



Operational Intelligence with the PI System within ENGIE Energie Nederland

Presented by **Herold van der Vegt**
Rob Linckens





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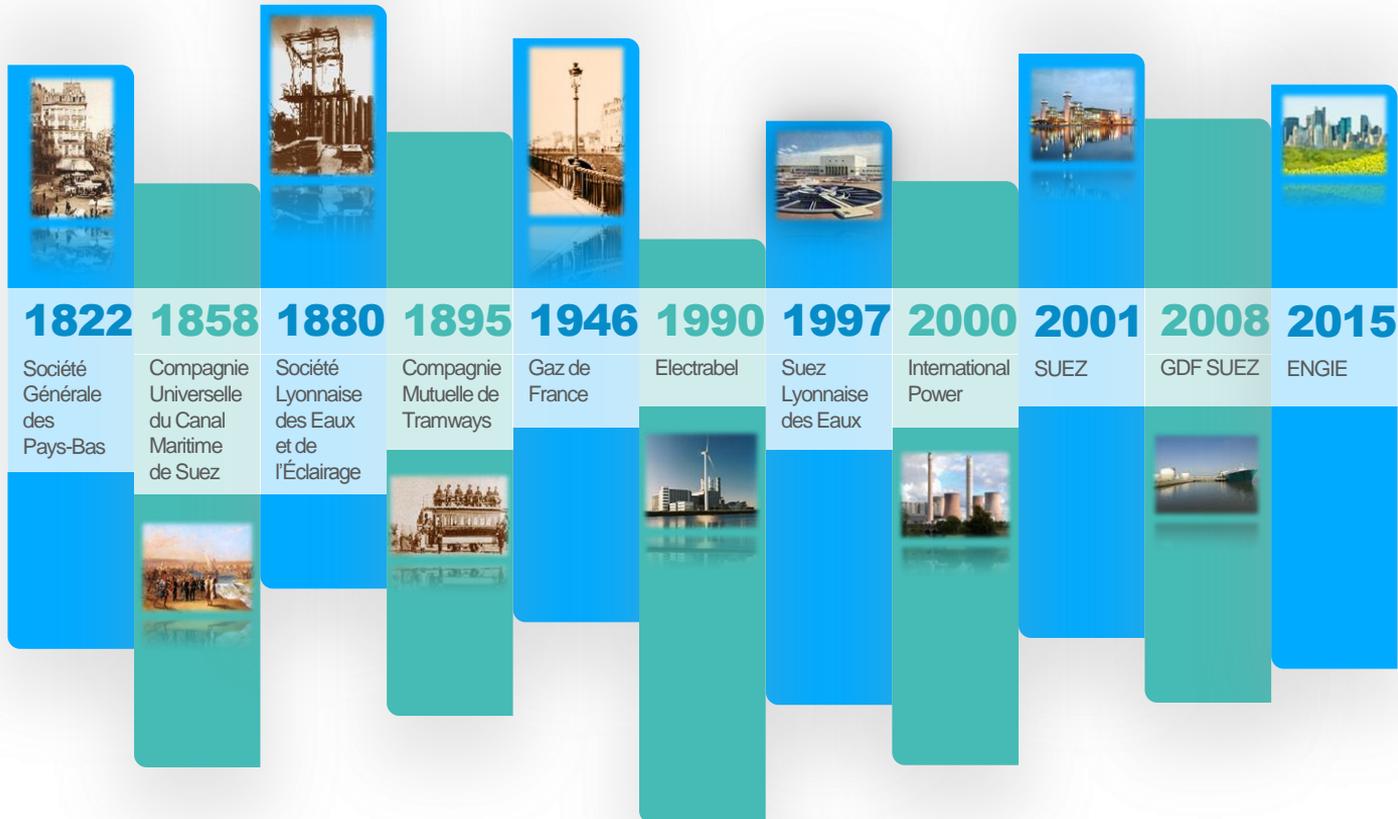


GDF SUEZ to ENGIE

GDF SUEZ is now



A history of services in public utilities



Key figures*

- €74.7 billion in 2014 revenues.
- 152,900 employees throughout the world
 - inc. **58,200** in power and natural gas
 - and **94,700** in energy services.
- €6-7 billion of net investment per year over 2014-2016.
- Operations in 70 countries.
- 900 researchers and experts at 11 R&D centers.

* At December 31, 2014.

Three expanding businesses

Power

- **No.1** independent power producer (IPP) in the world.
- **No.6** supplier in Europe.
- **115.3 GW*** of installed power-production capacity.*
- **10.5 GW*** of capacity under construction.*

Natural gas

- **No.3** seller of natural gas in Europe.
- **No.3** LNG supply portfolio in the world.
- **No.1** distribution network in Europe.
- **No.2** transport network in Europe.
- A supply portfolio of **1,296 TWh**.

Services

- **No.1** supplier of energy efficiency services in the world.
- **230** district cooling and heating networks throughout the world.
- **140** million m² managed in the tertiary sector.

