



SmartECR Business Value Through Real-Time Data

Presented by
Uwe Fischer
E.ON



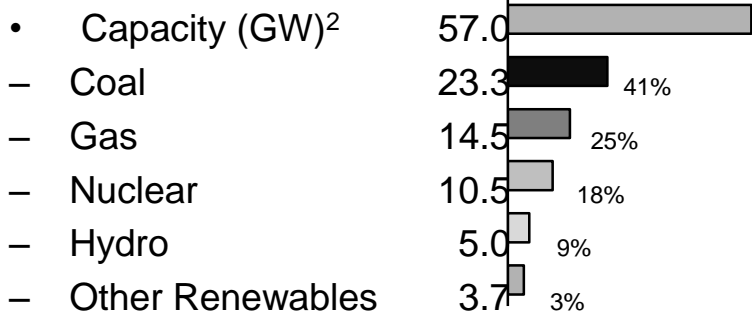
Agenda

- Company Overview
- SmartECR Scope
- SmartECR Challenges
- SmartECR Solutions
- Next Steps

E.ON is one of the world's largest investor-owned power and gas companies – with a growing renewables business

E.ON Group (2010)¹

- Adj. EBITDA >€13bn
- Adj. Net Income ~€5.1bn
- Employees >88,000



Renewable technologies



Wind Onshore



Wind Offshore



Photovoltaic (PV)



Solar thermal (CSP)



Biomass



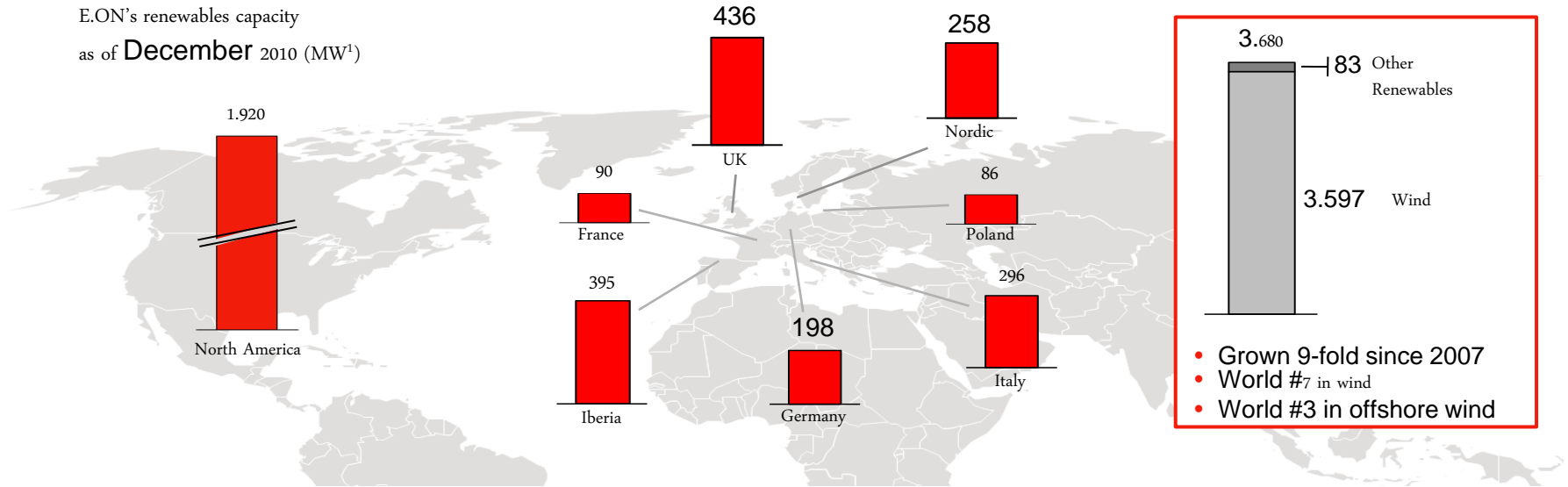
Marine

¹ 2010 forecast. Sources: E.ON Capital Markets Day Nov 2010, EC&R

² Total own generation; all figures presented in accounting view: only full consolidated plants, fully owned plants & ownership in fractional shares

E.ON operates 3.680 MW renewables capacity in Europe and North America – and eyes further regions to grow

E.ON's renewables capacity
as of **December 2010** (MW¹)



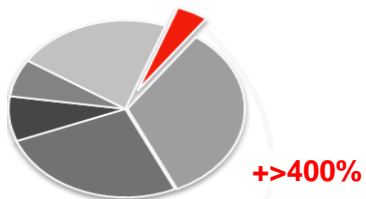
E.ON 2015 target: 25% of EBITDA from outside Europe (up from 5% today)

¹ E.ON Equity MW (COD's and major announcements; Figures rounded), excluding large hydro

Renewables have significant worldwide potential – relevant technologies are at different levels of maturity

Global capacity (GW)

