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EMEA USERS CONFERENCE

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Data Acquisition from Distributed Power Plants and Integration into the Business Intelligence System

Presented by **Dr. Zijad Lemeš, ENTEGA**

Agenda

- ENTEGA AG - a brief overview
- How we monitor our power plants at present
- Motivation for centralized data acquisition system
- System set-up and architecture
- Summary and outlook

ENTEKA AG – A Brief Overview

Portrait

We are **one of the biggest regional suppliers** in Germany.

With our subsidiaries and shareholdings, we cover **the entire value-added chain** of a **sustainable energy supply and modern fundamental public services**.

Our sales subsidiary ENTEKA is one of the **biggest suppliers of carbon-neutral energy in Germany**.

We are investing considerable amounts in the energy turnaround. So far we have invested **850 million € in renewable energy** and gas power stations with low environmental impact.

Our aim: By 2020, we wish to generate all the green power consumed by our ENTEKA private customers from our own plants – this is equivalent to approximately **1.1 billion kWh per year**.

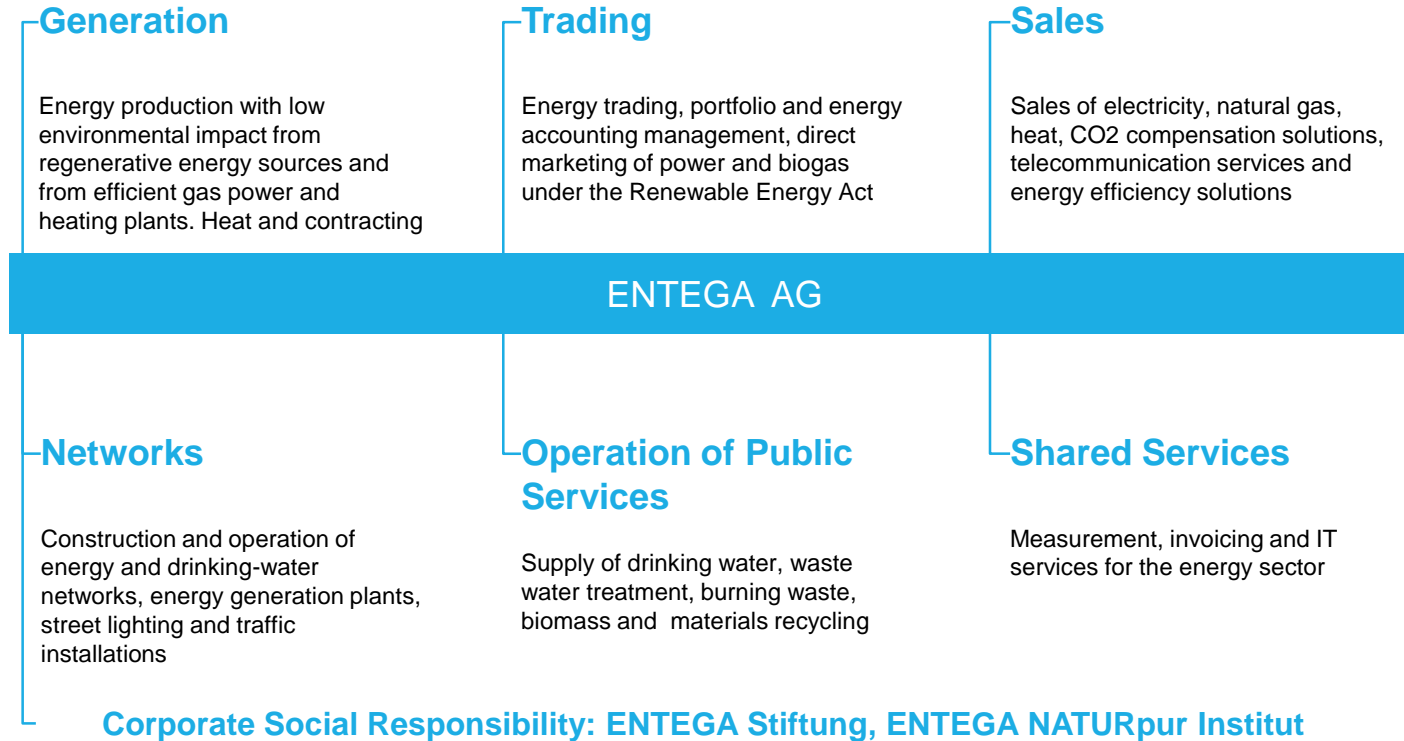
We supply electricity and natural gas to over **600,000 customers**.

The ENTEKA group currently employs about **2,000 persons** – among them **90 trainees**.



ENTEGA AG – A Brief Overview

Our Fields of Activity



ENTEGA AG – A Brief Overview

Key Figures for 2015

Group turnover **1,592.7 million €**

Number of **employees 2,046**

Sales of **electricity 8.8 billion kWh***

Sales of **natural gas 4.7 billion kWh***

Sales of **drinking water 13.5 million m³**

Amount of **treated waste water 13.7 million m³**

Amount of **garbage disposal 209,186 t**

*Supplies to customers and traded quantities



ENTEKA AG – A Brief Overview

Key Figures for 2015

Renewable Energies

Capacity aim ~ **1.1 billion kWh**

Plant capacity under construction/in operation ~ **255 MW**

Sales of **carbon-neutral natural gas** **2.12 billion kWh**

Sales of **green electricity** **2.57 billion kWh**

CO₂ emissions compensated by carbon-neutral natural gas **444,613 t CO₂e**

Energy efficiency potential identified in consulting projects **7,730 MWh**



ENTEKA AG – A Brief Overview

Renewable Power Plants

Renewable energy sources

- | | |
|-----|---------------|
| 11 | wind parks |
| 3 | solar parks |
| 2 | biogas plants |
| 130 | PV plants |



Currently 255 MW, with
annual production of
approx. 700 GWh

ENTEKA AG – A Brief Overview

Conventional Power Plants



We also operate several heat plants and heat & power plants in south Hesse.