* Including 100% of capacity of assets held by the Group at December 31, 2014, regardless of the actual holding rate.

Revenues, workforce and capacity by region*

€74,7 billion
in 2014 revenues

152,900
employees

115.3 gigawatts
of installed power capacity

10.5 gigawatts
under construction

North America
Rev.: **€3.8bn**
4,100 emp.
13.1 GW
0.1 GW

Latin America
Rev.: **€4.3bn**
5,450 emp.
14.2 GW
3.2 GW

Europe¹
Rev.: **€58.7bn**
136,600 emp.
49.2 GW
0.4 GW

Africa
Rev.: **€0,4bn**
150 emp.
0,3 GW
2.5 GW

Middle East
Rev.: **€0.5bn**
1,250 emp.
25 GW
3.6 GW

Asia
Rev.: **€5.4bn**
2,550 emp.
9.6 GW
0.7 GW

Pacific
Rev.: **€1.5bn**
2,800 emp.
3.9 GW

* Including 100% of capacity of assets held by the Group at December 31, 2014, regardless of the actual holding rate.

(1) Inc. Turkey.

Plants Netherlands

PI System Generation & EMT

140 MW (Gas)



880 MW (Gas)



736 MW (Coal)



- 350 Users
- Rotterdam newest plant



1880 MW (Gas)



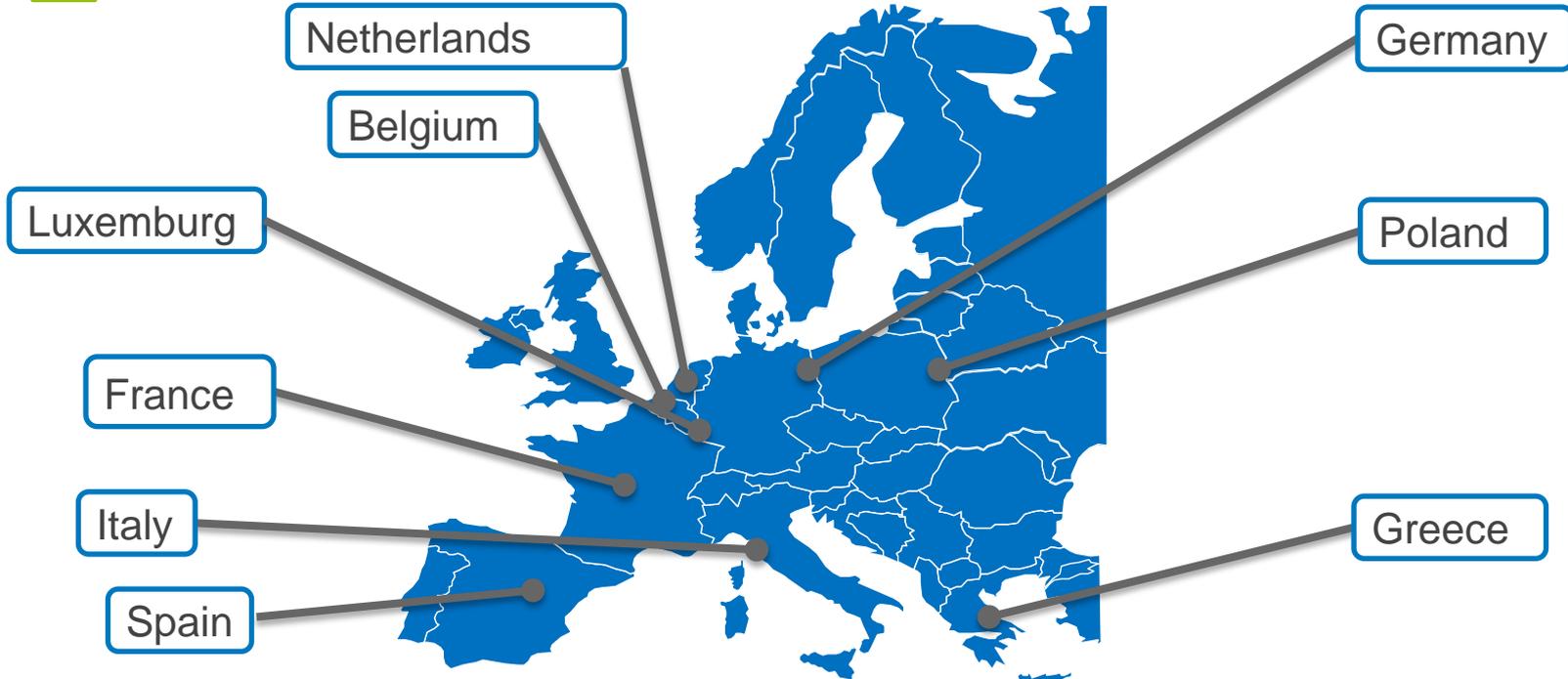
80 MW (Gas)



592 MW (Coal)



The PI System: GDF-SUEZ Europe



There are certainly more PI Servers to be found within our group...