2008 Σ 4,500 GW



2020 Σ 6,800 GW

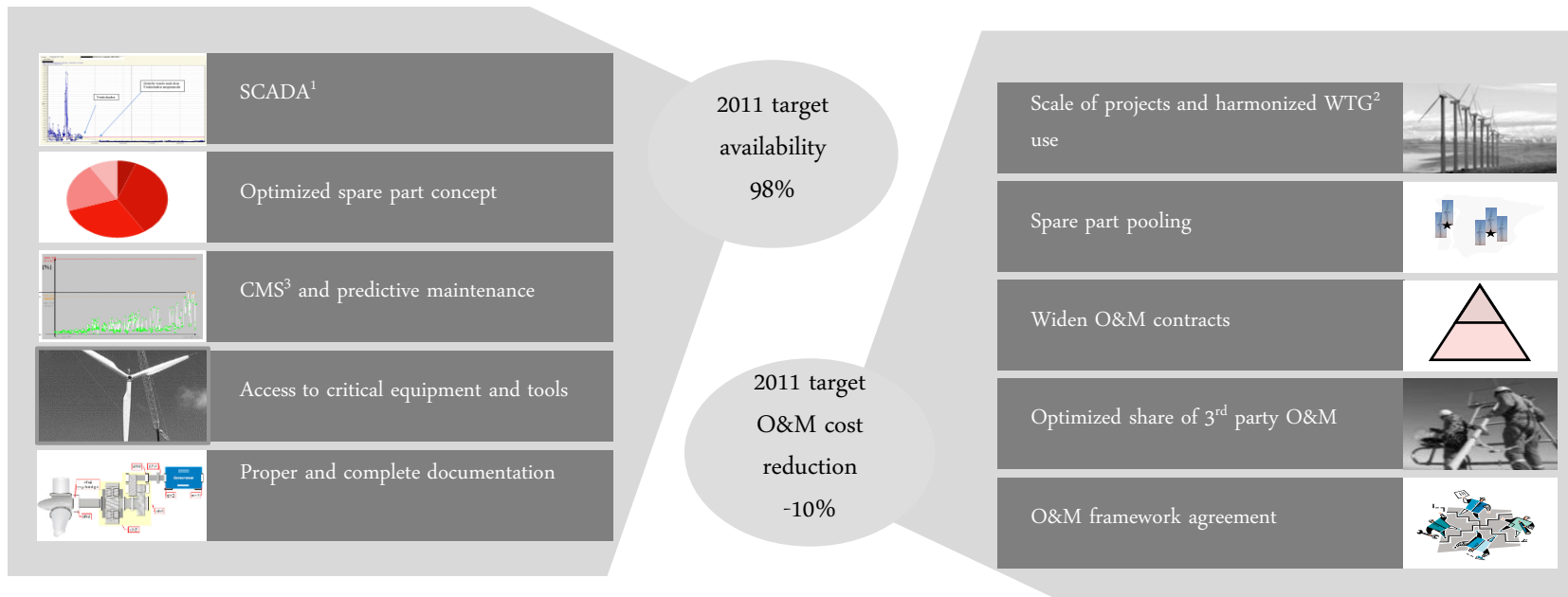


>400%



	Wind	Biomass	Solar	Marine
Global capacity [GW]	<p>154 900</p> <p>2009 2020</p>	<p>50 110</p>	<p>20 160</p>	<p>0.01 2</p>
Long-term feasible potential worldwide [GW]	<p>~5,000</p>	<p>~2,000</p>	<p>~50,000</p>	<p>~5,000</p>
Current technology maturity	Advanced		Step changes in technology possible	Proof-of-concept & technology tracking

“Boutique to Industrial” will stay our fundamental driver



We will stay at the forefront of industry development both in wind and other Renewables technologies

¹ Supervisory Control And Data Acquisition ² Wind Turbine Generator ³ Condition Monitoring System

Platform Scope



Remote Monitoring and Control:

- Global, Regional, Site, Turbine, Sub-Station level real-time monitoring & Control
- Automated event based error handling
- Shared Service Platform across geographies
- Curtailment Tracking



Asset and Power Generation Optimisation:

- Asset Optimization & Component level inventory management on global level
- Proactive spare parts management
- Asset Insurance management
- Speedy emergency response
- Energy Scheduling and Load Forecasting



Business Performance Management & Analytics:

- Operational and Business KPI reporting in real-time
- Optimized Power Prediction and input to trading
- New project planning, scheduling and tracking
- Predictive Maintenance & optimised Shutdown Planning
- Energy Accounting & Production Cost Calculations



Technical Excellence and Procurement:

- Uncover trends, patterns from turbine errors
- Historical Analysis of Turbine performance
- Modelling and Simulation of optimal site location based on historic wind directions
- Comparison of actual power curves w.r.t. to OEM power curves

Operational challenges

▪ Globally **dispersed** enterprise with regional 'boutique' shops



▪ Reporting of operational data via Xcel



▪ **Unique SCADA system** for each wind park / Hydro plant



▪ **Diverse Turbines** with unique controlling philosophy



▪ **Diverse hardware and network** infrastructure



▪ **Reactive maintenance and procurement**



▪ **Manual process** for Site authorization and field force management



▪ Globally **Integrated enterprise with industrial scale**

▪ **Real-time reporting** of operational data

▪ **Single system for monitoring & control**

▪ **Common reference semantic model** to acquire, normalize data and error/alarm codes

