Operational Intelligence with the PI System within ENGIE Energie Nederland

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Rob Linckens

by people for people

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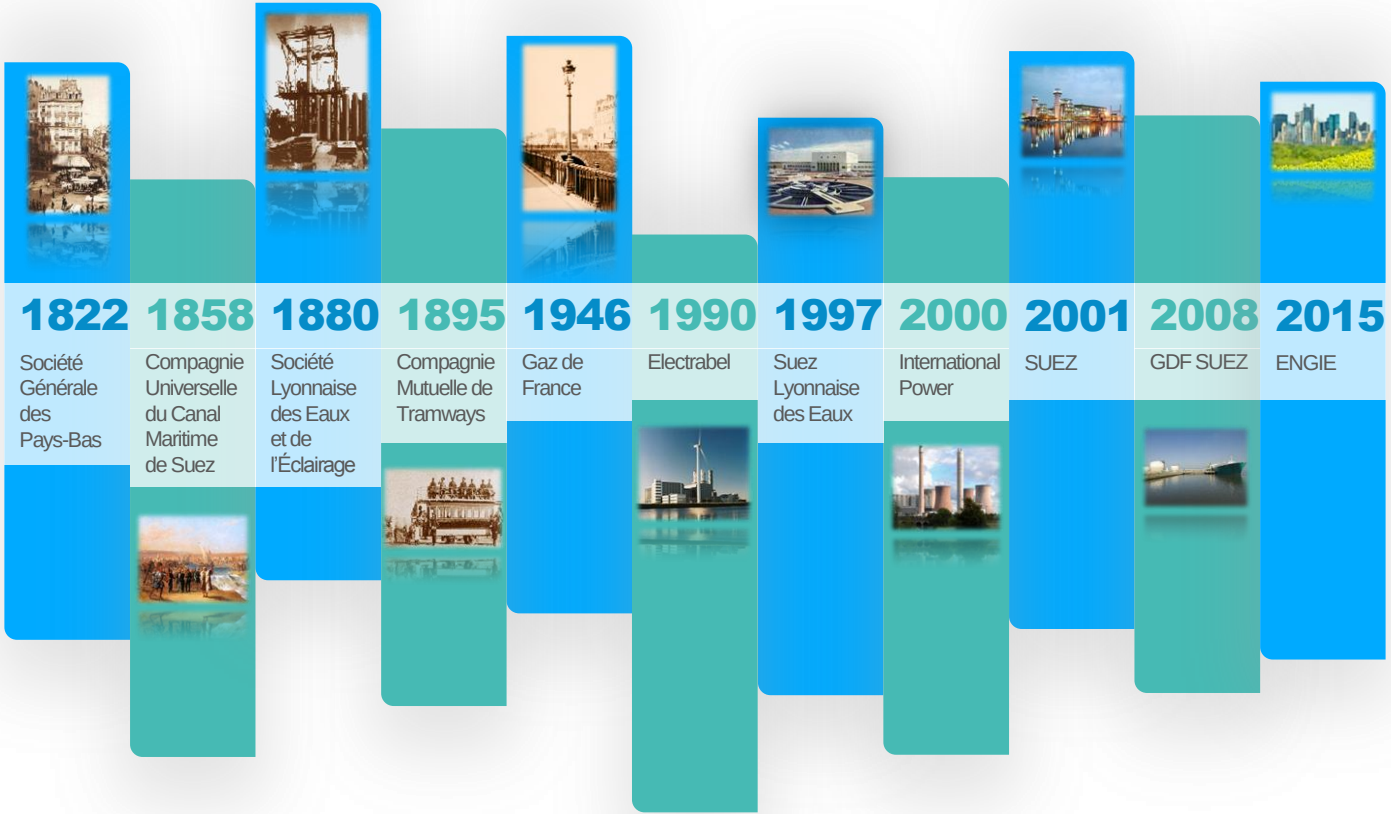
Operational Intelligence with the PI System within ENGIE Energie Nederland

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 m^2 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.

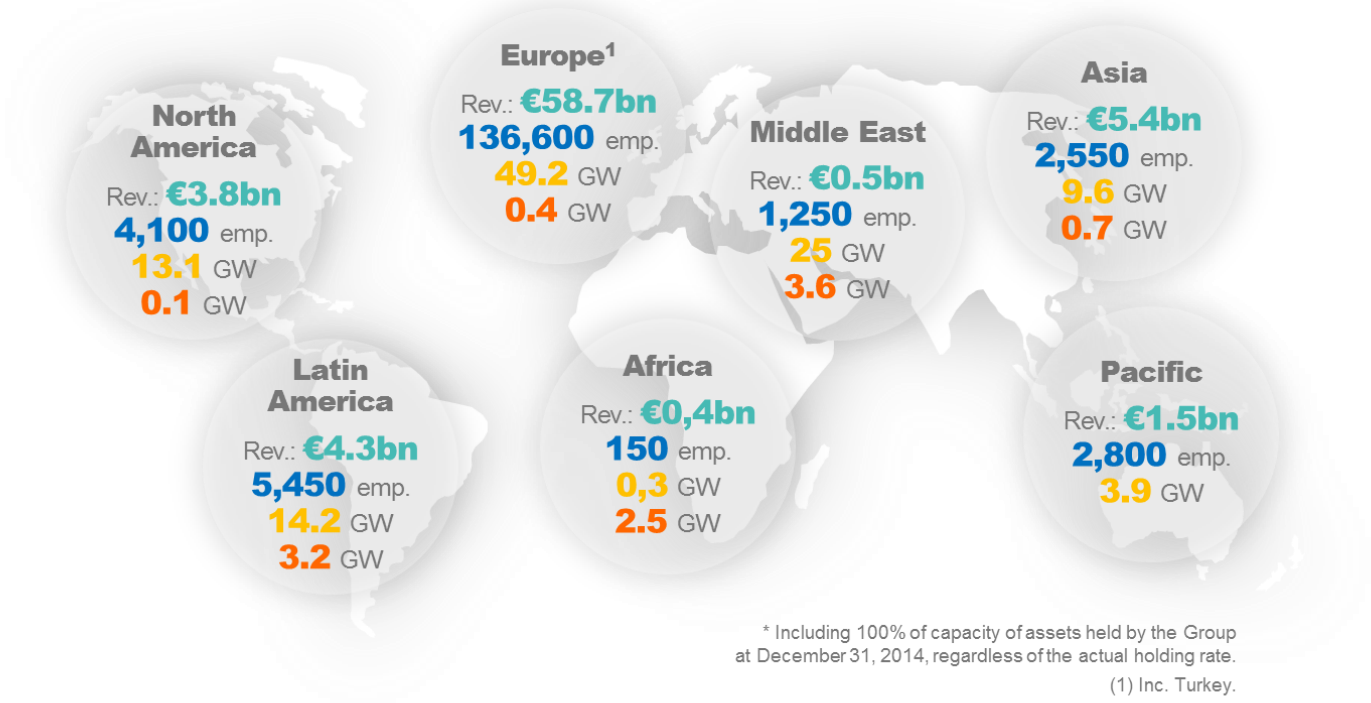
Revenues, workforce and capacity by region*