Why the PI System @ ENGIE [NL]?

- Centralized Data
 - Multiple DCS systems on plants
 - Corporate PI Server
- High reliability of real-time data collection
- Easy access to real-time data through powerful clients for end users
- It's a standard in the ENGIE group

PI System core usage

- 1999: First use of PI System
- 2003: PI Server as bases of Plant Information Management System (PIMS)
- 2009: Maxima plant added
- 2012: Rotterdam plant added
- 2014: Redesign of the PIMS architecture in the Netherlands

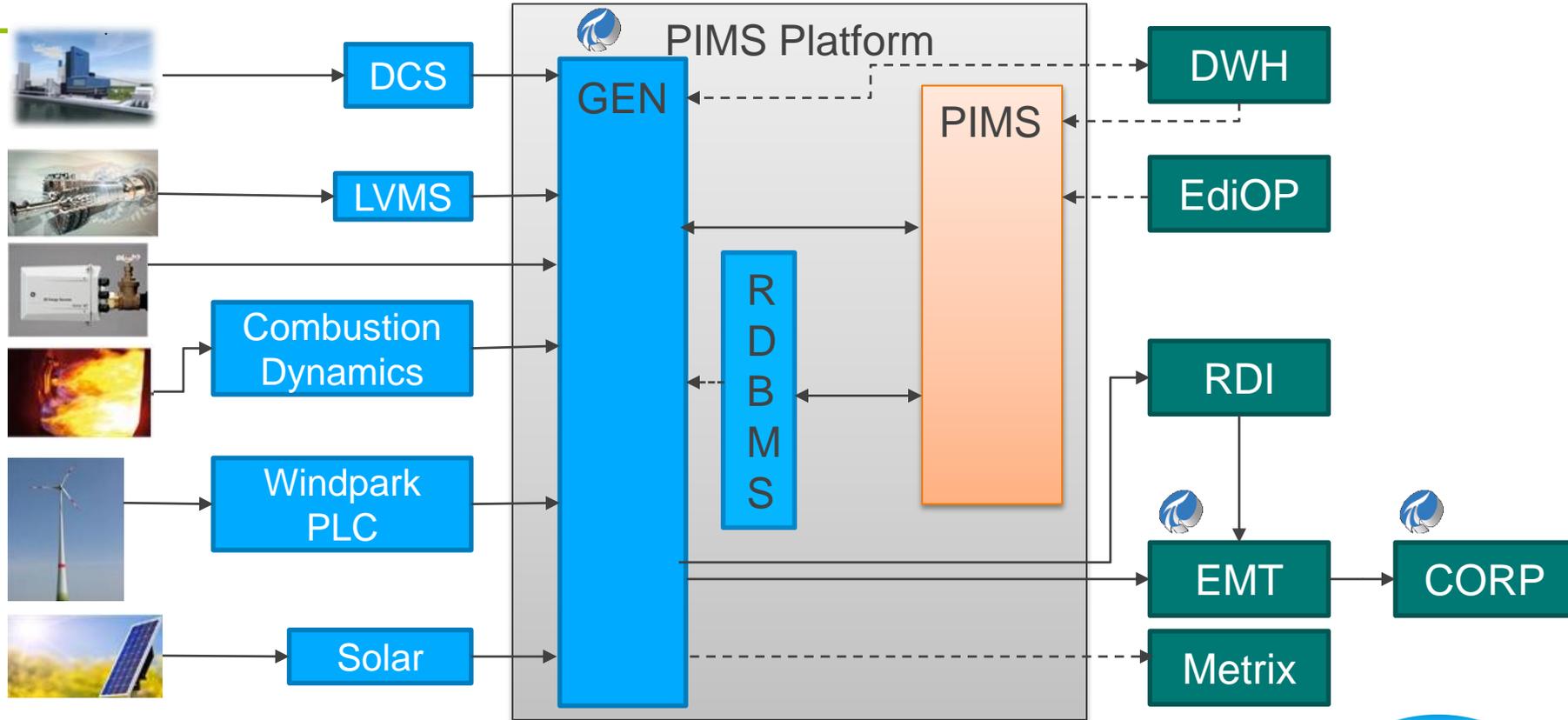
Power Generation

- Generation Reliability coordination
- Vibration Control and Transformer-monitoring
- Generation statistics control
- Plants emission control
- Performance calculations

Portfolio Management & Operations

- Real-time Dispatching
- Gas Balancing
- Fleet overview and control
- Production regulation control

PI System Architecture [NL]



PI System Modules [NL]

Server

- PI Server 2012

Interfacing

- OPC, DNP3, PItoPI, PI UFL, PI XML, PI SDK, TXP, COM Connector , PI Web Services
- Custom interface to IBM MQ Series

Calculation & online analysis

- PI ACE, PI PE, PI Totalizers
LVMS

Modelling & configurations

- PI Module Database (PI MDB)

Clients

- PI ProcessBook
- PI DataLink
- Custom ASP.Net websites

System Management

- PI System Management Tools (PI SMT)
- PI Perfmon Interface (basic)
- PI Ping Interface

