NOxTool - Statoil's IT solution for reporting NOx emissions

Presented by **Astri Hinna Fjermeros**

Lars Anton Mygland

Statoil

OSIsoft.

REGIONAL SEMINAR 2012

EMEA

The Power of Data

Agenda

Why NOxTool
How
Lessons learned

Statoil

Statoil ASA

Statoil is an international energy company with operations in 36 countries. Building on 40 years of experience from oil and gas production on the Norwegian continental shelf, we are committed to accommodating the world's energy needs in a responsible manner, applying technology and creating innovative business solutions.

Statoil is headquartered in Norway with 21,000 employees worldwide, and is listed on the New York and Oslo stock exchanges. More information on www.statoil.com

Business Case

- NOx is gas which is produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures.
- NOx emission is subject to tax in Norway.
- Klif (Klima- og forurensningsdirektoratet / Climate and Pollution Agency) requires through the emission permits that Statoil Development and Production Norway (DPN) uses PEMS (”Predictive/Parametric Emission Monitoring System”), or other method with satisfactory accuracy, for monitoring and reporting of NOx emissions from conventional gas turbines.

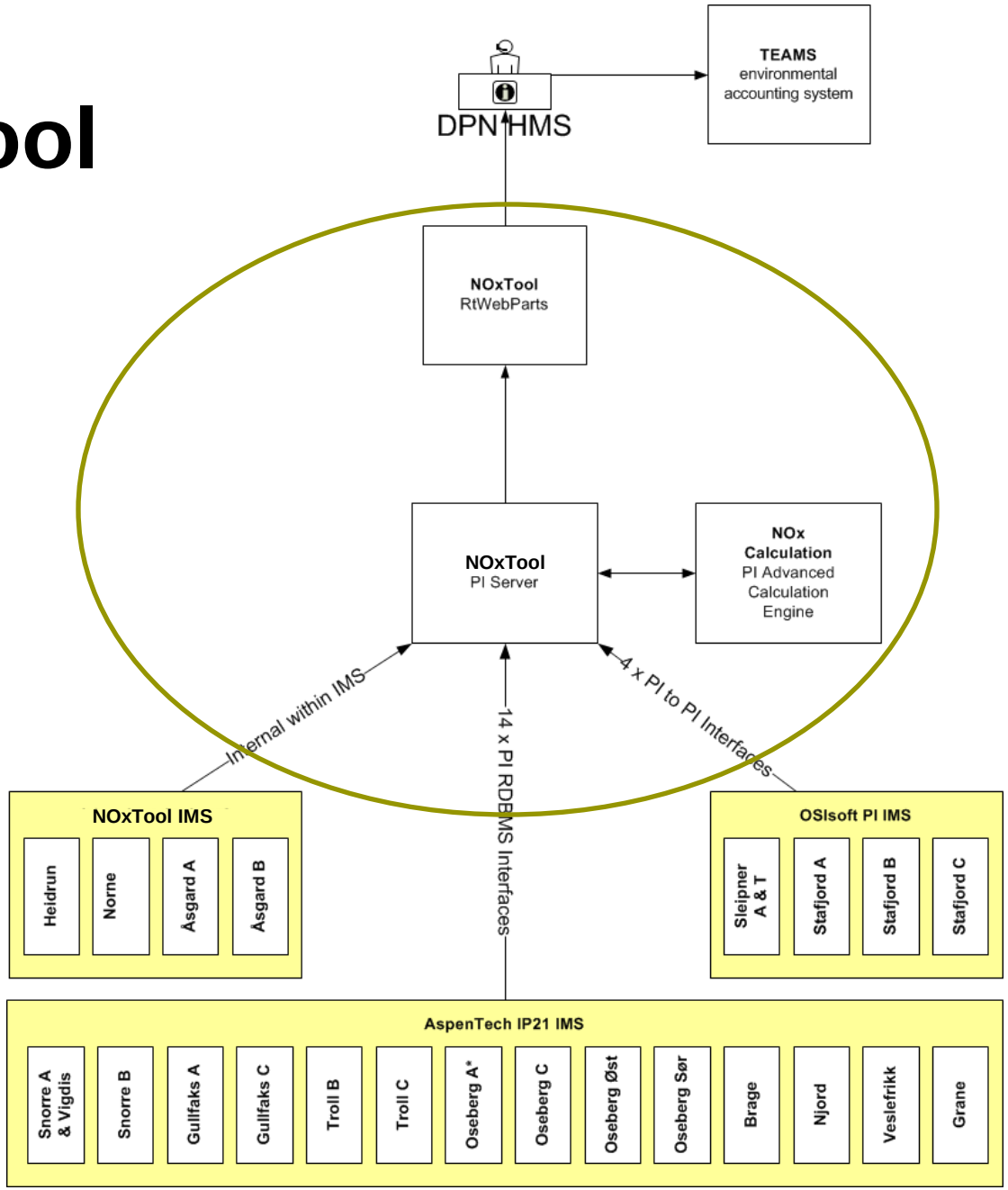
Background

- Statoil has developed specifications for a Klif approved PEMS calculation model for gas turbines.
- Statoil has 23 installations with 78 gas turbines with PEMS in current scope.
- NOxTool is a solution for gathering, calculating, presenting and storing information required for reporting NOx emission (about 1000 input tags and 1600 calculated tags).
- NOxTool is a Statoil developed system based upon OSIsoft technology.

Why using a PI System?

- Due to the high number of installations this required rapid development of a common Statoil solution to meet KLIF's deadlines.
- Statoil had an existing PI System with available capacity.
- The PI System had proven stable over years.
- Deep in-house knowledge to the PI System, PI ACE and PI Interfaces.
- Access to skilled resources from Amitec.

NOxTool



NOxTool's End User Interface

- It is a web application based upon
  - MS SharePoint
  - RTWebParts
- Rapid development