▪ **Standard Hardware and Network** for interface to global system

▪ **Proactive maintenance and spare parts inventory management**

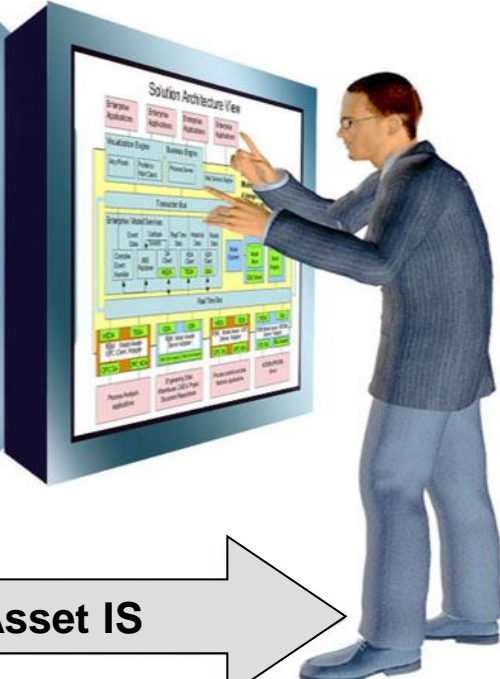
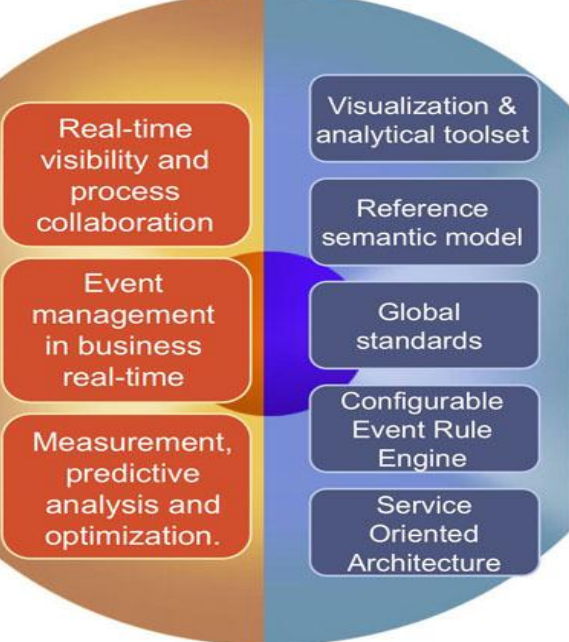
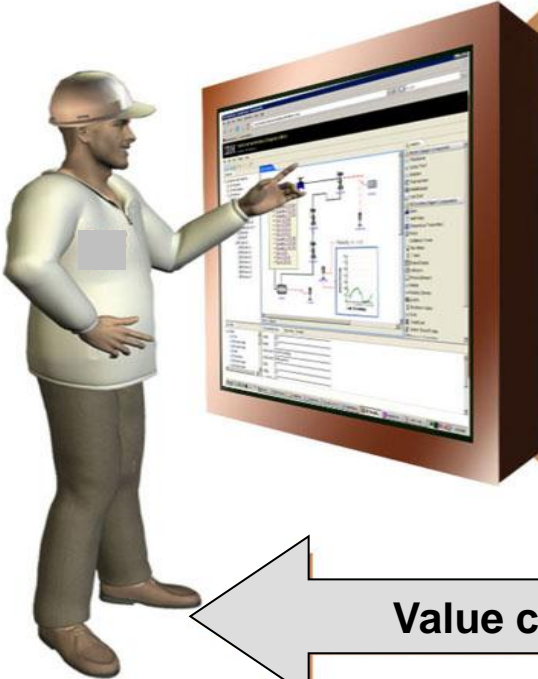
▪ **Automated** wind park authorization and field force management

It's all about bridging engineering know-how with Asset Information Systems

Smart Operations

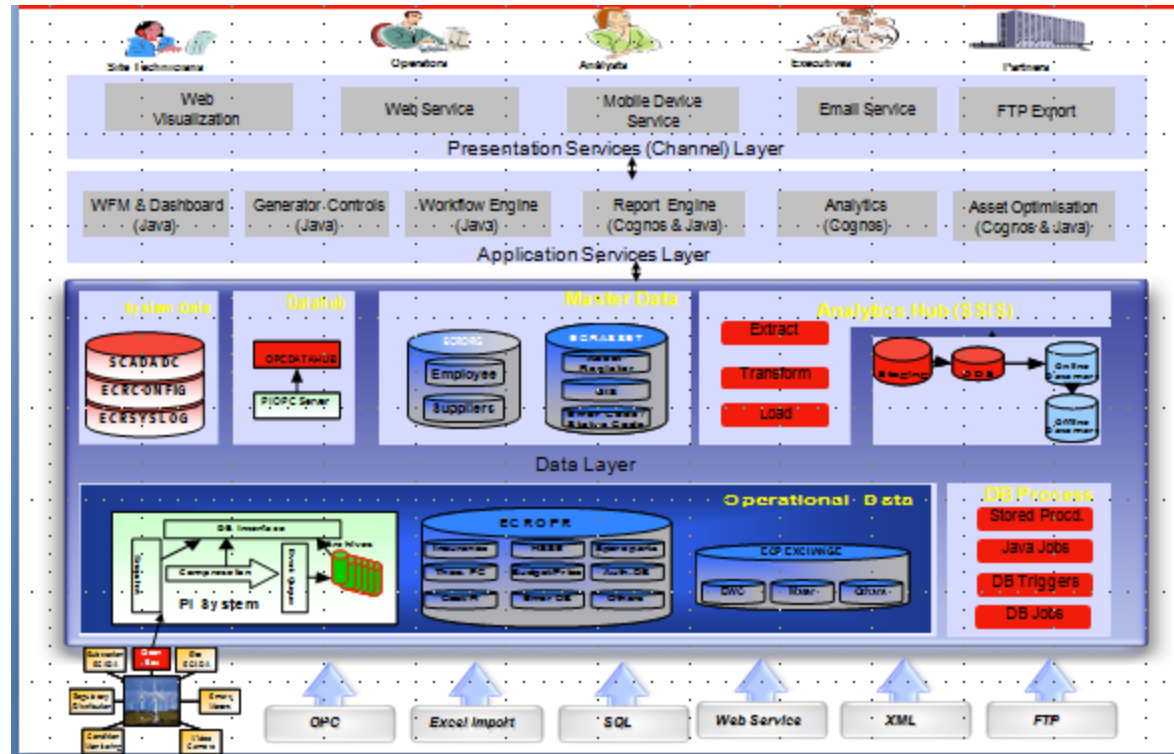
Engineering Leadership's
Vision for new capabilities