PI ACE (Technical Performance Data)

TPD General (FL-5) version: v.2004

General	Seasonal influ.	Config. pos.	Heatratercurves	Ramprate	Logging
Maximal extra power (Pmax)			Heatratercurves		
Maximal producible power in overload (Pmax)			MW		
Maximal theoretical producible power (Pmth)			MW		
Normal economic maximum (Pnem) (range) *		447	MW		
Maximal producible power (Pm) *			MW		
Maximal producible heat (Ph)			MW		
Minimal producible power (Pmin) *			MW		
Minimal producible power (Plow) *			MW		
Minimal producible power (Plowx)			MW		
Steamtemperature inlet HP turbine			°C		
Steamtemperature inlet IP turbine			°C		
Steamtemperature inlet LP turbine			°C		
Steampressure inlet HP turbine			bar		
Steampressure inlet IP turbine			bar		
Steampressure inlet LP turbine			bar		
Nominalconditions					
Cooling water temperature			°C		
Ambient temperature *			°C		
Ambient pressure *			mbar		
Fuel type *					
Low heating value			kJ/Nm3		

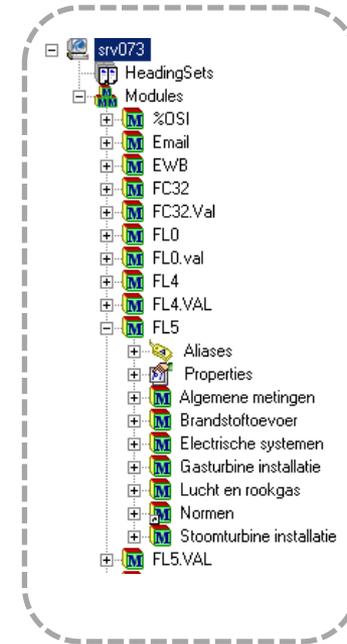
Ingangsdatum: 05-04-2012 08:20 (Uiterste) Reviewdatum: Status: Definitief

Sluiten



Sync.

Module Database



PI ACE (Data flows)

- 30 operational PI Advanced Computing Engine (PI ACE) modules
- >1750 Running contexts
- Recalculation
- Calculation frequency 5min

General

- FlowBioOil
- FlowGeneral
- Multiplier
- Summation
- Average
- Ratio
- Correctionfactor
- Cosphi

Fuel Performance

- Gas Turbine
- S.T. Conventional
- Ketel
- Netto Production
- Delta Heatconsumption
- Configuration Unit