ENTEKA AG – A Brief Overview

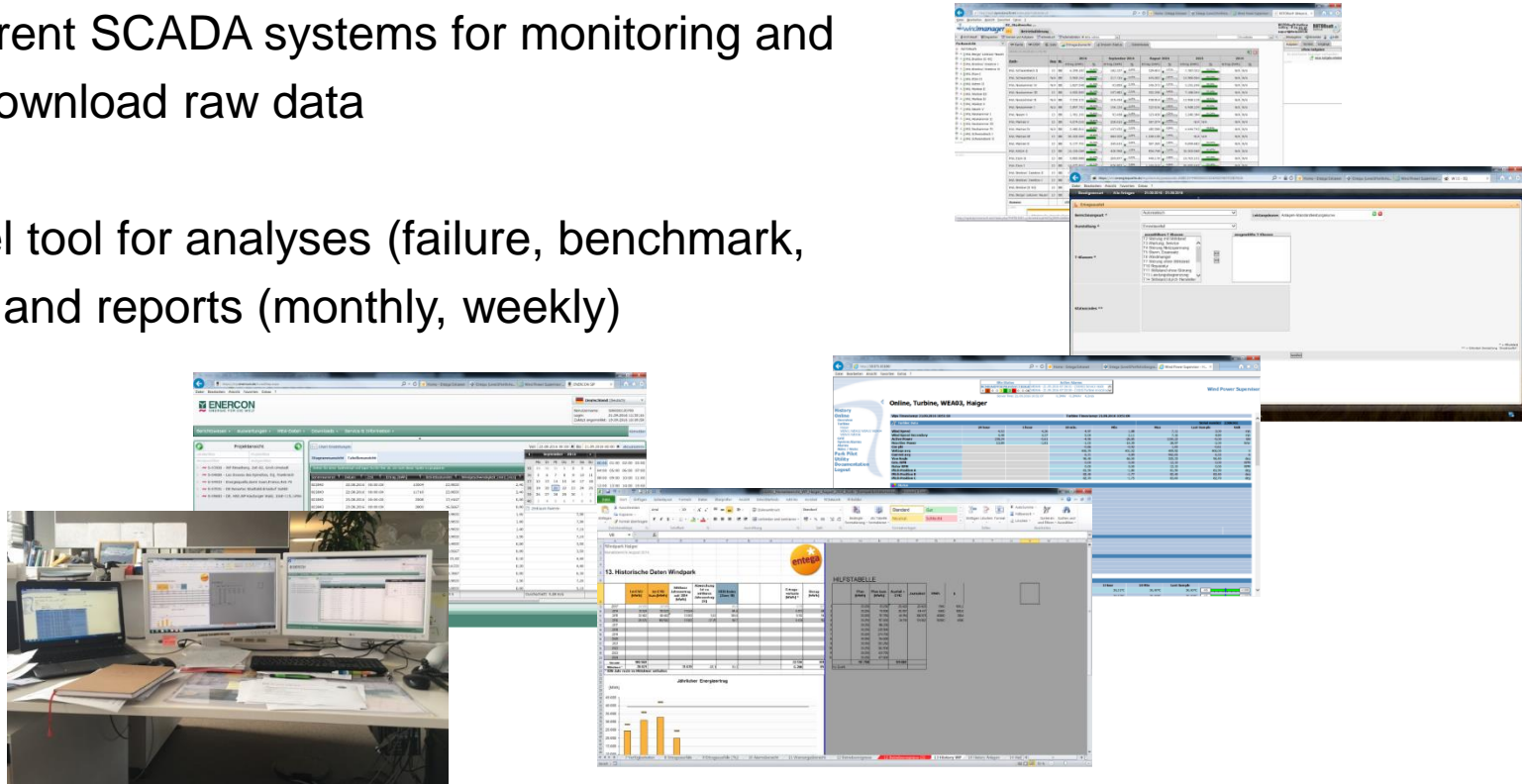
Our Grid

Electricity	9,112 km
Natural gas	2,484 km
Drinking water	944 km
Telecommunications	4,442 km
Heat	80 km



How we monitor our power plants at present

- Different SCADA systems for monitoring and for download raw data
- Excel tool for analyses (failure, benchmark, etc.) and reports (monthly, weekly)



Motivation for centralized data acquisition system

- Digitalization and interconnection as a basis for future-oriented operation management and optimization of working processes
- Holistic and integrated solution have the advantage that the data from different technologies (Wind, PV, Biogas, Gas Turbines, etc.) and from different manufacturers can be analyzed, archived and exported to other applications using only one tool
- Powerful data base allows storing of big data amounts at different temporal resolutions
- Automated generation of important information and KPIs and comprehensive data analysis