  - PI ProcessBook is used for designing and implementing the End User Interface pages.
  - The PI Module database structure is reused for navigation.
  - A generic gas turbine page was developed once and reused for all turbines.

NOxTool's End User Interface

It uses out of the box features to facilitate:

- User Access Control
- Time Control, an easy way of specifying a start and end time
- Navigation, a tree view for navigation between the overview, installations and their turbines.
- Overview page , presenting a summary of key NOx related data for all installations and their turbines
- Installation specific page, presenting fiscal fuel gas information and turbine specific tags
- Generic gas turbine page, presenting all tags needed for calculating NOx according to PEMS method

No custom SharePoint WebParts have been developed.

Welcome

Welcome Lars Anton Mygland | My Site | My Links |

NOx

This Site: NOx

Welcome | ONO | Leismer | NOx | SLP

Site Actions

Welcome > NOx > NOxDocs > NOxTool

NOxTool

NOxTool's Installation specific page

Time Control

Start Time *-7d End Time * Apply

Installations

- Rotating Equipment
  - Åsgard A
  - Åsgard B
  - Brage
    - C07-CT80001A
    - C07-CT80001B
    - M16-CT23010
  - Grane
  - Gullfaks A
  - Gullfaks C
  - Heidrun
  - Njord A
  - Norne
  - Oseberg C
  - Oseberg Øst
  - Oseberg Sør
  - Sleipner A
  - Sleipner T
  - Snorre A
  - Snorre B
  - Statfjord A
  - Statfjord B
  - Statfjord C
  - Troll B
  - Troll C
  - Veslefrikk

View

C07-CT80001A	C07-CT80001B	M16-CT23010
P2: -10.00 mbarg P3: 15.05 barg	P2: 0.00 mbarg P3: 0.01 barg	P2: -11.00 mbarg P3: 14.09 barg
T2: 8.20 degC T3: 394.53 degC	T2: 18.02 degC T3: 662.88 degC	T2: 10.35 degC T3: 388.67 degC
T5.4: 732.40 degC	T5.4: 19.50 degC	T5.4: 692.80 degC
Measured Flow: 4182 Sm3/h	Measured Flow: 354 Sm3/h	Measured Flow: 3859 Sm3/h
GAS Allocated Flow: 3998 kg/h	GAS Allocated Flow: 0 kg/h	GAS Allocated Flow: 3666 kg/h
NOx Concentration (*) 170 ppm	NOx Concentration (*) 0 ppm	NOx Concentration (*) 147 ppm
NOx Rate (*) 0.89 kg/min	NOx Rate (*) 0.00 kg/min	NOx Rate (*) 0.72 kg/min
NOx Method (*) PEMS	NOx Method (*) PEMS	NOx Method (*) PEMS
NOx Last Month 14281 kg	NOx Last Month 18970 kg	NOx Last Month 31997 kg
* Value one hour ago	* Value one hour ago	* Value one hour ago