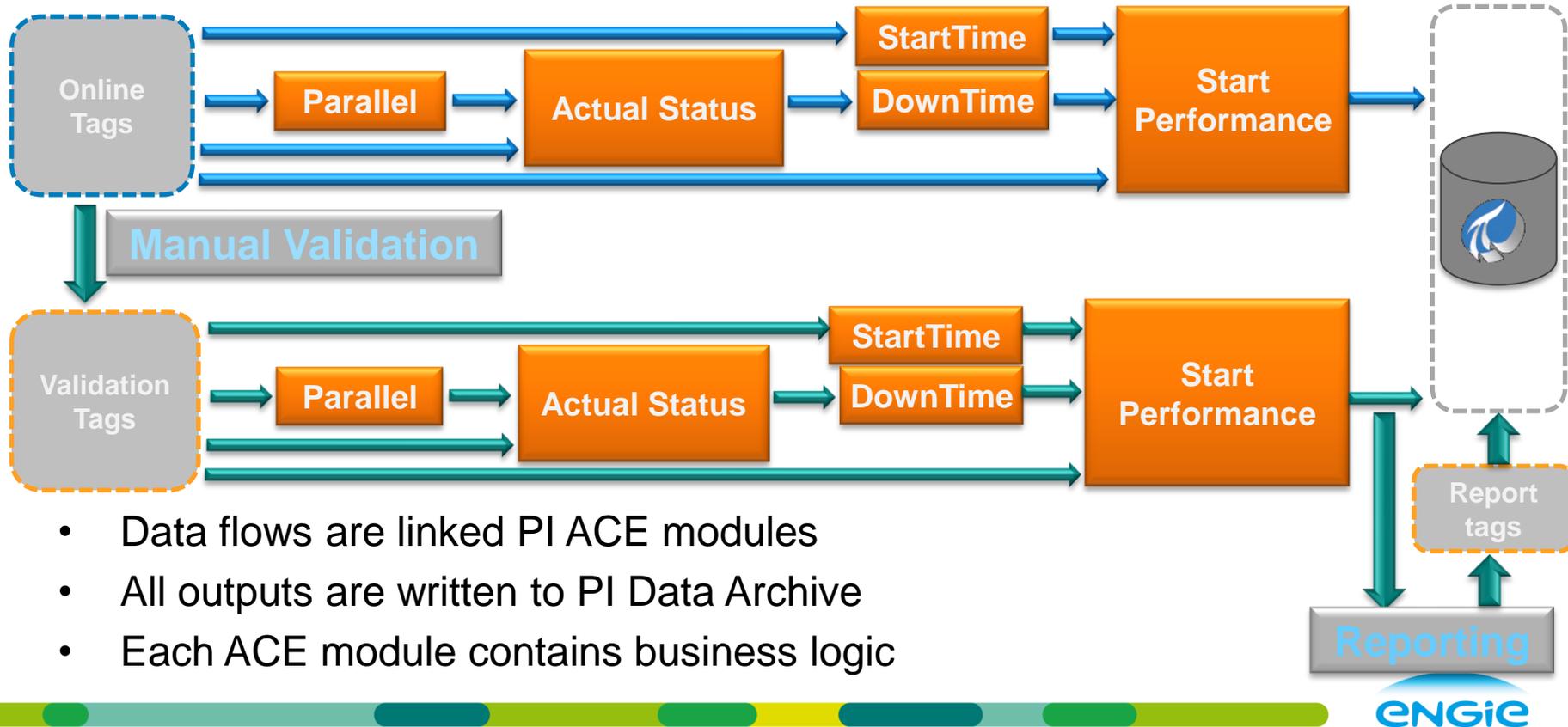
Proces Optimization

- Heat Consumption Gas
- Heat Consumption Coal
- Start Performance
- Status Parallel
- Actual Status
- DownTime
- DynamicMaintenance

Environment

- Relative Emission
- Absolute Emission
- Average gross power

PI ACE (Data flows)



PI ACE (Condition Based Maintenance)

Measurement

- Condition of a valve based on flow and pressure.

Current solution

- Created PI ProcessBook.
- User activated.

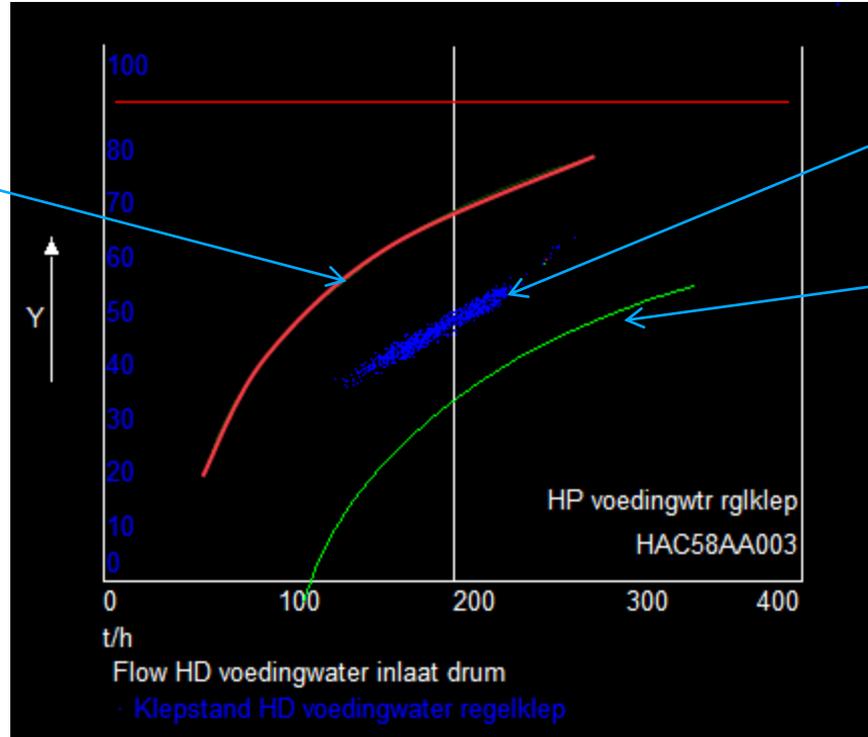
New solution

- More automation, independent of user action.
- KISS



PI ACE (Condition Based Maintenance)