System set-up and architecture

Project Team



Requirements and technology specific implementation



Hardware, implementation and operation

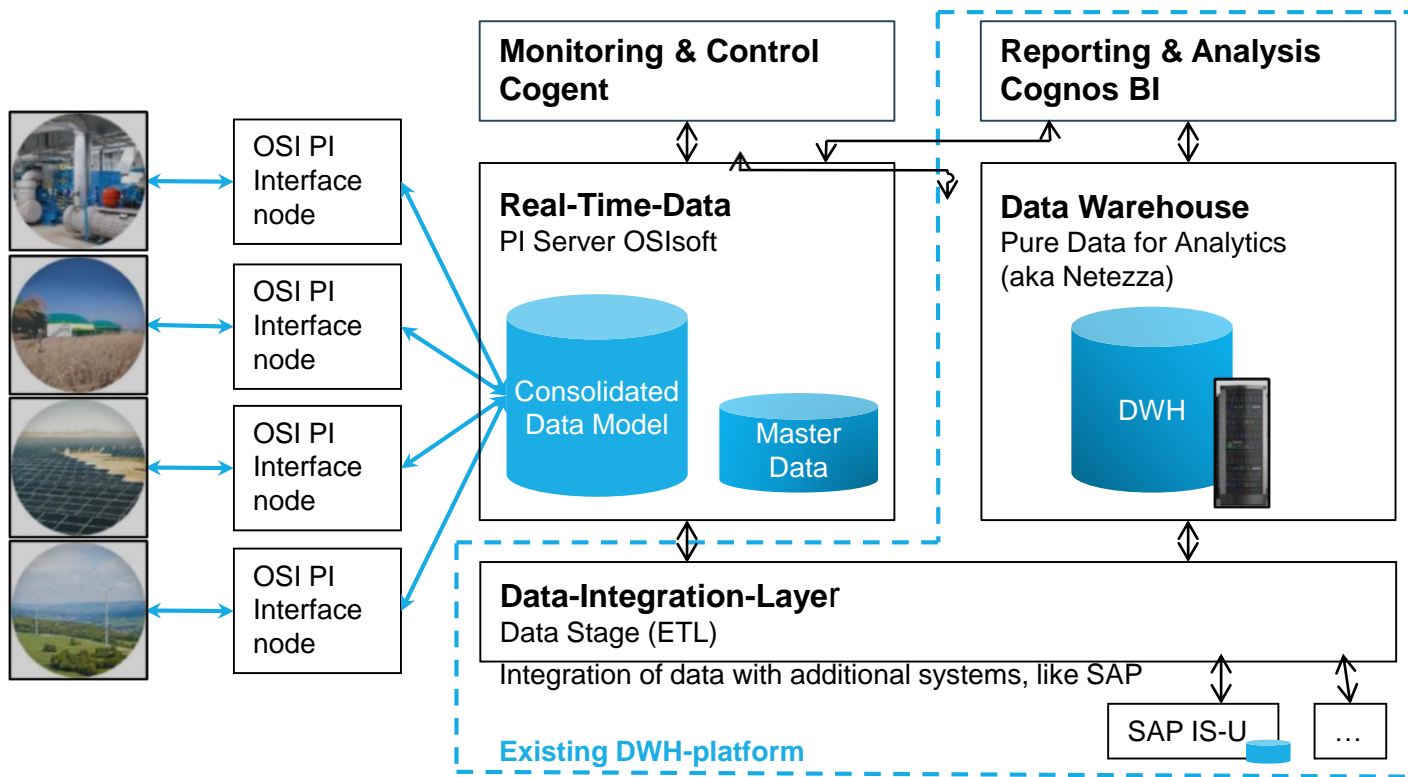


Software



Implementation

System set-up and architecture



System set-up and architecture

PI Interface nodes

- OPC XML DA and OPC XML interfaces
 - Used to connect wind farms of the manufacturers Vestas, Siemens and Enercon
- Modbus interface
 - Used to connect PV farms of the manufacture SMA
- UFL interface
 - Used to connect sites communicating per structured text data like biogas plants and PV farms and other sources like historical data, production forecast, etc.
- One license allows multiple instances at one server
 - Security is ensured with a VPN Site to Site link

System set-up and architecture

Procedure of a site connection

1. Establishing a technical connection between OSIsoft PI Server and the site (OPC, Modbus, FTP, WebService, etc.)
2. Mapping of site data to allow a homogenous storage and processing
3. Build the site in the monitoring tool Cogent
4. Introducing the data into the analyzing tool Cognos BI
5. Creation or rather adaption of reports

System set-up and architecture

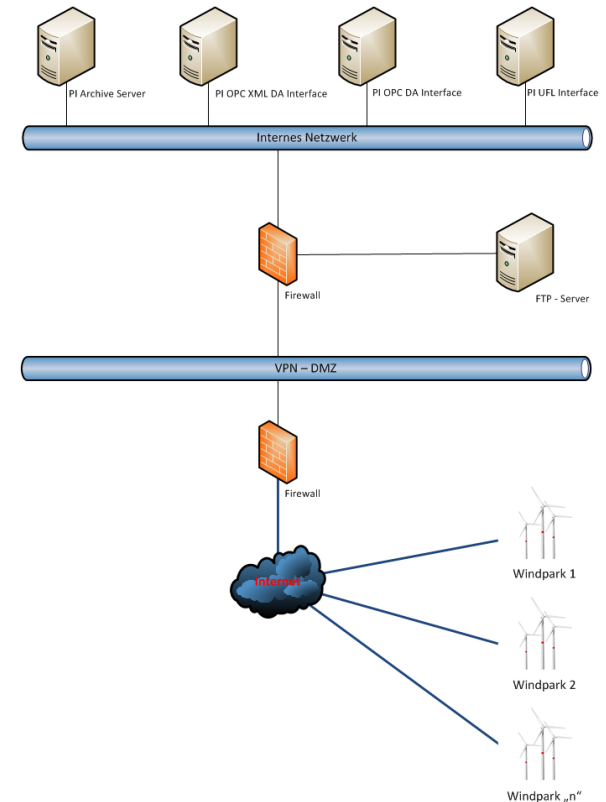
Procedure of a site connection

Data transfer via FTP:

- Checking of data which were delivered from the plant
- Configuration of PI UFL Interface for the certain plant

Site-To-Site coupling:

- Checking of plant connection possible (UMTS or DSL)
- Configuration of VPN router and installation of the VPN router on site
- Checking of communication between PI Interface Server and SCADA Server in the plant possible
- Configuration of the interface for the plant