€74,7 billion in 2014 revenues

152,900 employees

115.3 gigawatts of installed power capacity

10.5 gigawatts under construction



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

(1) Inc. Turkey.

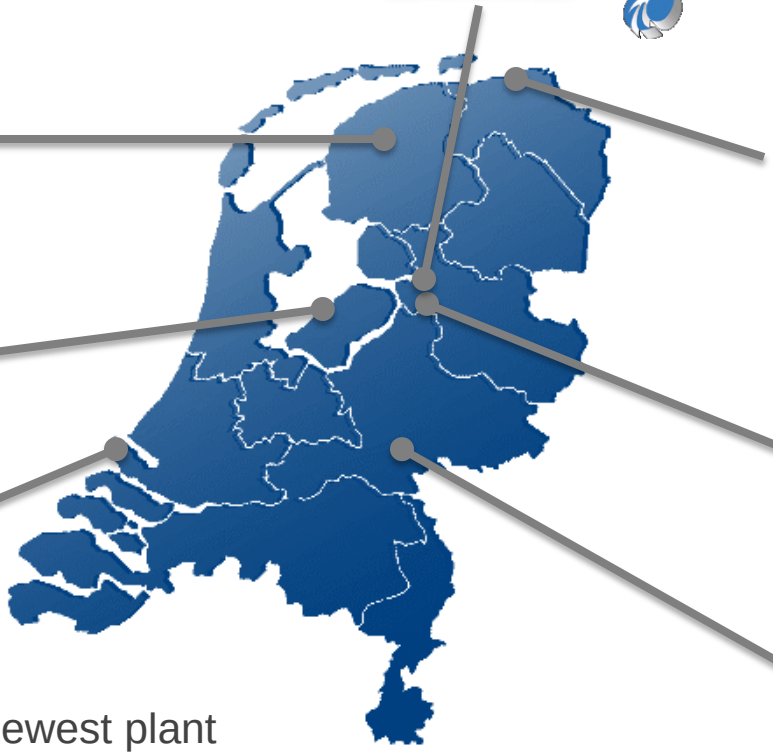
Plants Netherlands

PI System Generation & EMT

140 MW (Gas)

880 MW (Gas)

736 MW (Coal)



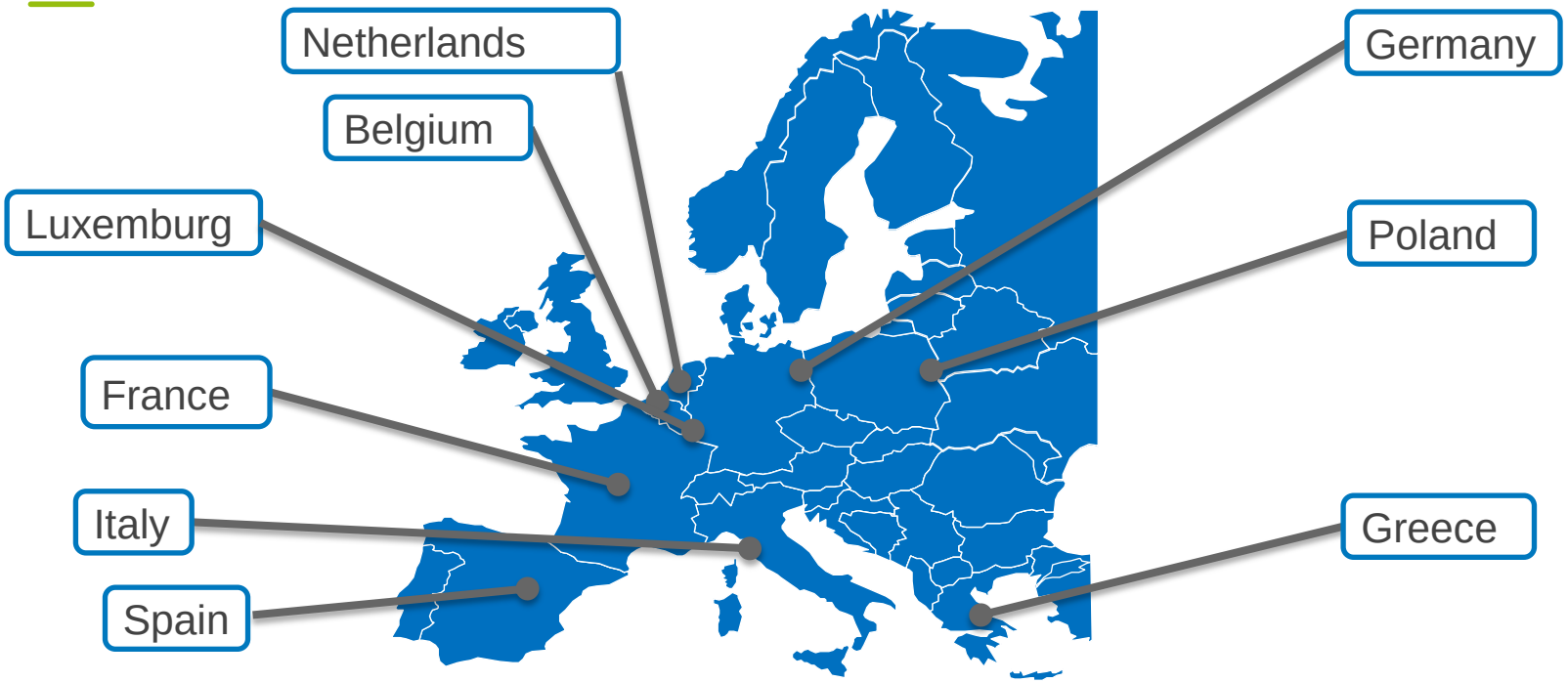
1880 MW (Gas)