Total values

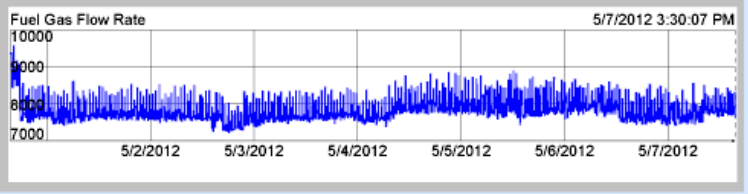
NOx Rate (*)	1.61 kg/min
NOx Last Month	65248 kg
Calculated Density (*)	0.93 kg/Sm3
Fuel Gas Flow Rate	7664 kg/h
Relative Humidity	66 %RH
Ambient Temperature	6 degC

* Value one hour ago

Fuel gas analysis

N2	1.96 %
CO2	1.66 %
C1	74.53 %
C2	10.92 %
C3	6.86 %
iC4	1.01 %
nC4	2.03 %
iC5	0.42 %
nC5	0.41 %
C6+	0.20 %

Brage



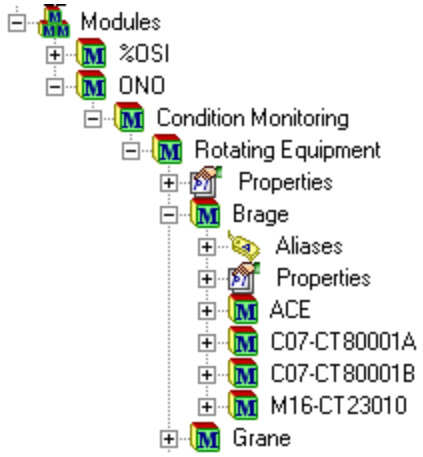
NOxTool's OSIsoft Products

- PI Server
- PI Module Database
- PI ACE
- PI Performance Equations
- PIWebParts
- Interfaces
  - PI RDBMS
  - PI to PI
- PI Notifications
- PI AF
- PI PI MCN Health Monitor (planned)

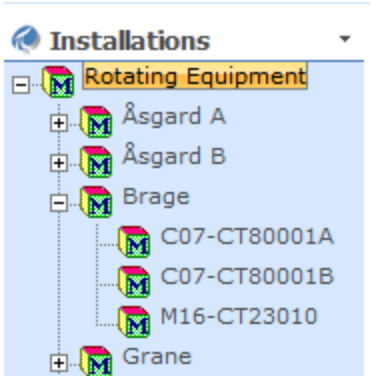
NOxTool's PI Module Database

- It is central to NOxTool's design
- It defines and resolves
  - the attributes needed to calculate NOx emissions using PI ACE
  - the structure and attributes needed by PIWebParts for
    - Navigation within End User Interface
    - Present a gas turbine generically

PI Module Database



PIWebParts



NOxTool's Calculation timing

- The NOx emission ACE calculations are done
  - Every minute
  - With a delay of 1 hour to ensure that
    - All input tags have arrived
    - All pre-calculations have completed
  - Using archived values

Lessons Learned

- Extending an existing PI System has reduced the development time.
- Using PI ACE as workaround for PI Performance Equations has improved the solution.
- Experienced technical issues by not running the “latest version” of all PI products. I.e. PI ACE performance is improved in later versions.
- Handle all installations with few design templates.
- Creating a simple solution gives quick results and increases the stability.

THANK YOU

Brought to you by OSIsoft.