System set-up and architecture

Data mapping and creation of tags in PI Builder

Marking of tags to apply or to edit

Name of tags in PI Server

Instrument tag in the plant

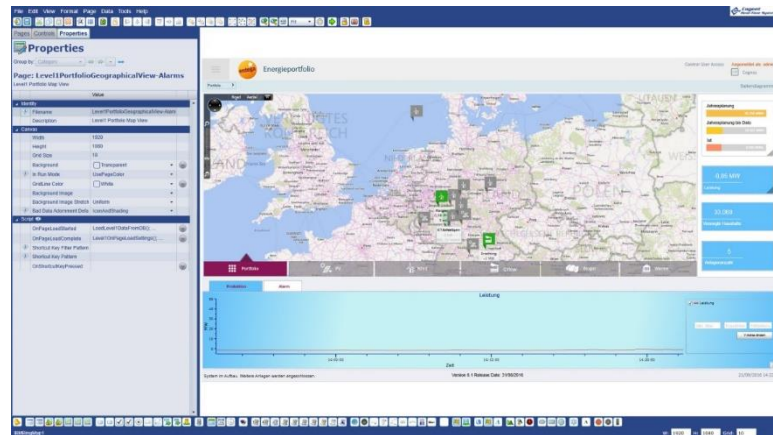
The screenshot shows a Microsoft Excel spreadsheet titled 'All_PI_Tags_20160915.xlsx'. The spreadsheet contains a table with 11 columns: Selected(x), Name, ObjectType, Description, displaydigits, engunits, future, pointsource, pointtype, ptclassname, and instrumenttag. The table lists various PI tags, including W001-GM0001-M5600 through W001-GM0001-M5615. Annotations with arrows point to specific parts of the spreadsheet: 'Marking of tags to apply or to edit' points to the 'Selected(x)' column, 'Name of tags in PI Server' points to the 'Name' column, and 'Instrument tag in the plant' points to the 'instrumenttag' column.

Selected(x)	Name	ObjectType	Description	displaydigits	engunits	future	pointsource	pointtype	ptclassname	instrumenttag
x	W001-GM0001-M5600	PIPoint	State indication from Wps. Coding	-5	Integer	0	XML	Int32	classic	GMS.ION1.WpsStatus
x	W001-GM0001-M5601	PIPoint	Date and time for Grid station	-5	Date	0	XML	String	classic	GMS.ION1.Date
x	W001-GM0001-M5602	PIPoint	Active Power Production	-5	MW	0	XML	Float64	classic	GMS.ION1.ActivePower
x	W001-GM0001-M5603	PIPoint	Reactive Power Production	-5	MVar	0	XML	Float64	classic	GMS.ION1.ReactivePower
x	W001-GM0001-M5604	PIPoint	Active Energy Export total	-10	kWh	0	XML	Int32	classic	GMS.ION1.ActiveEnergyEx
x	W001-GM0001-M5605	PIPoint	Reactive Energy Export total	-10	kVarh	0	XML	Int32	classic	GMS.ION1.ReactiveEnergy
x	W001-GM0001-M5606	PIPoint	Active Energy Import total	-10	kWh	0	XML	Int32	classic	GMS.ION1.ActiveEnergyIm
	W001-GM0001-M5607	PIPoint	Reactive Energy Import total	-10	kVarh	0	XML	Int32	classic	GMS.ION1.ReactiveEnergy
	W001-GM0001-M5608	PIPoint	Frequency	-5	Hz	0	XML	Float64	classic	GMS.ION1.Frequency
	W001-GM0001-M5609	PIPoint	Total Harmonic Distortion	-5	%	0	XML	Float64	classic	GMS.ION1.THD
	W001-GM0001-M5610	PIPoint	Voltage Phase U	-5	kV	0	XML	Int32	classic	GMS.ION1.VoltageU
	W001-GM0001-M5611	PIPoint	Voltage Phase V	-5	kV	0	XML	Int32	classic	GMS.ION1.VoltageV
	W001-GM0001-M5612	PIPoint	Voltage Phase W	-5	kV	0	XML	Int32	classic	GMS.ION1.VoltageW
	W001-GM0001-M5613	PIPoint	Current Phase U	-5	A	0	XML	Int32	classic	GMS.ION1.CurrentU
	W001-GM0001-M5614	PIPoint	Current Phase V	-5	A	0	XML	Int32	classic	GMS.ION1.CurrentV
	W001-GM0001-M5615	PIPoint	Current Phase W	-5	A	0	XML	Int32	classic	GMS.ION1.CurrentW