“dirty” curve



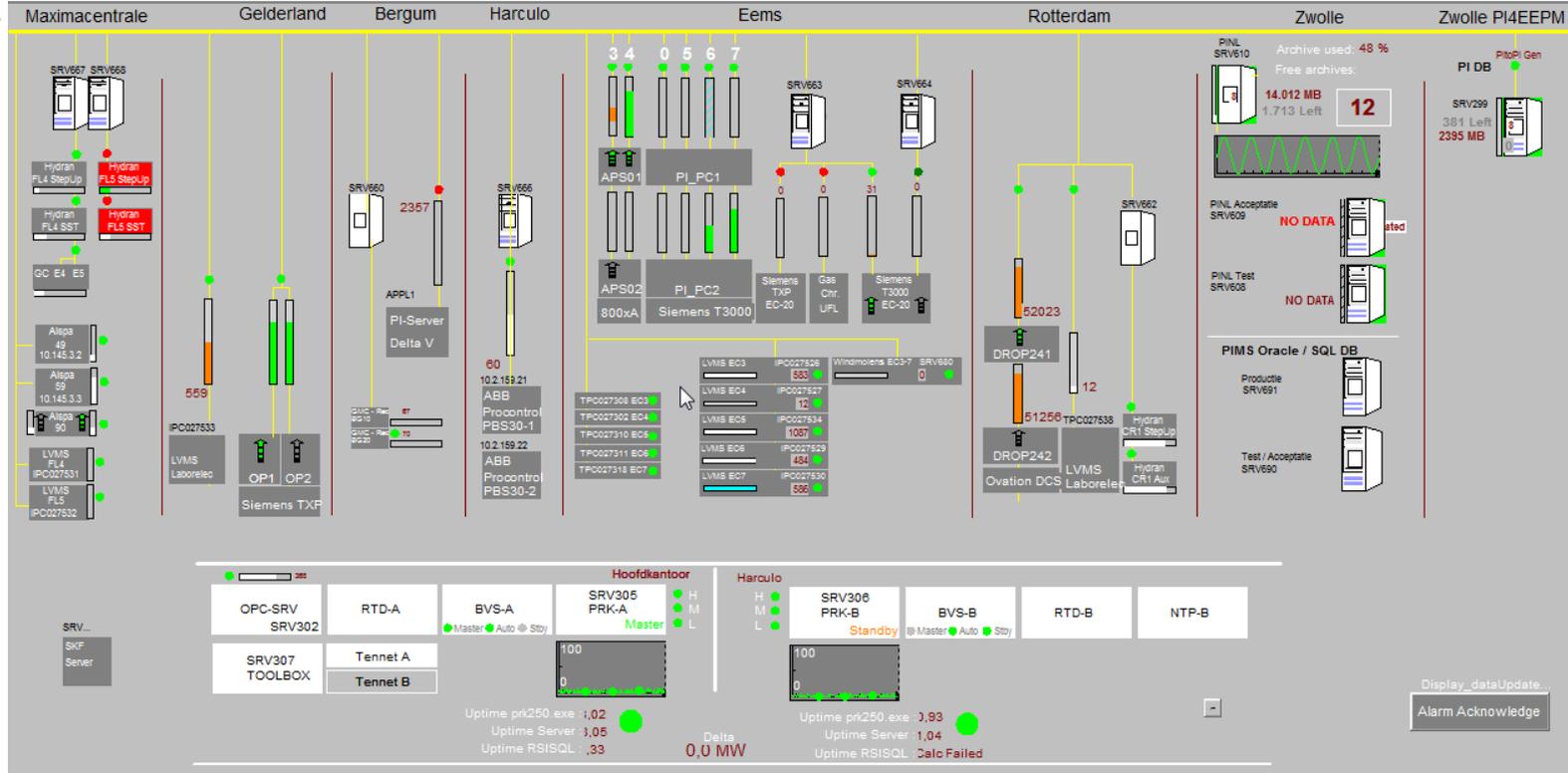
Measurements based on flow

“clean” curve

PI ACE (Condition Based Maintenance)

- ABC curve limit $f(x) \Rightarrow ax^2 + bx + c$ in PI Module Database (PI MDB)
- Valve position \Rightarrow expected flow
- Configuration
 - Sample Window
 - Min \ Max
 - Percentage good \ over limit
- Output is written to the PI System
- Trigger further actions

PI Clients (PI System Monitoring)



PI System Custom Application (Validation)

Validatietool Overzicht Configuratie Process book Klabbok Help Inlognaam: sdm0162255 Productieomgeving

Gebruiker: Jan Postema Let op: de zometijd gaat binnen deze periode in.

Locatie:

Valideren tot (alle rapporten):

Inactieve tags actief maken:

Algemeen	Laatst gevalideerd	Valideren tot	Actie
Gas	31-01-2015 06:00	08-02-2015 06:00	Valideren ■ ■ ■
Algemeen	02-03-2015 08:05	02-03-2015 13:34	Valideren ■ ■ ■

Rapportage	Laatst gevalideerd	Valideren tot	Actie	EC-20	EC-3	EC-4	EC-5	EC-6	EC-7
Brandstofperformance	02-03-2015 06:00	02-03-2015 13:34	Valideren	■	■				
Startperformance	25-02-2015 10:53	02-03-2015 13:34	Valideren	■	■				
E-Productie	02-03-2015 08:15	02-03-2015 13:34	Valideren	■	■				
Koelwater	12-12-2013 03:15	20-12-2013 03:15	Valideren	■	■				
Omzetfactoren	02-03-2015 08:00	02-03-2015 13:34	Valideren	■	■				
Milieu rapport	02-03-2015 08:20	02-03-2015 13:34	Valideren	■	■				



Validatietool Overzicht Configuratie Process book Klabbok Help Inlognaam: sdm0162255 Productieomgeving

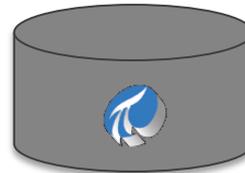
Omgangsvormen: Startperformance Milieu rapport E-Productie