80 MW (Gas)

592 MW (Coal)

- 350 Users
- Rotterdam newest plant

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 trough 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]

DCS

LVMS

Combustion Dynamics

Windpark PLC

Solar

PIMS Platform

GEN

RDBMS

PIMS

DWH

EdiOP

RDI

EMT

CORP

Metrix

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

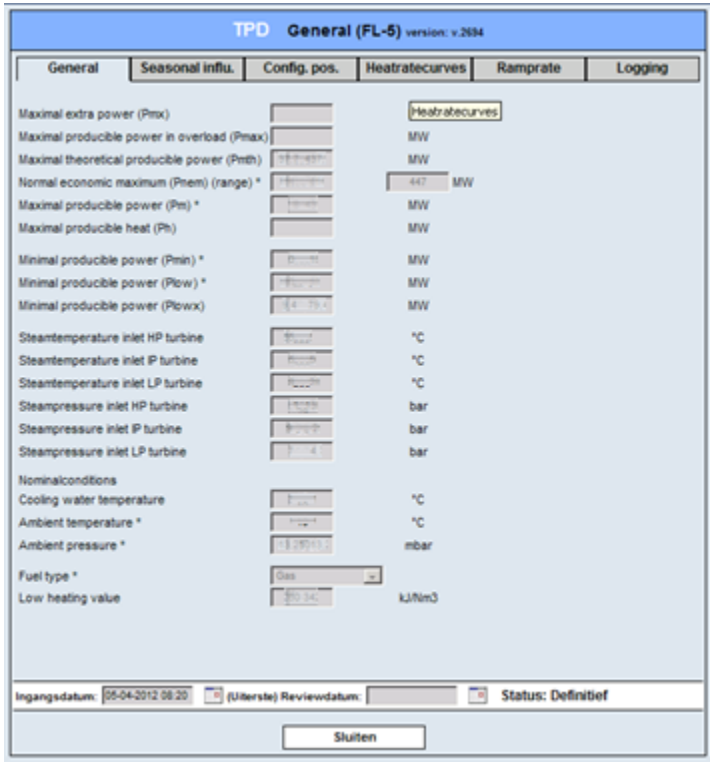
Calculation & online analysis
- PI ACE, PI PE, PI Totalizers LVMS

Modelling & configurations
- PI Module Database (PI MDB)

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

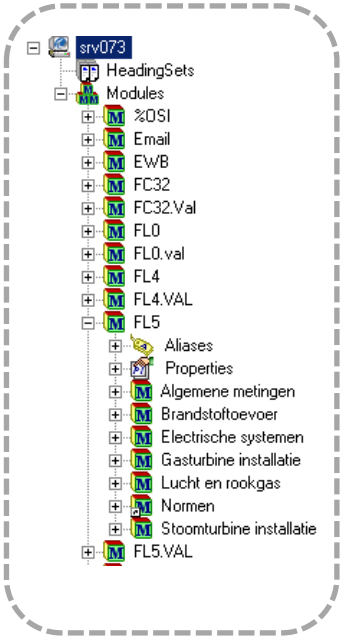
System Management
- PI System Management Tools (PI SMT)
- PI Perfmon Interface (basic)
- PI Ping Interface

PI ACE (Technical Performance Data)



Sync.