System set-up and architecture

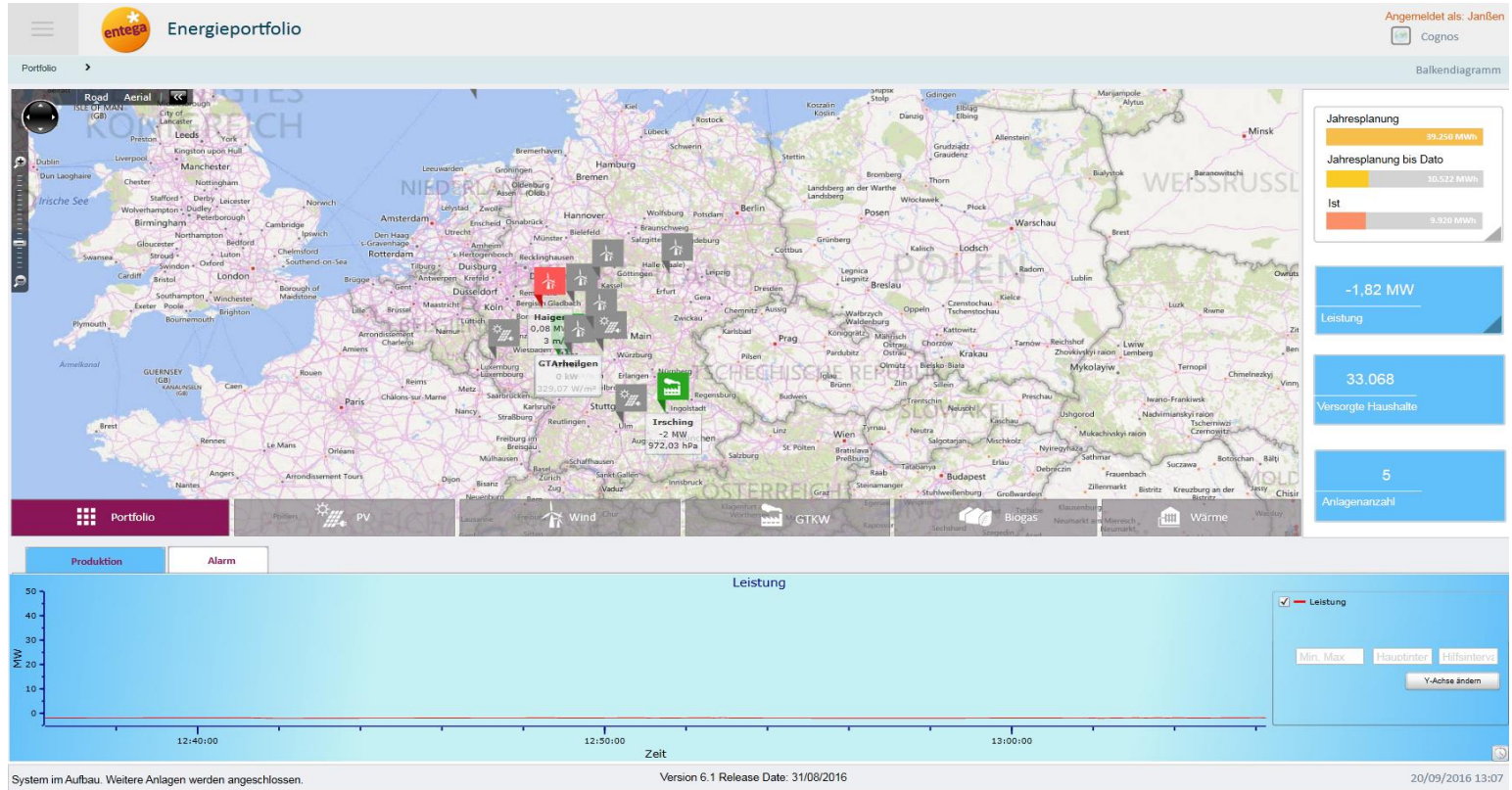
Monitoring

- Cogent is directly linked to OSIsoft PI Server
- Web-based solution
- Access control is implemented, also for external user
- Main features
 - Alarm handling
 - Online values
 - Most important KPIs
 - History of last three days
 - Forecast