new tools and approaches
to achieve the vision

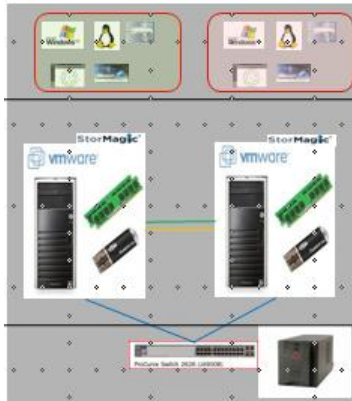


SmartECR an Enterprise SCADA and Information Platform

Central - SmartECR Platform

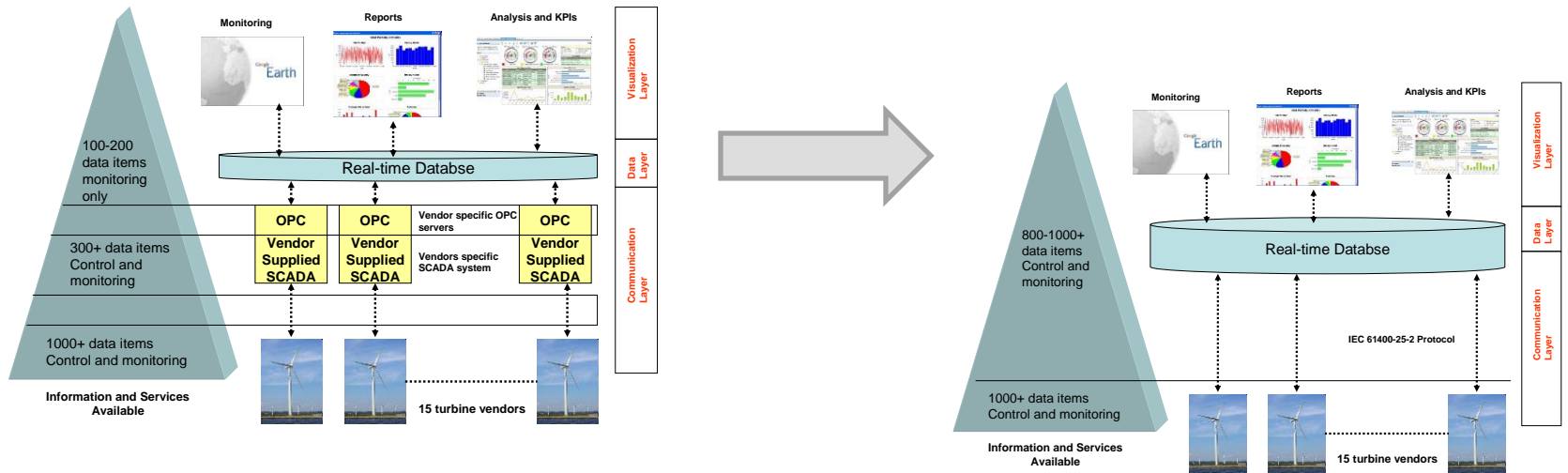


Decentral
Greenbox



Simplified architecture with IEC 61400-25-2

- Standardisation → Cost reduction
- Simplified networking → Security
- Reduced complexity → increased reliability
- Single data conversion per asset → accuracy and unlimited data
- Distributed SCADA 2.0 → endless possibilities ... e.g. professional services



...IEC 61400-25-2 → From Strategy to Reality

Search	Tag Name	Server	Timestamp	Value	Units	Descriptor
Servers	90113_WEA3:GenSpeed	172.17.3.149	5/11/2011 2:11:25 PM	1,059.3		Generator Speed
	90113_WEA3:RotorSpeed	172.17.3.149	5/11/2011 2:11:15 PM	8.325		Rotor Speed
<input type="checkbox"/> 10.255.6.149	90113_WEA3:TransferCurrent	172.17.3.149	5/11/2011 2:11:25 PM	16		Transfer voltage
<input checked="" type="checkbox"/> 172.17.3.149	90113_WEA3:TransferFrequency	172.17.3.149	5/11/2011 2:11:15 PM			Transfer frequency
	90113_WEA3:TransferVoltage	172.17.3.149	5/11/2011 2:11:15 PM			
	90113_WEA3:Yaw	172.17.3.149	5/11/2011 2:11:15 PM			
	90114_WEA1:GenSpeed	172.17.3.149	5/11/2011 2:11:18 PM			
	90114_WEA1:RotorSpeed	172.17.3.149	5/11/2011 2:11:15 PM			
	90114_WEA1:TransferCurrent	172.17.3.149	5/11/2011 2:11:25 PM			
	90114_WEA1:TransferFrequency	172.17.3.149	5/11/2011 2:11:15 PM			
	90114_WEA1:TransferVoltage	172.17.3.149	5/11/2011 2:11:15 PM			
	90114_WEA1:Yaw	172.17.3.149	5/11/2011 2:11:15 PM			
	90115_WEA5:GenSpeed	172.17.3.149	5/11/2011 2:11:25 PM	963.5		
	90115_WEA5:RotorSpeed	172.17.3.149	5/11/2011 2:11:15 PM	8.0172		
	90115_WEA5:TransferCurrent	172.17.3.149	5/11/2011 2:11:23 PM	48.532		
	90115_WEA5:TransferFrequency	172.17.3.149	5/11/2011 2:11:15 PM	49.969		
	90115_WEA5:TransferVoltage	172.17.3.149	5/11/2011 2:11:15 PM	389.29	Volts	
	90115_WEA5:Yaw	172.17.3.149	5/11/2011 2:11:15 PM	69.142	degrees	
System Management	90116_WEA2:GenSpeed	172.17.3.149	5/11/2011 2:11:25 PM	1,041.8	rpm	
Search	90116_WEA2:RotorSpeed	172.17.3.149	5/11/2011 2:11:15 PM	9.3008	rpm	
<input type="checkbox"/> Alarms	90116_WEA2:TransferCurrent	172.17.3.149	5/11/2011 2:11:25 PM	117.48	Amps	
<input type="checkbox"/> Batch	90116_WEA2:TransferFrequency	172.17.3.149	5/11/2011 2:11:15 PM	49.967	Hz	
<input type="checkbox"/> Data	90116_WEA2:TransferVoltage	172.17.3.149	5/11/2011 2:11:15 PM	389.79	Volts	Transfer
Archive Editor	90116_WEA2:Yaw	172.17.3.149	5/11/2011 2:11:15 PM	78.786	degrees	Yaw Angle
Current Values	90117_WEA4:GenSpeed	172.17.3.149	5/11/2011 2:11:25 PM	1,176.2	rpm	Generator Speed
Stale and Bad Point	90117_WEA4:RotorSpeed	172.17.3.149	5/11/2011 2:11:15 PM	9.8013	rpm	Rotor Speed
<input type="checkbox"/> Interfaces	90117_WEA4:TransferCurrent	172.17.3.149	5/11/2011 2:11:24 PM	209.01	Amps	Transfer voltage
<input type="checkbox"/> IT Points	90117_WEA4:TransferFrequency	172.17.3.149	5/11/2011 2:11:15 PM	49.968	Hz	Transfer frequency
	90117_WEA4:TransferVoltage	172.17.3.149	5/11/2011 2:11:15 PM	389.83	Volts	Transfer voltage
	90117_WEA4:Yaw	172.17.3.149	5/11/2011 2:11:15 PM	121.59	degrees	Yaw Angle