Module Database



PI ACE (Data flows)

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

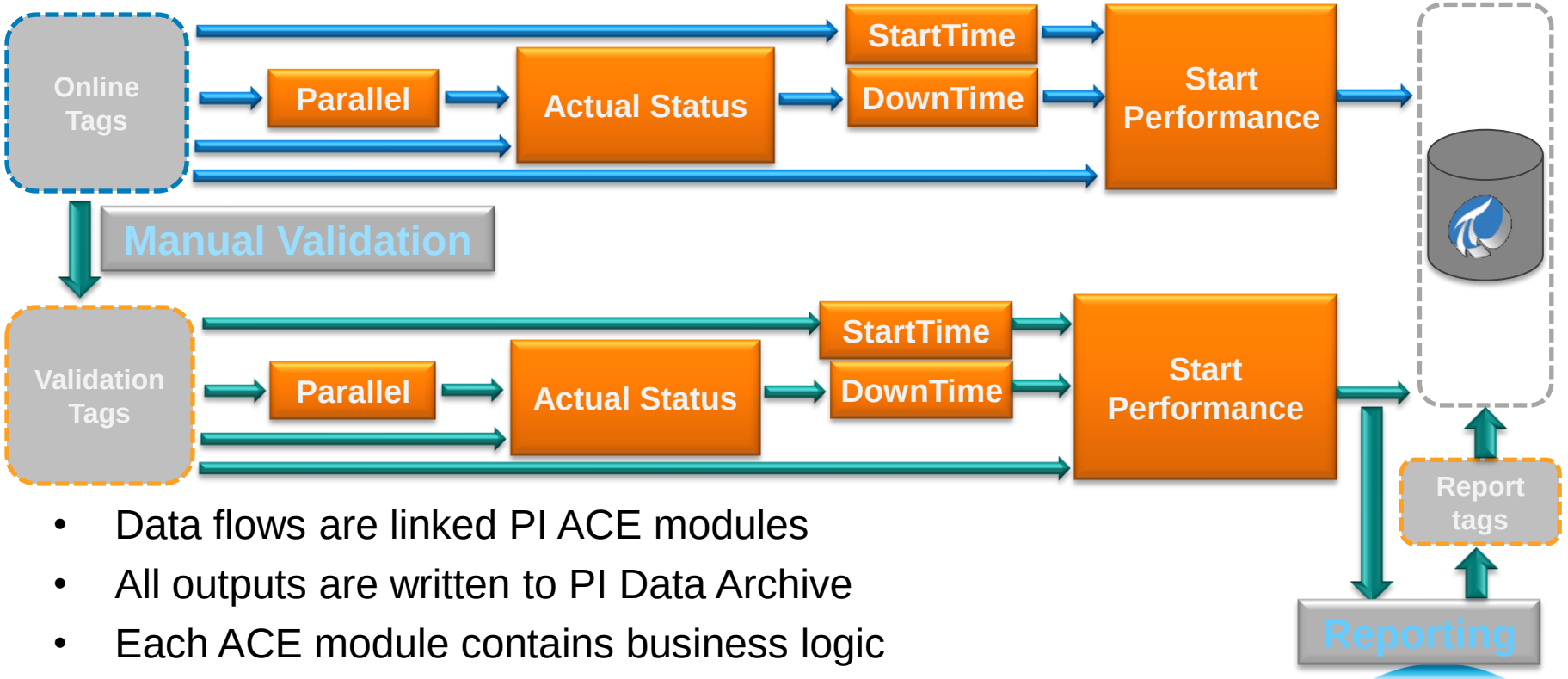
Proces Optimalization
- Heat Consumption Gas
- Heat Consumption Coal
- Start Performance
- Status Parallel
- Actual Status
- DownTime
- DynamicMaintenance

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

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

Environment
- Relative Emission
- Absolute Emission
- Average gross power

PI ACE (Data flows)



- Data flows are linked PI ACE modules
- All outputs are written to PI Data Archive
- Each ACE module contains business logic

PI ACE (Condition Based Maintenance)

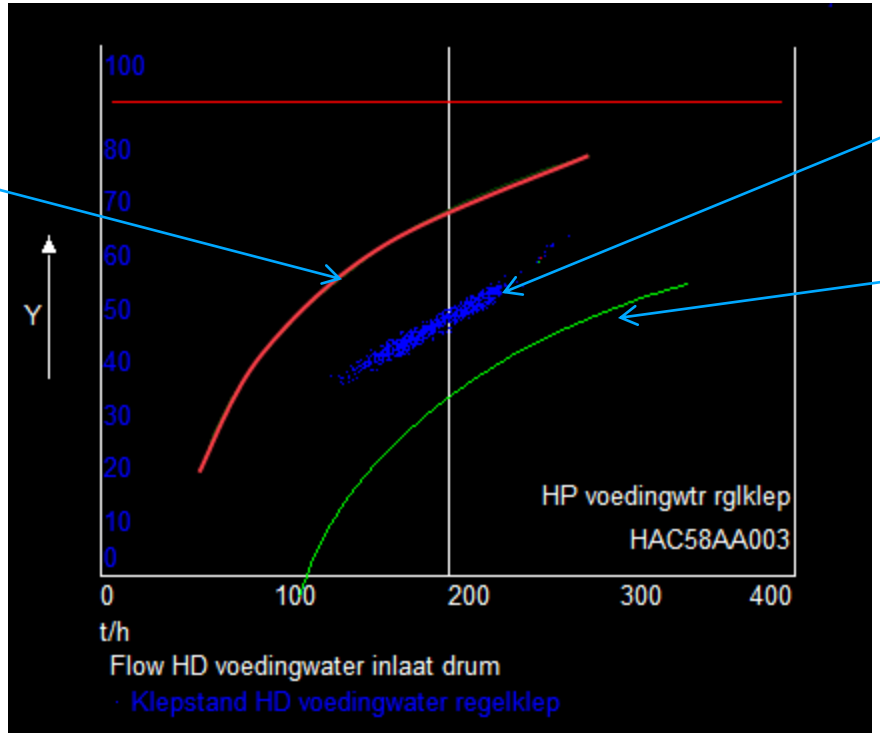
Measurement
- Condition of a valve based on flow and pressure.

Current solution
- Created PI ProcessBook.
- User activated.