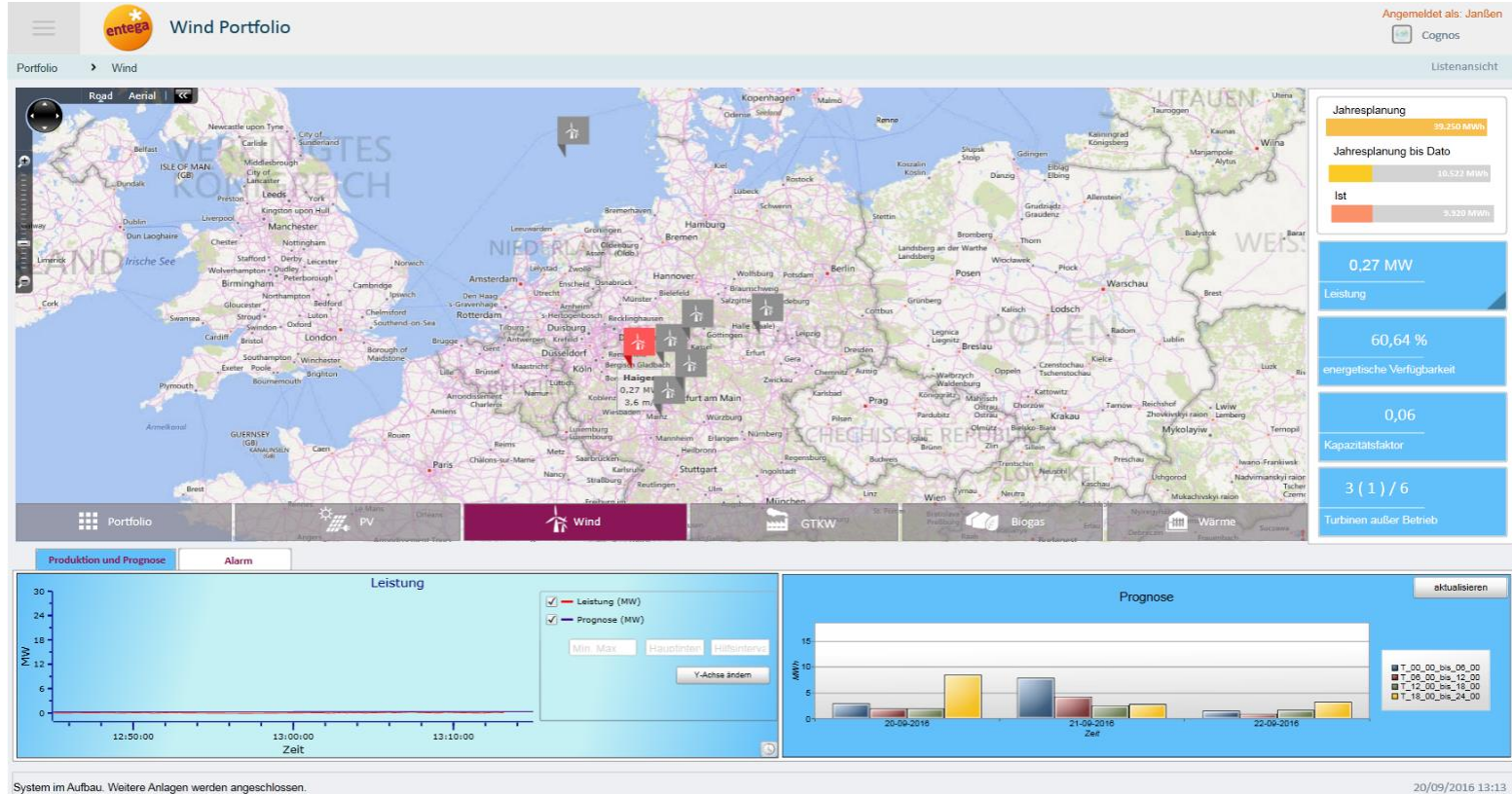
System set-up and architecture

Dashboard Portfolio



System set-up and architecture

Dashboard – Wind Level



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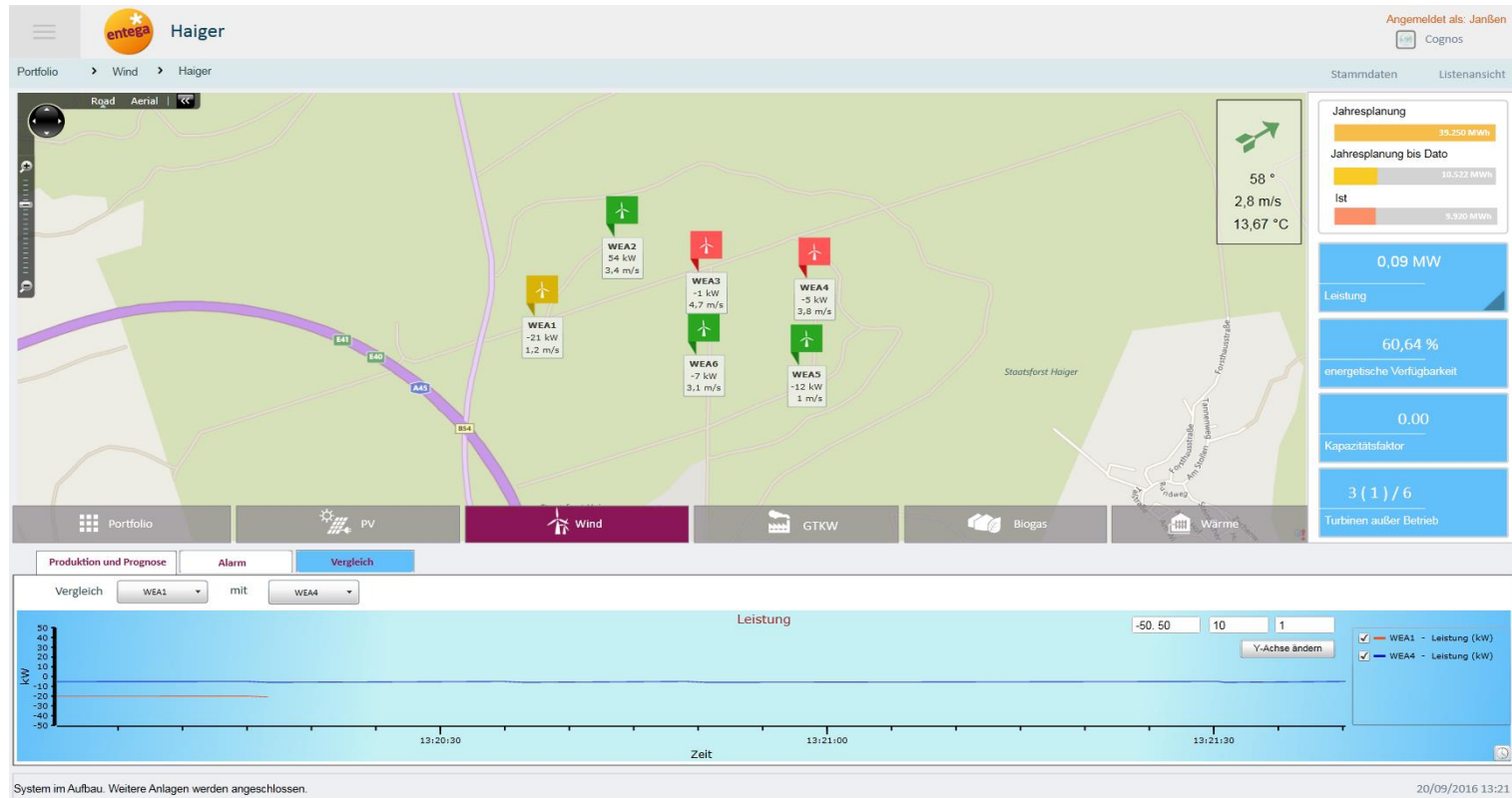
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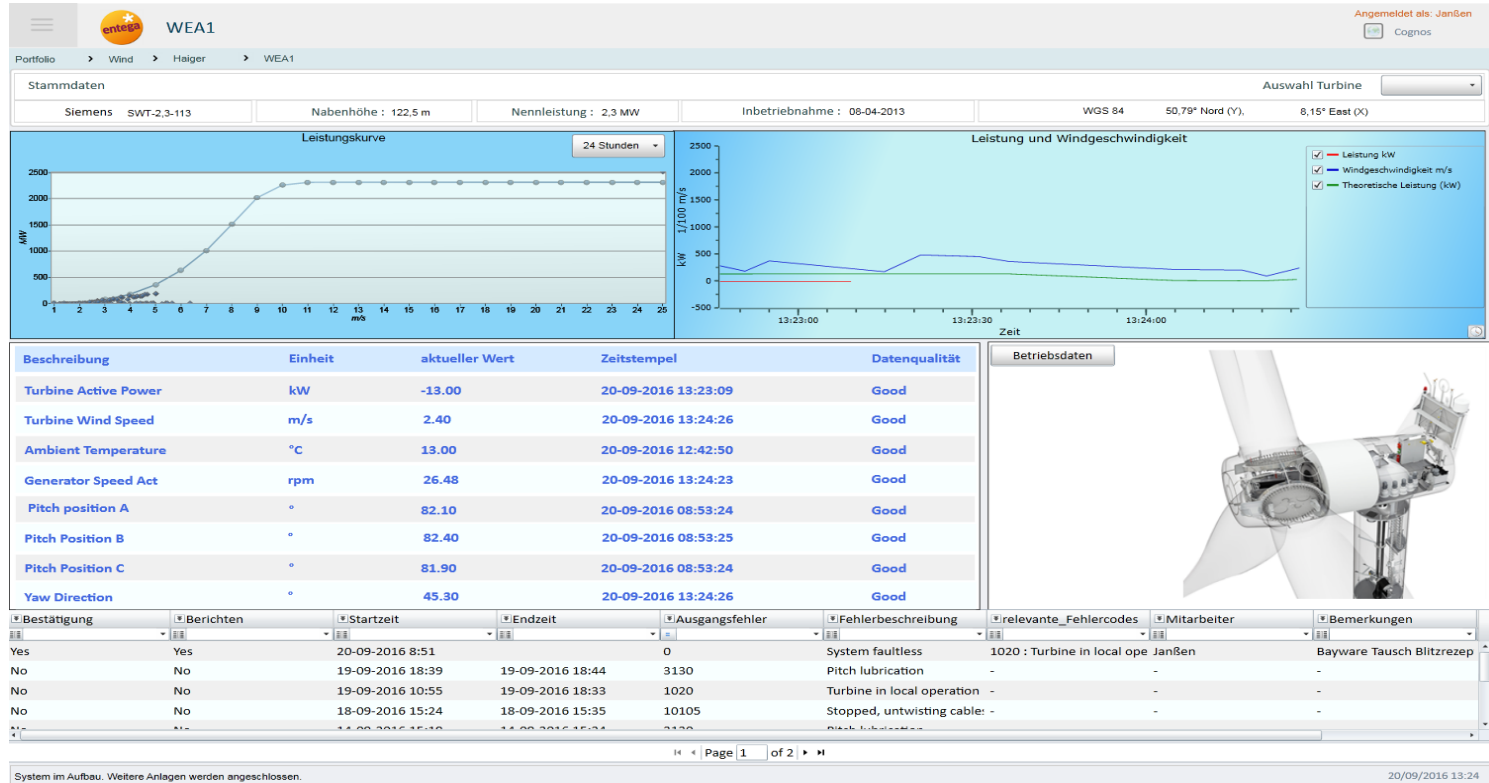
System set-up and architecture