Implemented and Live
 Many thanks to OSIsoft, SISCO
 Bachmann and Repower

Dayahead Forecasting per Turbine

Platform allows easy implementation and ROI of < 1 month

Day-ahead forecast for Rödsand 2 - 2011 Calendar week 20

Developer/ responsible: Uwe Fischer EC&R Central Team

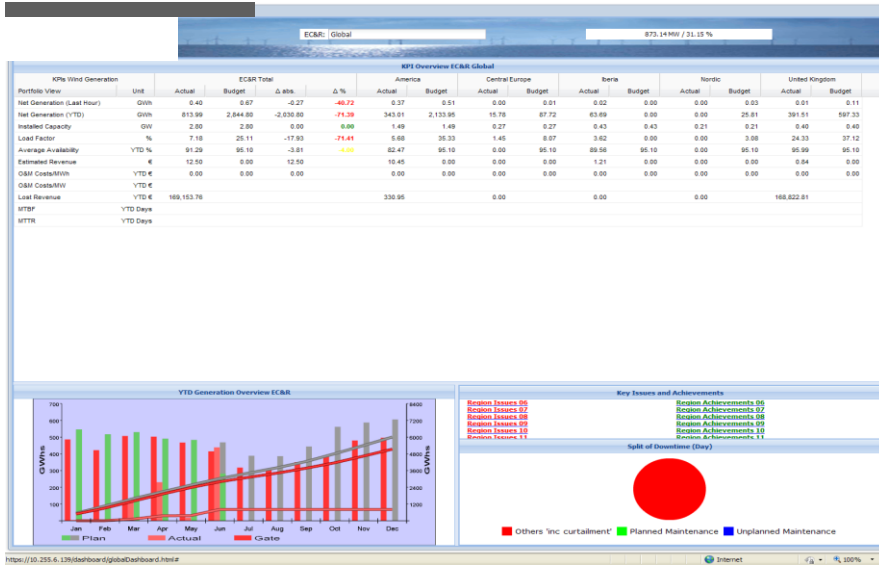
Quality control: Niels Emsholm EC&R Nordic

Forecasted day	Forecasted hour	Wind Power (forecast) [MW]	Wind Power (real) [MW]	Deviation (real-forecast) [MW]	Spot price [€/MWh]	Imbalance price production-PURCHASE (EUR/MWh)	Imbalance price production-SALES (EUR/MWh)	Balancing costs for over-production [€]	Balancing costs for under-production [€]	Total balancing costs [€]	Accuracy	Forecast created on
	14:00:00-15:00:00	29,99	67,15	37,15	52,56	52,56	52,56	0,00	0,00	0,00	37,15	
	15:00:00-16:00:00	21,05	146,78	125,73	52,46	52,46	52,46	0,00	0,00	0,00	125,73	
	16:00:00-17:00:00	28,88	61,71	32,83	52,42	59,98	52,42	0,00	0,00	0,00	32,83	
	17:00:00-18:00:00	38,27	49,69	11,43	52,61	62	52,61	0,00	0,00	0,00	11,43	
	18:00:00-19:00:00	48,94	136,22	87,28	52,91	62	52,91	0,00	0,00	0,00	87,28	
	19:00:00-20:00:00	64,02	80,01	15,99	53,63	63,93	53,63	0,00	0,00	0,00	15,99	
	20:00:00-21:00:00	81,70	85,17	3,48	53,28	63,93	53,28	0,00	0,00	0,00	3,48	
	21:00:00-22:00:00	101,03	85,98	-15,05	54,84	62,7	54,84	0,00	118,31	118,31	15,05	
	22:00:00-23:00:00	113,87	87,11	-26,76	55,32	62,7	55,32	0,00	197,47	197,47	26,76	
	23:00:00-00:00:00	127,78	96,42	-31,35	53,28	62,53	53,28	0,00	290,01	290,01	31,35	
	TOTAL	TOTAL	TOTAL	TOTAL	AVERAGE	AVERAGE	AVERAGE	TOTAL	TOTAL	TOTAL	TOTAL	
TOTAL	CW20 2011	13.293	13.565	271	54,62	58,75	52,24	7.770	4.919	12.688	64,28%	