New solution
- More automation, independent of user action.
- KISS

PI ACE (Condition Based Maintenance)

“dirty” curve



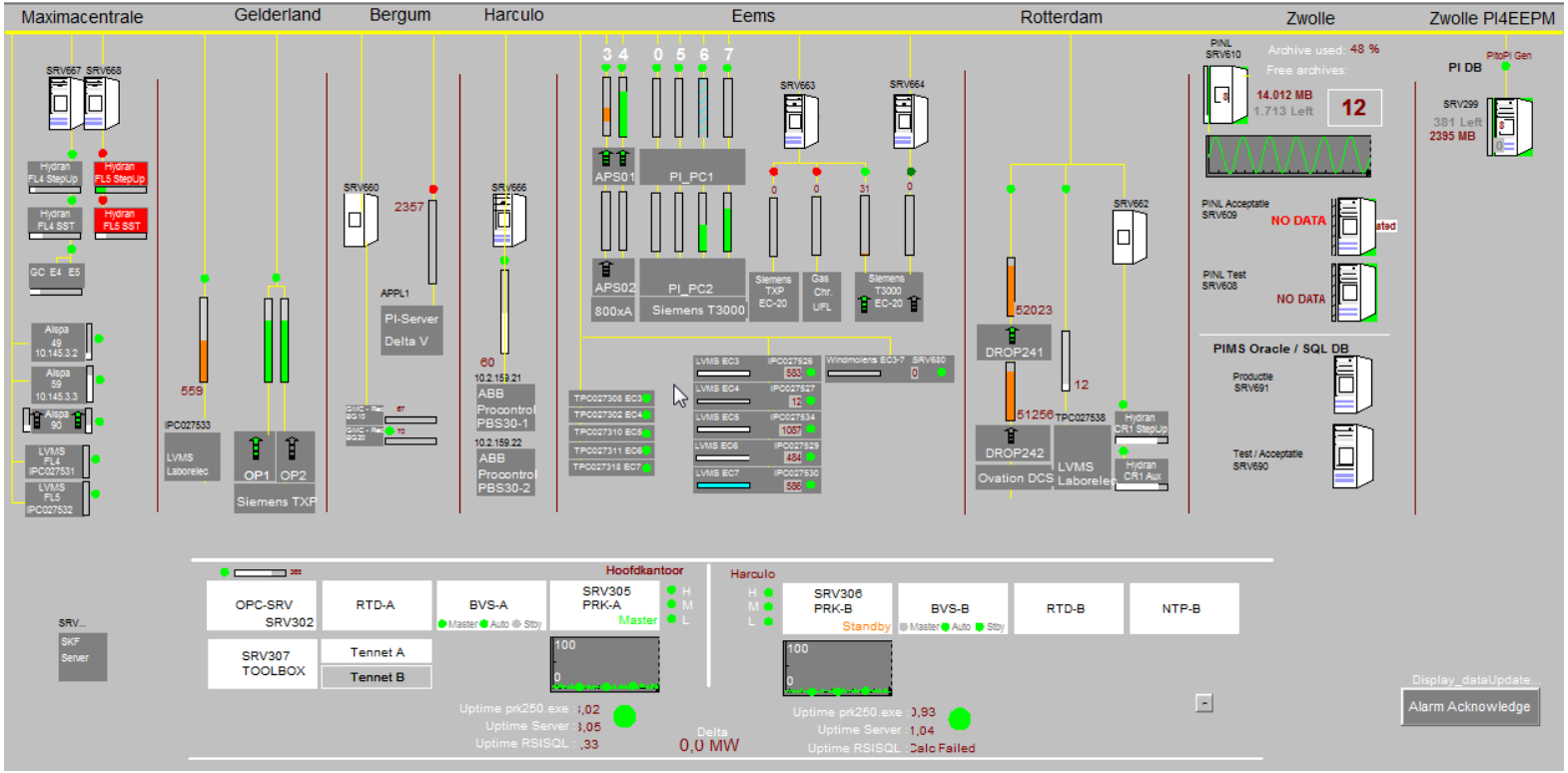
Measurements based on flow

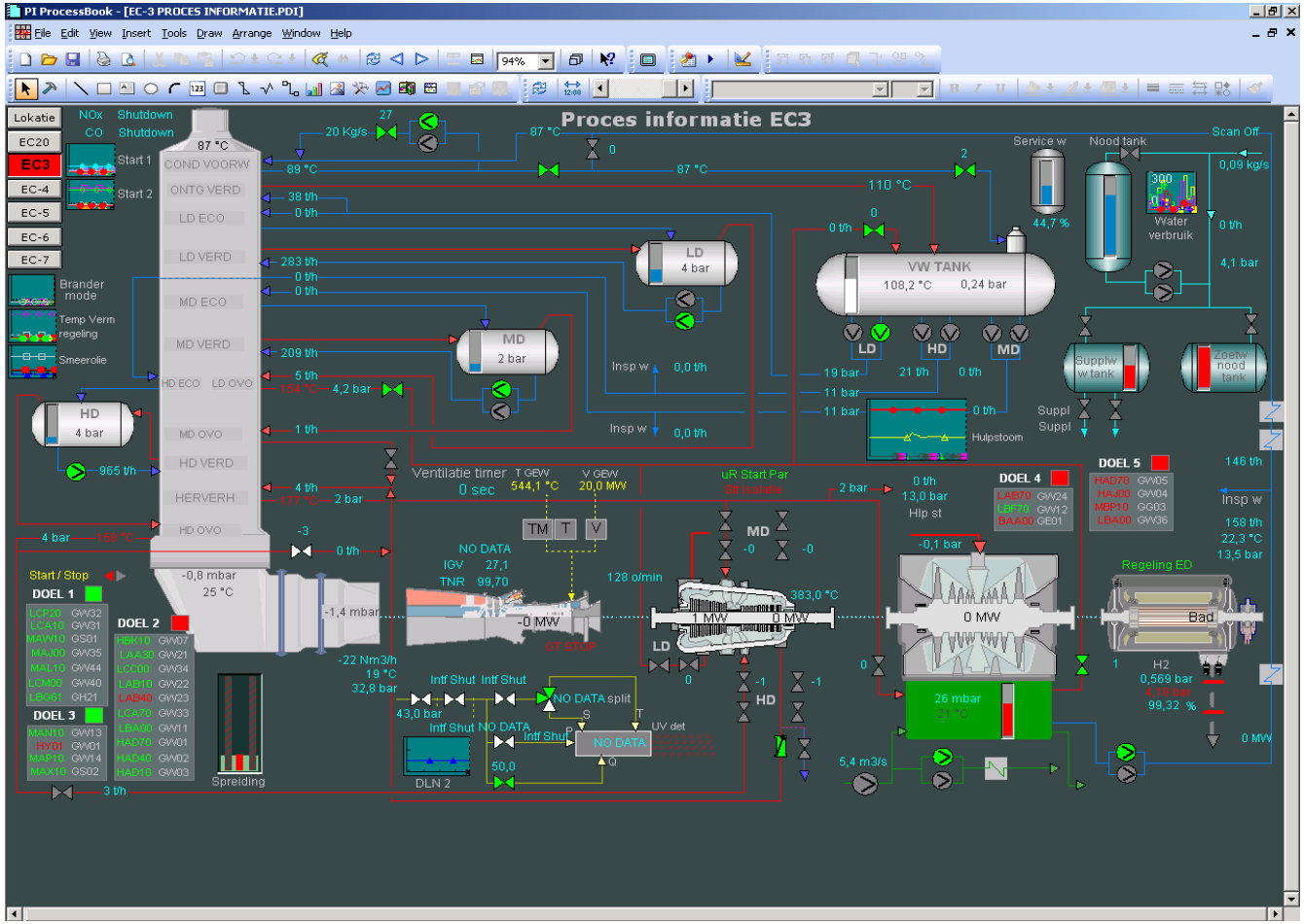
“clean” curve

PI ACE (Condition Based Maintenance)

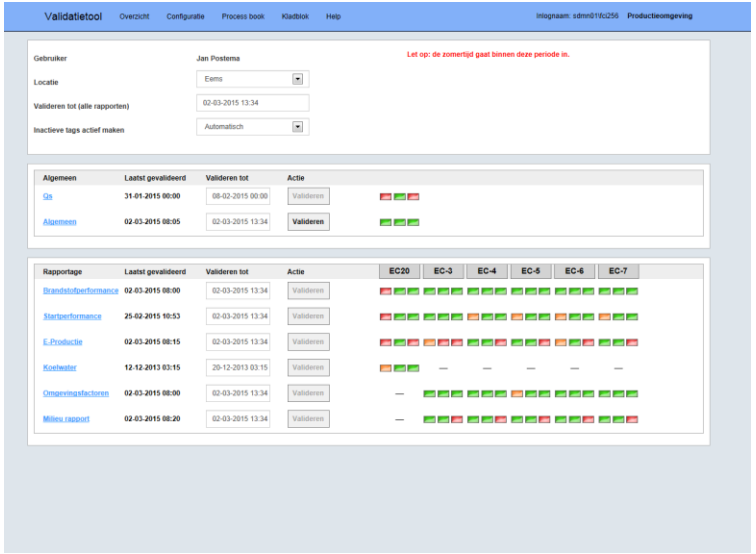