Dashboard – Wind Level



System set-up and architecture

Dashboard – Turbine Level



System set-up and architecture

Alarm Handling

- Alarm occurs if there is a change in the status from faultless to failure or to no communication
- Get information about all alarms which are coming up during the time until the status changed back to faultless
- Decide if alarm should be reported or not and attach a comment

Fehlercode

* Fehlercode	* Startzeit	* Fehlerbeschreibung	* Impens
1001	21-09-2016 10:04	Manual stop	1
13317	21-09-2016 11:01	T.O.R Converter coolant pump	W
3203	21-09-2016 11:07	Pitch pawl A Feedb. Operation	1
3205	21-09-2016 11:08	Pitch pawl C Feedb. Operation	1
3204	21-09-2016 11:09	Pitch pawl B Feedb. Operation	1
1001	21-09-2016 13:19	Manual stop	1
13317	21-09-2016 13:19	T.O.R Converter coolant pump	W
1022	21-09-2016 13:20	Local, scheduled service work	W
1020	21-09-2016 8:33	Turbine in local operation	W
1022	21-09-2016 8:34	Local, scheduled service work	W

Page 1 of 2

Bemerkungen

08:30 Uhr Serviceteam (Kallmeier) angemeldet: Retrolfs, Rauchmeldertausch und Leiteranfertigung

☒ Berichten ☒ Als primären Fehlercode markieren

einreichen

Ausgewählte Fehler

1022 : Local, scheduled service work

* Bestätigung	* Berichten	* Startzeit	* Endzeit	* Ausgangsfehler	* Fehlerbeschreibung	* relevante_Fehlercodes	* Mitarbeiter	* Bemerkungen
Yes	Yes	21-09-2016 8:33		1020	Turbine in local operation	1022 : Local, scheduled se	Janßen	08:30 Uhr Serviceteam (Ka
No	No	20-09-2016 8:40	20-09-2016 18:27	1020	Turbine in local operation	-	-	-
No	No	18-09-2016 13:41	18-09-2016 13:57	3130	Pitch lubrication	-	-	-
No	No	13-09-2016 13:41	13-09-2016 13:46	0	Data was not available for	-	-	-

System im Aufbau. Weitere Anlagen werden angeschlossen.

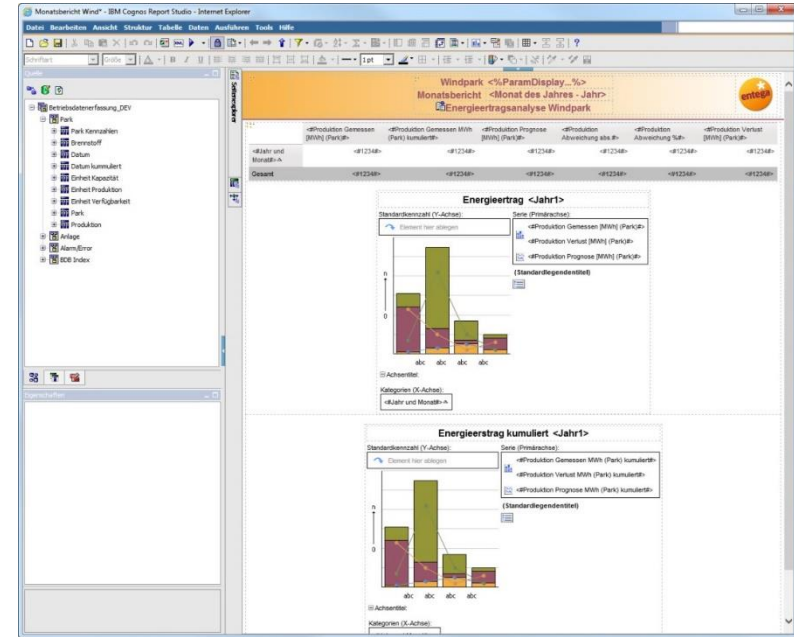
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System set-up and architecture