Starttijd: 02-03-2015 08:00 Eindtijd: 04-03-2015 08:00

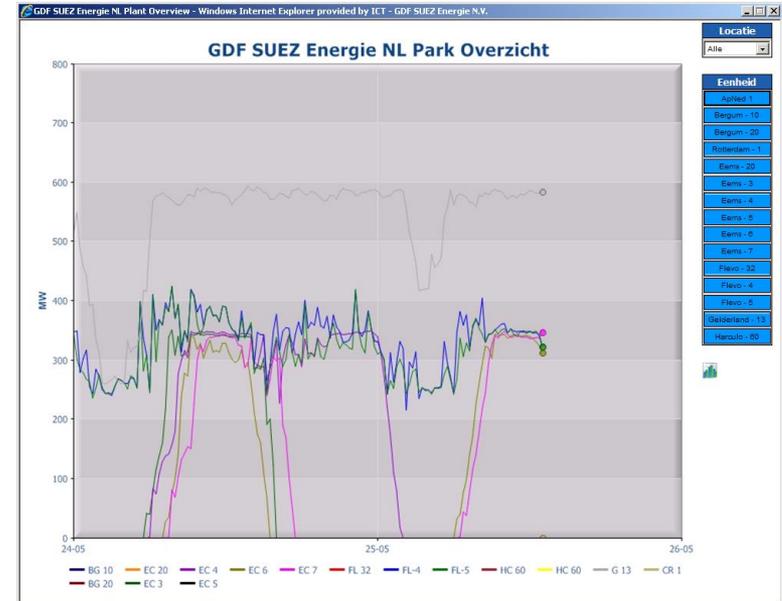
Sturen

Brandstofperformance

Tag	Gevalideerd tot	Actie
ACE-ECT-Verbruik-OT-Meting1	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting2	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting3	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting4	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting5	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting6	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting7	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting8	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting9	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting10	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting11	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting12	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting13	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting14	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting15	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting16	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting17	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting18	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting19	02-03-2015 13:34	Valideren ■ ■ ■
ACE-ECT-Verbruik-OT-Meting20	02-03-2015 13:34	Valideren ■ ■ ■



Custom Applications (Plant Overview)



Custom Applications (Pmax Test)

Release 1.5.1 **P M A X** PMAX ACCORDEREN PMAX HISTORIE PMAX/PNEM TEST BRANDSTOF RAPPORTAGES ? ☆

Start
Stop

Actueel
 Vermogen: 339,36 MW

Hulpsystemen EC7
 Forecast: 0,00 MW
 Actual: 0,00 MW

Locatie / eenheid
 Eems
 Eems - 7

Periode
 01-06-2011
 31-05-2012

15:00

PMAX | **PNEM**

Periode	Locatie	Eenheid	Realisatie	Pnem	Verschil %	LT	LD	KWT	AI	EB	AB	HS	Status
29-05-2012 10:39-10:54	EC	EC7	356,48	356,23	0,07	13,65	1011,46	18,37	0,00	4,16	1,64	0,00	🟢
25-05-2012 13:09-13:24	EC	EC7	348,87	349,68	-0,23	20,41	1025,74	16,40	0,00	4,28	0,00	4,10	🟢
14-05-2012 13:31-13:46	EC	EC7	357,33	357,13	0,06	14,39	1010,93	12,66	0,00	4,35	0,24	1,11	🟢
07-05-2012 10:47-11:02	EC	EC7	363,47	363,61	-0,04	9,46	1014,10	11,15	0,00	4,26	1,25	2,11	🟢
01-05-2012 12:22-12:37	EC	EC7	353,42	354,92	-0,42	16,77	1013,57	12,09	0,00	4,15	1,29	0,00	🟢
24-04-2012 09:59-10:14	EC	EC7	354,77	355,45	-0,19	9,40	989,77	8,84	0,00	4,32	0,00	2,91	🟢
17-04-2012 10:58-11:13	EC	EC7	362,13	362,03	0,03	7,65	1003,71	8,53	0,00	4,22	1,31	2,46	🟢
10-04-2012 13:43-13:58	EC	EC7	346,18	348,27	-0,60	12,11	986,60	7,71	0,00	4,16	0,00	5,69	🟢
29-03-2012 12:46-13:01	EC	EC7	367,86	369,20	-0,37	8,46	1016,10	9,27	0,00	4,33	0,00	0,00	🟢
06-03-2012 10:47-11:02	EC	EC7	369,01	367,85	0,31	9,40	1019,69	5,20	0,08	4,30	1,52	0,00	🟢
27-02-2012 10:20-10:35	EC	EC7	368,04	367,69	0,10	7,33	1016,71	4,06	0,00	4,32	1,55	1,74	🟢
20-02-2012 10:11-10:26	EC	EC7	373,86	372,78	0,29	7,68	1025,73	1,04	0,68	4,32	0,00	0,00	🟢
13-02-2012 12:06-12:21	EC	EC7	369,60	369,95	0,10	7,01	1014,10	5,68	0,48	3,37	0,00	0,97	🟢