- ABC curve limit f(x) => $ax^2 + bx + c$ in PI Module Database (PI MDB)
- Valve position => expected flow
- Configuration
  - Sample Window
  - Min \ Max
  - Percentage good \ over limit
- Output is writen to the PI System
- Trigger further actions

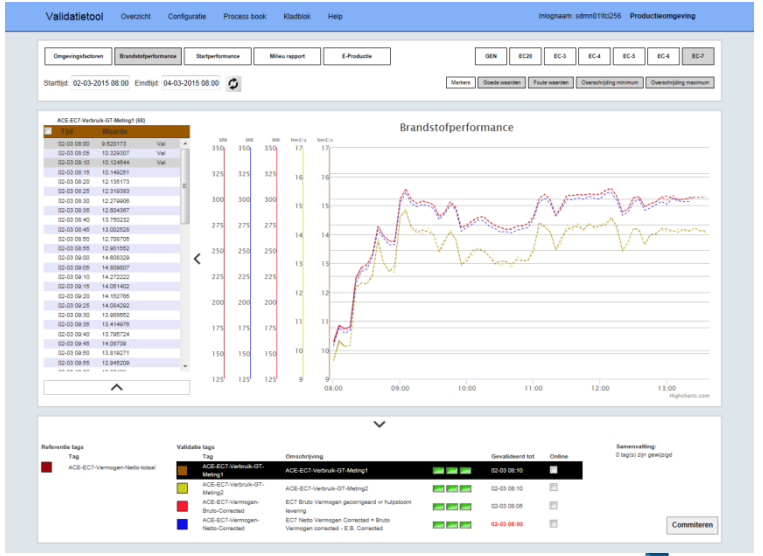
PI Clients (PI System Monitoring)