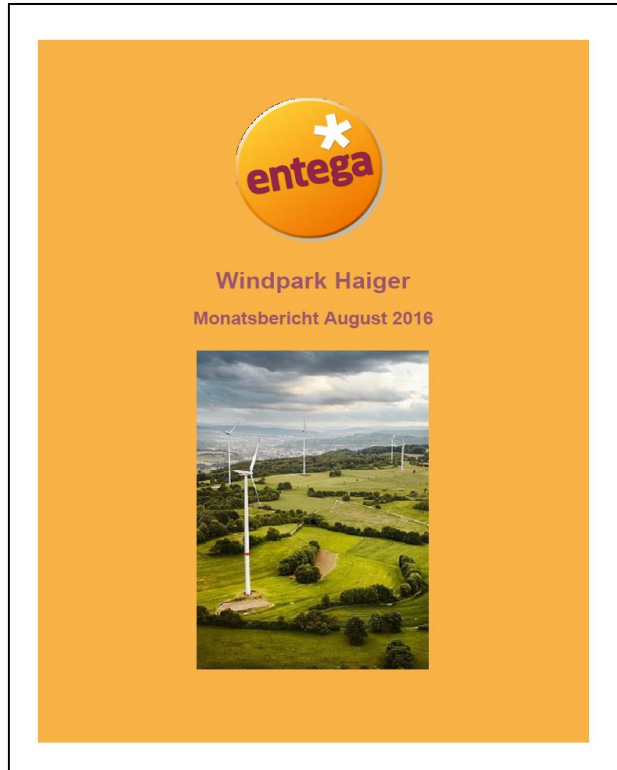
Analysis and Reporting Tool – Cognos

- Comprehensive, individual and customized configurations of standardized or ad-hoc reports
- Automatic preparation and distribution by mail as html, pdf or xls based on time, events or ad-hoc
- Extensive, multidimensional ad-hoc request for analysis errors or benchmarking the portfolio among each other
- Web-based and thereby mobile and standardized work area



System set-up and architecture

Analysis and Reporting Tool – Cognos

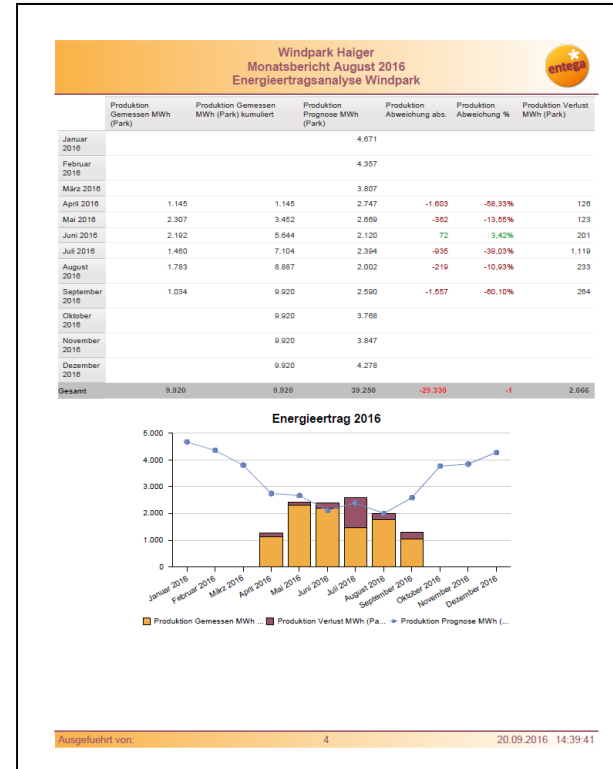
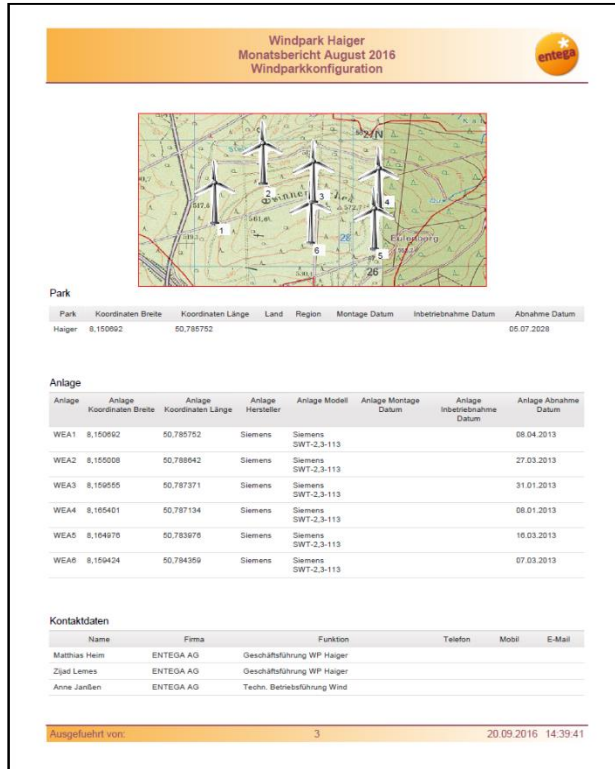


Windpark Haiger Monatsbericht August 2016 Inhaltsverzeichnis	
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System set-up and architecture

Analysis and Reporting Tool – Cognos



Summary and Outlook

- From different standalone solutions to one integrated system with the link to BI and so the possibility to enlarge the reporting and bring the technical and commercial world together, but...
 - every site is really unique with its special efforts concerning the hardware and software, unfortunately not too much copy and paste possible
 - different players with different needs need to be satisfied, comprehensive coordination process is very important and indispensable
- Digitalize processes: Establish automated data analysis, generate and exchange KPIs, information and recommendation with operator, service teams, manufacturers, controllers, etc.

Contact Information

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Team

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Thank you for your attention!

Questions

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

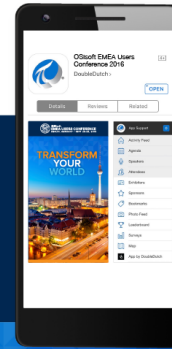


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谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado



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