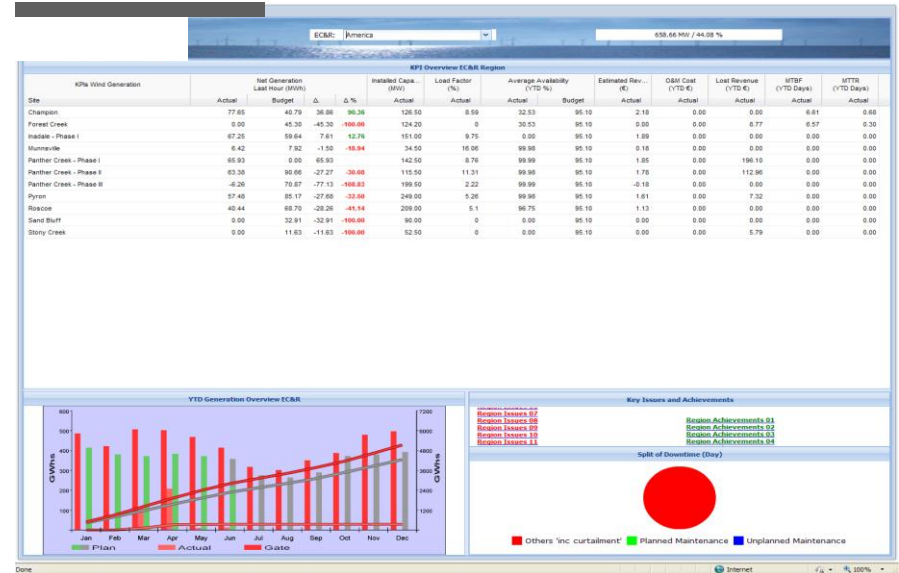
TARGET TBD

Balancing costs [€/MWh]: 0,94

Executive Dashboards

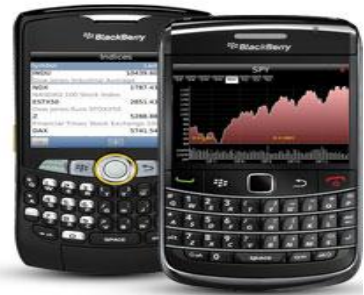


Global



Regional

SmartECR recognizes loss production & notifies operator



e-on Smart ECR

Turbine/Site ID: R005-C010-S002-P000-T022

Turbine/Site Name: Turb 22

Stopped since: 08.06.2010 16:04:00

Reason of Failure: Unknown

Expected Start: unknown

Site Wind Speed: 18.06.2010 15:13 [m/s]

Site Active Power: 42.06 [MW]

Comments:

Submit

e-on Smart ECR

Turbine/Site ID:

Turbine/Site Name:

Stopped since:

Reason of Failure: Unknown

Expected Start:

Comments:

- Unknown
- Planned Maintenance
- Un-planned Maintenance
- Accident
- Spareparts problem
- Grid Problem
- Remote Start
- Turbine Fault
- Manual Stop
- False Alarm

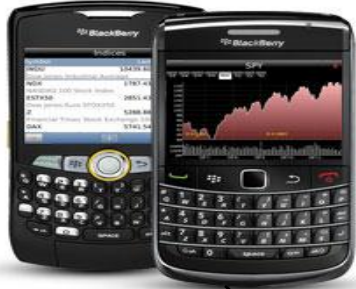
e-on Climate & Renewables

Turbine/Site Planned Stop

Region	County	Site	Turbine	Shutdown Since	Acknowledge	Expected Start	Expected Duration	Loss Of Power	Loss Of Revenue(K)	Reason of Shutdown	Comments
UK Region	UK	Oldside	*** Site Based T	05.10.2009 15:28	YES	27.10.2009 01:47	01:22:12:18	0 MW		Unknown	
UK Region	UK	Homeside	Turbine 2	05.10.2009 15:26	YES	11.12.2009 00:00	03:08:10:33	1479228649.6 MW		Unknown	DAB @ NJUR EN T
UK Region	UK	Lowca	Turbine 3	05.10.2009 15:00	NO			755983389 MW			
UK Region	UK	Lowca	Turbine 7	05.10.2009 15:00	NO			795160233 MW			
UK Region	UK	Siddick	Turbine 3	05.10.2009 15:05	NO			0 MW			
UK Region	UK	Hare Hill	Turbine 2	05.10.2009 15:18	NO			1178334860.6 MW			
UK Region	UK	Siddick	*** Site Based T	06.10.2009 10:39	NO			0 MW			
UK Region	UK	High Volts	Turbine 1	06.10.2009 10:35	NO			1208239653 MW			
UK Region	UK	Rhesidol	Turbine 3	06.10.2009 10:38	NO			0 MW			
UK Region	UK	Hare Hill	Turbine 1	06.10.2009 15:39	NO			1235284827.2 MW			
UK Region	UK	Homeside	Turbine 1	06.10.2009 15:35	NO			1430091405.8 MW			
UK Region	UK	Askam	Turbine 7	06.10.2009 15:40	NO			56674209.2 MW			
UK Region	UK	Askam	Turbine 2	06.10.2009 16:15	NO			585566410 MW			
UK Region	UK	Askam	Turbine 4	06.10.2009 18:15	NO			758117995 MW			
UK Region	UK	Askam	Turbine 5	06.10.2009 18:15	NO			697642236.8 MW			
UK Region	UK	Askam	Turbine 6	06.10.2009 18:15	NO			564572972 MW			
UK Region	UK	Rhesidol	Turbine 5	06.10.2009 23:46	NO			0 MW			
UK Region	UK	Royd Moor	Turbine 3	07.10.2009 02:59	NO			0 MW			
UK Region	UK	Royd Moor	Turbine 13	07.10.2009 03:04	NO			0 MW			
UK Region	UK	Lowca	Turbine 5	07.10.2009 10:30	NO			747101868 MW			
UK Region	UK	High Volts	*** Site Based T	07.10.2009 12:30	NO			1190479834.1 MW			
UK Region	UK	Royd Moor	Turbine 7	07.10.2009 19:05	NO			0 MW			
UK Region	UK	Royd Moor	Turbine 8	07.10.2009 19:06	NO			0 MW			
UK Region	UK	Royd Moor	Turbine 9	07.10.2009 19:13	NO			0 MW			
UK Region	UK	Royd Moor	Turbine 6	07.10.2009 19:23	NO			0 MW			

Mobile Device based Dashboard

Blackberry



	Prod (MW)	Load (%)	Cap (MW)	Turbines	Stopped
Total	873.9	31.0	2803.0		
Europe	669.9	45.0	1494.2	938	0
	8.5	3.0	268.8	143	0
	11.9	3.0	434.9	417	0
	50.3	24.0	207.0	90	0
United Kingdom	133.3	33.0	398.1	271	1