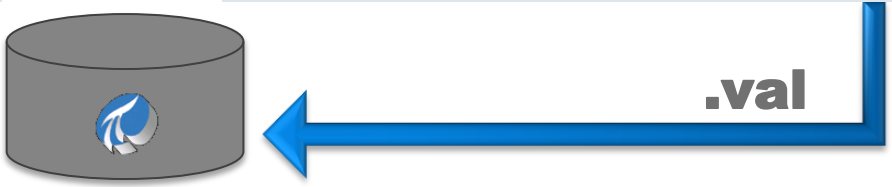



PI ProcessBook - [EC-3 PROCES INFORMATIE.PDI]
File Edit View Insert Tools Draw Arrange Window Help
Proces informatie EC3
Lokatie
EC20
EC3
EC-4
EC-5
EC-6
EC-7
NOx Shutdown
CO Shutdown
Start 1
Start 2
Brander mode
Temp Verm regeling
Smeerolie
COND VOORW
ONTG VERD
LD ECO
LD VERD
MD ECO
MD VERD
HD ECO
LD OVO
MD OVO
HD VERD
HERVERH
HD OVO
HD 4 bar
LD 4 bar
MD 2 bar
VW TANK
108,2 °C
0,24 bar
Service w
Nood tank
Scan Off
Water verbruik
Supplw w tank
Zoetw nood tank
Hulpstoom
Ventilatie timer
0 sec
T GEW
544,1 °C
V GEW
20,0 MW
uR Start Par
Start / Stop
DOEL 1
DOEL 2
DOEL 3
DOEL 4
DOEL 5
NO DATA
IGV 27,1
TNR 99,70
-0 MW
1 MW
0 MW
Regeling ED
Bad
H2
0,569 bar
99,32 %
26 mbar
Spreiding
DLN 2
NO DATA split
UV det
Intf Shut
Insp w
Hlp st
Suppl
Suppl
-0,8 mbar
25 °C
-1,4 mbar
-22 Nm3/h
19 °C
32,8 bar
43,0 bar
50,0
5,4 m3/s
128 o/min
383,0 °C
110 °C
87 °C
89 °C
20 Kg/s
38 t/h
283 t/h
209 t/h
4,2 bar
965 t/h
146 t/h
158 t/h
22,3 °C
13,5 bar
0,09 kg/s
4,1 bar
44,7 %
19 bar
21 t/h
11 bar
13,0 bar
-0,1 bar
3 t/h

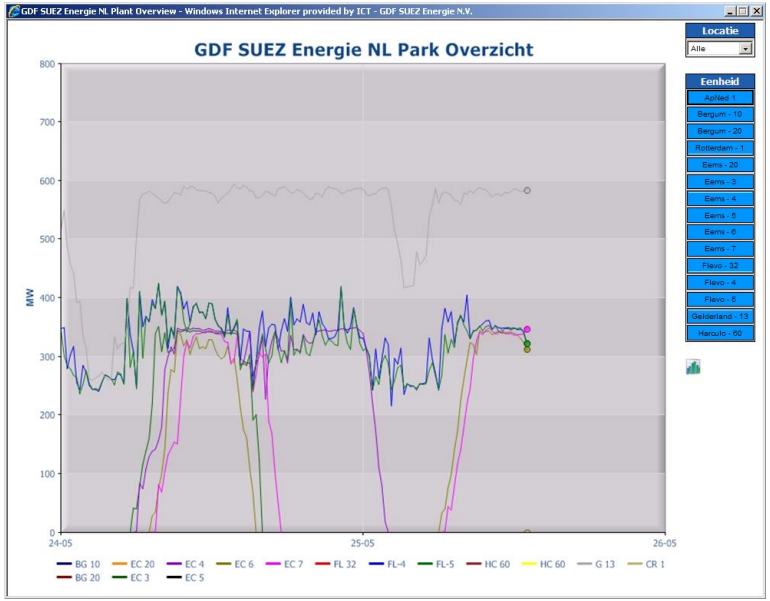
PI System Custom Application (Validation)



