eltérés (időben integrálva)
KOI Cost Increment	KOI eltérés költséghez való hozzájárulása
KOI Cost Increment Ratio	KOI eltérés költséghez való hozzájárulása
TS Deviation Cost Total	TS Eltérés költsége (időben integrálva)
TS Deviation Total	TS Eltérés (időben integrálva)

Notifications triggers



Summary

„There are a lot of new things going on in the microprocessor world, including increased focus on power and efficiency.”



Michael Dell

BUSINESS CHALLENGES	SOLUTION	RESULTS AND BENEFITS
<ul style="list-style-type: none">A. Dynamics quality specificationB. Strong focus on energy efficiency<ul style="list-style-type: none">– ISO50 001– NxDSP program– Solomon studies (EII, SEC)	<ul style="list-style-type: none">A. SQC – Statistical based validation system to identify bad quality specificationB. EMS – Operation monitoring tool to identify the energy wasteC. PI System tools to increase efficiency through turning the data into information.	<ul style="list-style-type: none">• Automatic quality limit validation system• 230 000 \$/y energy saving (EMS)• Decreased energy consumption – 2% YOY• NxDSP benefit 500-550 mUSD

Contact Information

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Engineer MOL Group

Questions

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



State your
name & company

Please don't forget to...

Complete the Online Survey
for this session



<http://eventmobi.com/emeauc15>



감사합니다

谢谢

Danke

Merci

Gracias

Thank You

Děkuji

Köszönöm

ありがとう

Спасибо

Obrigado