	Prod (MW)	Load (%)	Cap (MW)	Unit #	Stopped Unit #
Solar Total					
France (PV)					
Italy (PV)					
Spain (CSP)					
US (PV)					

ECR Portfolio	
Turbines	2713
Sites	131
Capacity (MW)	3042

Description

Prod (MW) = Production in MW
 Load (%) = Load as a percentage
 Cap (MW) = Total capacity in MW
 Turbines # = Number of turbines
 Stopped WTG # = Number of stopped WTG
 Unit # = Number of units
 Stopped Unit # = Number of stopped units

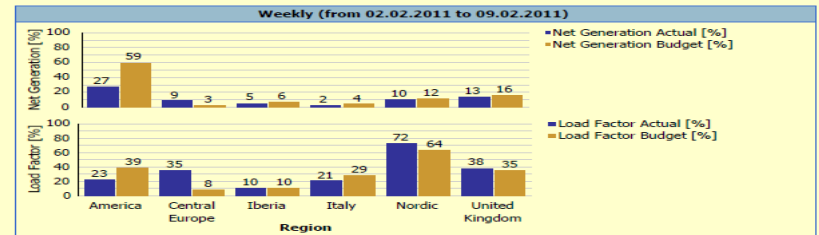
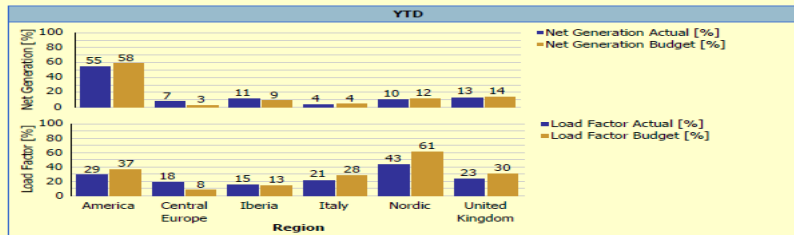
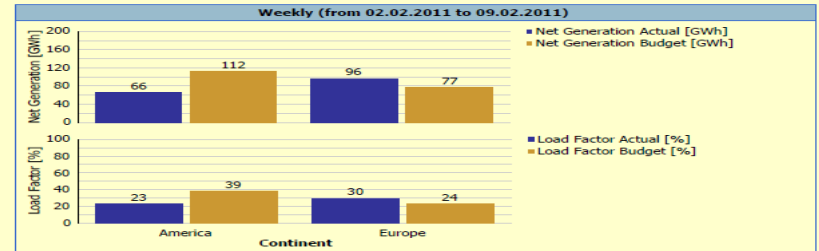
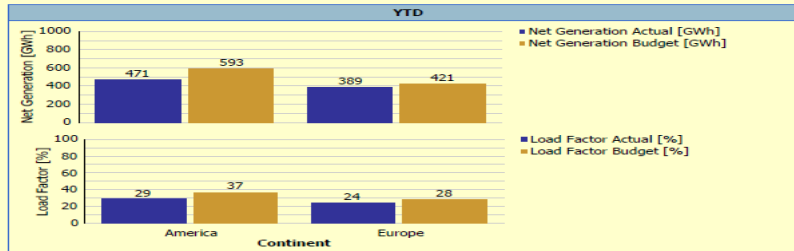
Android Tab



Weekly PDF Report by Email

EC&R Global Operation Weekly Report

Region	Installed Capacity Actual [MW]	YTD							Weekly (from 02.02.2011 to 09.02.2011)					
		Net Generation Budget [GWh]	Net Generation Actual [GWh]	Net Generation Theoretical [MWh]	Load Factor Budget [%]	Load Factor Actual [%]	Average Availability Actual [%]	MTBF [YTD Days]	MTTR [YTD Days]	Net Generation Budget [GWh]	Net Generation Actual [GWh]	Net Generation Theoretical [MWh]	Load Factor Budget [%]	Load Factor Actual [%]
America	1720	593	471	2059	37	29	3.729	337	0	112	66	370	39	23
Central Europe	369	27	64	2203	8	18				5	22	703	8	35
Iberia	701	89	98	308	13	15	1.028	404	0	12	12	49	10	10
Italy	164	43	33	0	28	21				8	6	0	29	21
Nordic	207	120	84	0	61	43				22	25	0	64	72
United Kingdom	498	141	110	5337	30	23	1.537	298	0	30	32	1572	35	38
EC&R Summary	3659	1014	860	9907	30	25	2.098	346	0	189	162	2694	31	33



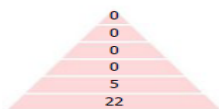
Monthly Report HSSE Report

EC&R HSSE Monthly Report

BU: EC&R UK
 Year: 2010
 Month: September
 Reported by: Bradford Garry

Provider Type	Hours Worked	Lost Days	Fatal Incidents	Fatalities	Lost Time Incidents	Restricted Work Cases	Medical Treatment Cases	First Aid Cases	Environmental Incidents	Property Or Business Continuity Damage	Harm To Business Reputation	Near Misses	Security Incidents
Employees	22.899	0	0	0	0	0	0	2	1	0	0	2	0
Contractors	23.094		0	0	0	0	0	3	0	0	0	20	
Third Party			0	0	0								

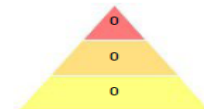
H&S Incidents (combined)



Fatalities
 LTI's
 Restricted Work Cases
 Medical Treatment Cases
 First Aid Cases
 Near-misses

Provider Type	LTIF	TRIF	LTISR
Employees	0.00	0.00	0.00
Contractors	0.00	0.00	
Combined	0.00		

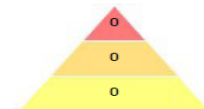
Incident Severity (combined)



Severity stage 3
 Severity stage 2
 Severity stage 1

Incident Severity	Harm To People	Property Or Business Continuity Damage	Harm To The Environment	Harm To Business Reputation	Security
3	0	0	0	0	0
2	0	0	0	0	0
1	0	0	0	0	0