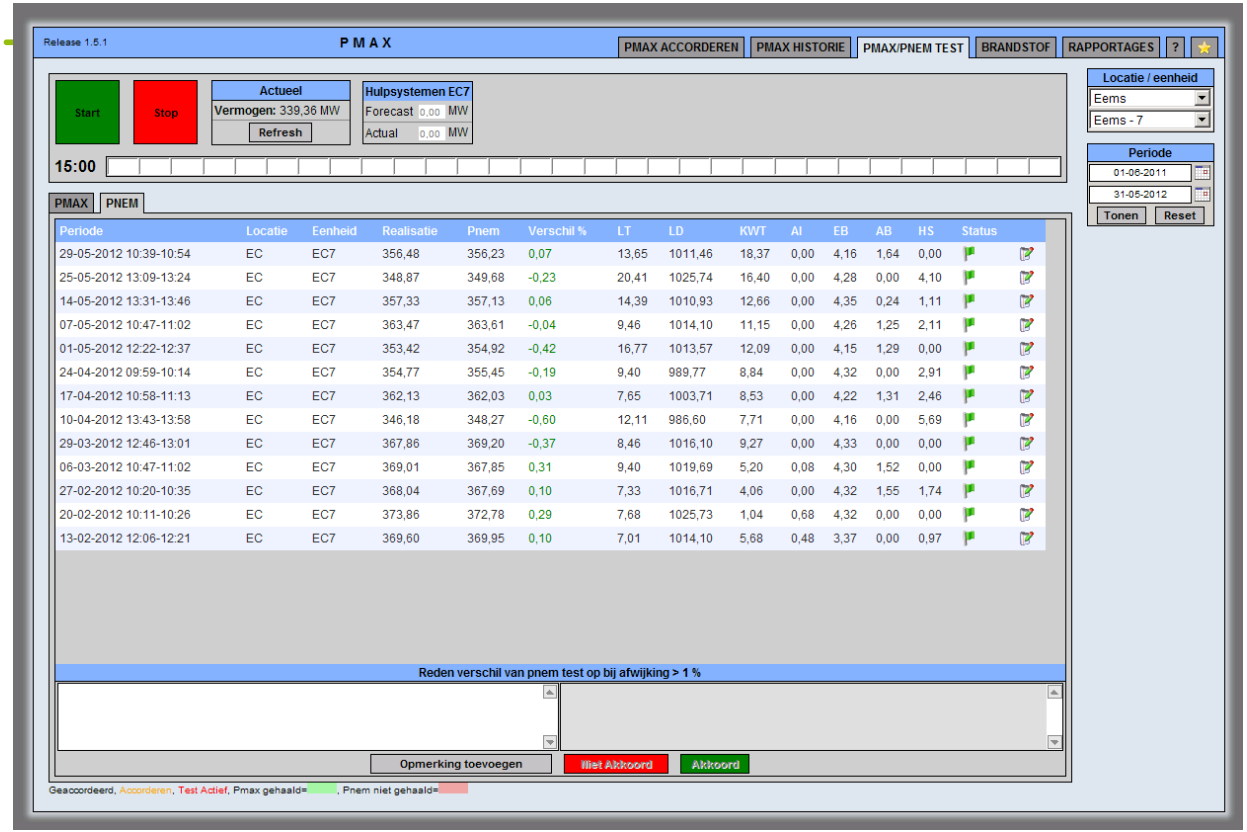




Custom Applications (Plant Overview)



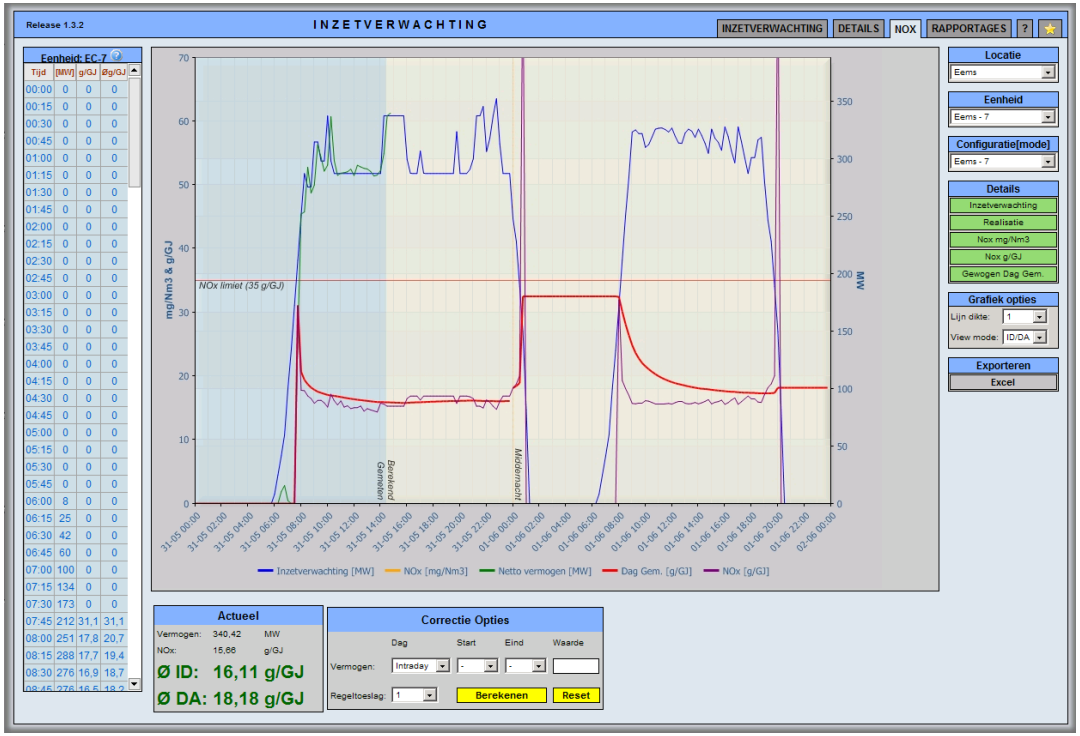
Custom Applications (Pmax Test)



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)

Summary

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

BUSINESS CHALLENGES	SOLUTION	RESULTS AND BENEFITS
A. Uniform data analysis, calculation and reporting	A. Data flows using PI ACE	• Improved data integrity
B. Embed PI System in everyday processes	B. Standard PI System Clients	• Improved data availability on corporate level
C. Analyze results of decisions made by power dispatch	C. Custom web applications	• Improved decision making on (near) real-time data

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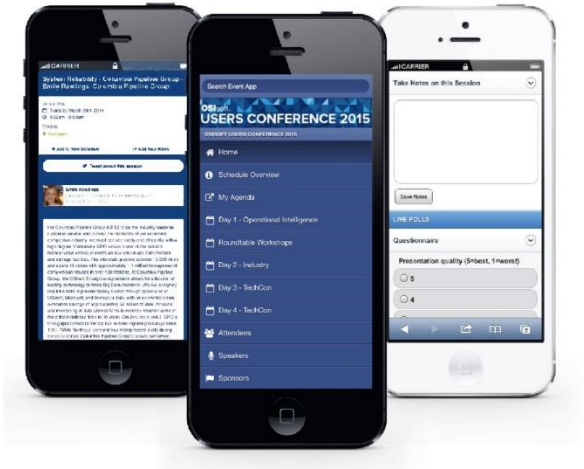
Questions

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



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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

Bedankt voor uw aandacht

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