Reden verschil van pnem test op bij afwijking > 1 %

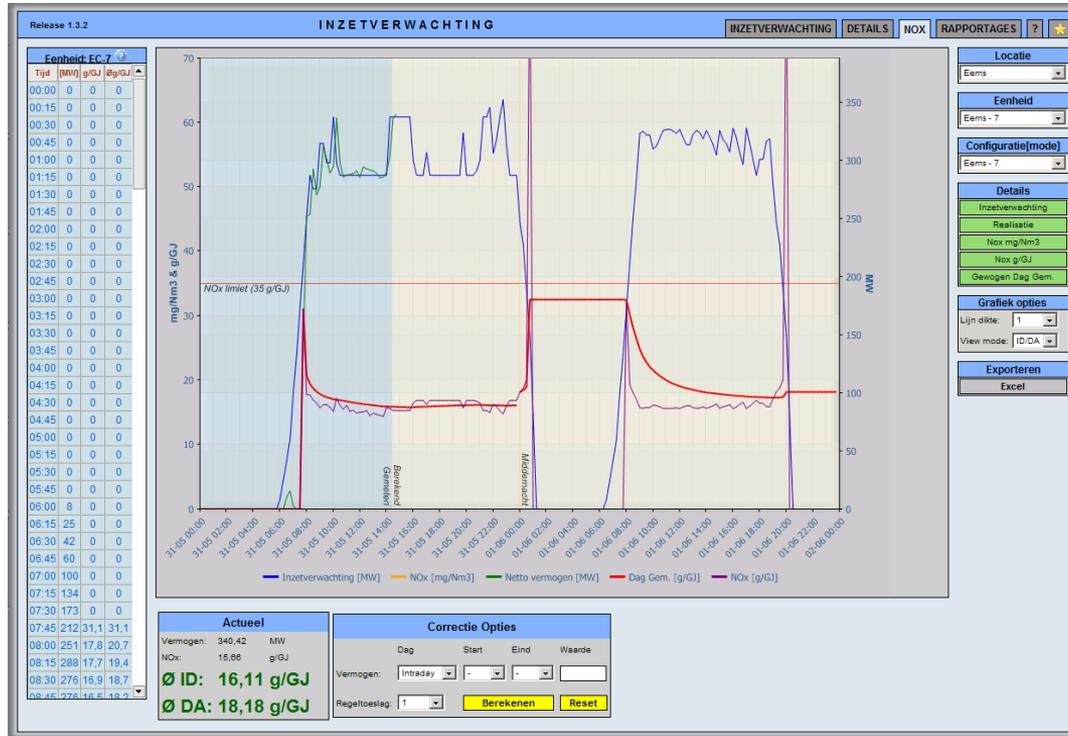
Niet Akkoord
Akkoord

Geaccordeerd, Accorderen, Test Actief, Pmax gehaald=🟢, Pnem niet gehaald=🔴

Base Load Test

- Netto Production
- Weather Data
- Pmax Model

Custom Applications (NOx Forecast)



- Based on Production Plan and PI System data

Custom Applications (Power dispatch)



The PI System has a broad range of uses to support your processes.

BUSINESS CHALLENGES

- A. Uniform data analysis, calculation and reporting
- B. Embed PI System in everyday processes
- C. Analyze results of decisions made by power dispatch

SOLUTION

- A. Data flows using PI ACE
- B. Standard PI System Clients
- C. Custom web applications

RESULTS AND BENEFITS

- Improved data integrity
- Improved data availability on corporate level
- Improved decision making on (near) real-time data

Contact Information

Herold van der Vegt

herold.van.der.vegt@gdfsuez.nl

Information System Analyst

ENGIE Energie Nederland

Rob Linckens

rob.linckens@gdfsuez.nl

Information System Analyst

ENGIE Energie Nederland

Questions

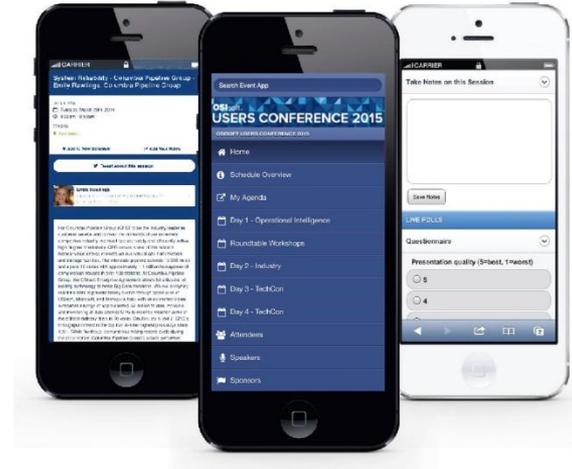
Please wait for the **microphone** before asking your questions



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

ありがとう

Спасибо

Obrigado

Bedankt voor uw aandacht