Potential Severity (combined)



Severity stage 3
 Severity stage 2
 Severity stage 1

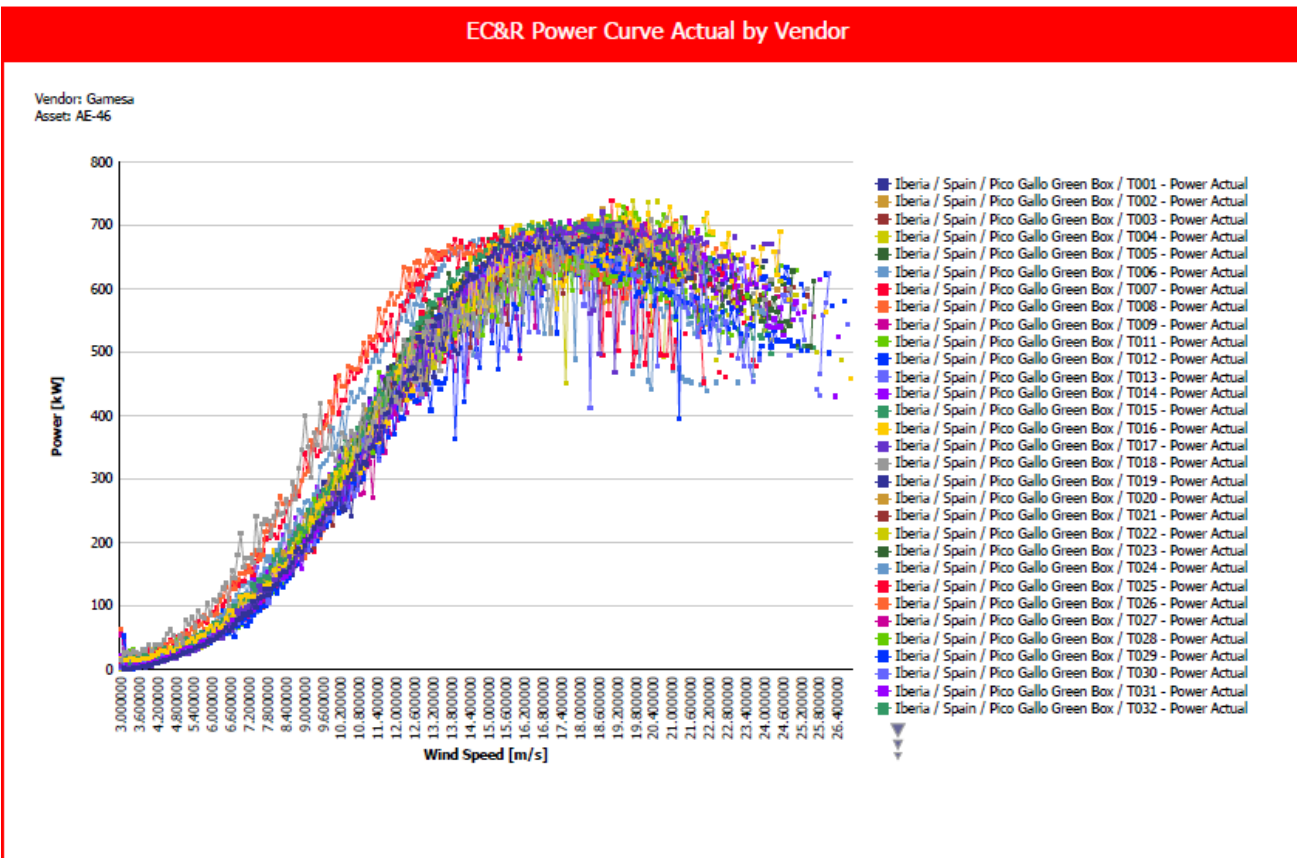
Potential Severity	Harm To People	Property Or Business Continuity Damage	Harm To The Environment	Harm To Business Reputation	Security
3	0	0	0	0	0
2	0	0	0	0	0
1	0	0	0	0	0

Dec 20, 2010

1

5:11:17 PM

Real Power Curves





OSIsoft Products and Services Employed

- Enterprise Agreement
 - Single Server 1.000.000 Tags
 - PI JDBC
 - PI DataLink
 - PI OPC
 - 24/7 NOC
- ... Beta Products, Strategy Consulting and Support !



Future Plans and Next Steps

- Complete Rollout to “legacy Assets”
- Integrate all Solutions in a ScadaPortal
- Rollout Park Control
- Integrate WTG Control based on OPC-DA and IEC 61400-25
- Develop O&M solution for PV
- Integrate Concentrated Solar Power
- Integrate with SAP PM

...



Questions

Uwe Fischer

Head of Asset Information Systems

Phone: + 49 211 4579 748

Fax: +49 211 4579 1 748

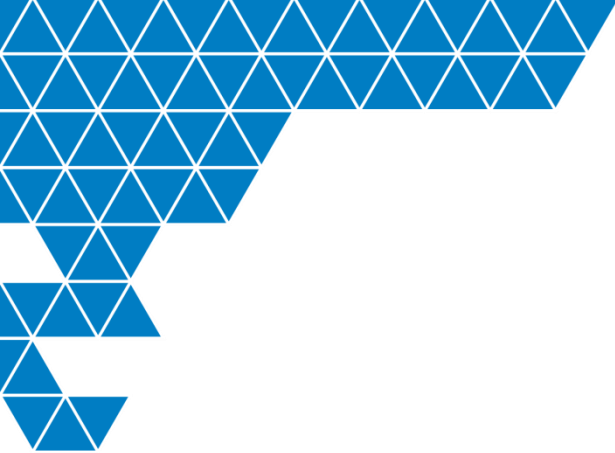
E-Mail: Uwe.Fischer@eon.com

EON Climate & Renewables GmbH

Völklinger Straße 4

40219 Düsseldorf

www.eon.com



Thank you

