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
- Capacity (GW)[2] 57.0
  - Coal 23.3 41%
  - Gas 14.5 25%
  - Nuclear 10.5 18%
  - Hydro 5.0 9%
  - Other Renewables 3.7 3%

• Renewable technologies


Wind Onshore


Wind Offshore


Photovoltaic (PV)


Solar thermal (CSP)

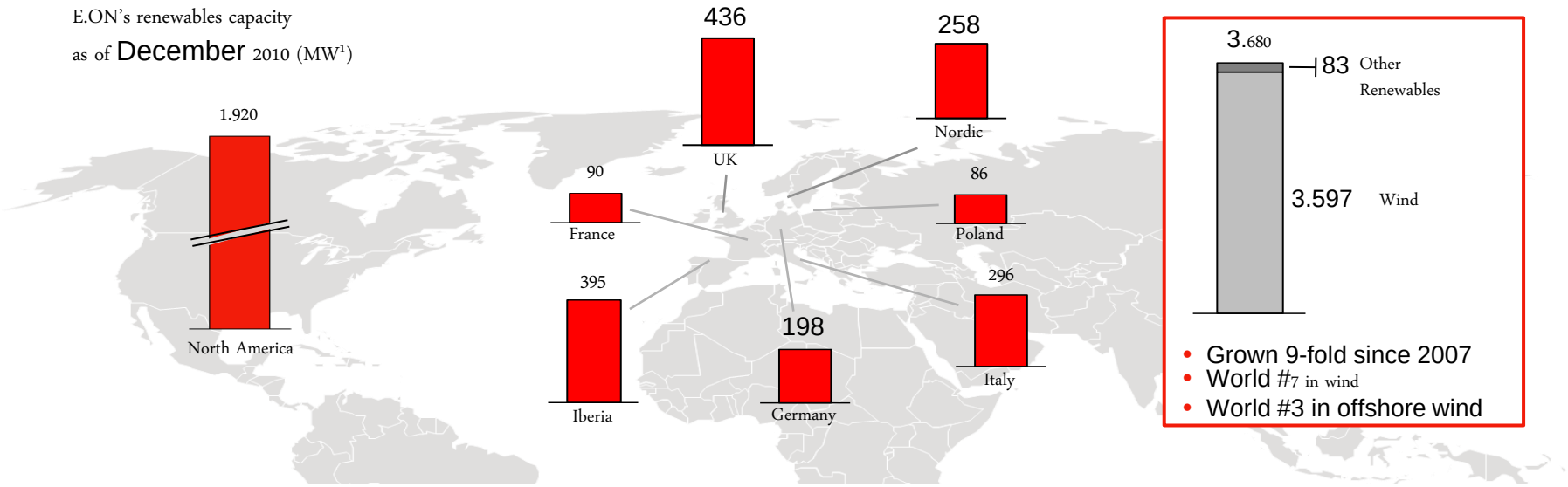

Biomass


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



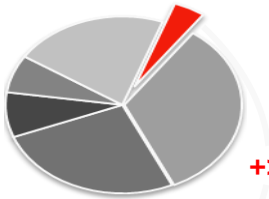
E.ON 2015 target: 25% of EBITDA from outside Europe (up from 5% today)

[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

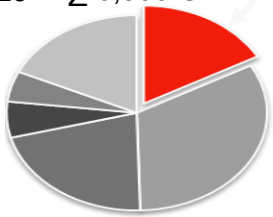
Global capacity (GW)

2008 ∑ 4,500 GW

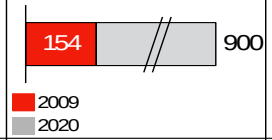
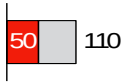
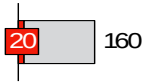
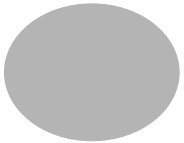


+>400%

2020 ∑ 6,800 GW

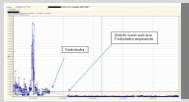


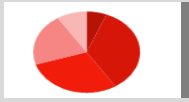
Renewables Gas Oil
Hydro Coal Nuclear

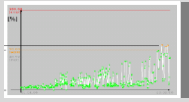
	Wind	Biomass	Solar	Marine
Global capacity [GW]				
Long-term feasible potential worldwide [GW]	 ~5,000	 ~2,000	 ~50,000	 ~5,000
Current technology maturity	Advanced		Step changes in technology possible	Proof-of-concept & technology tracking

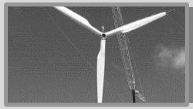
Sources: E.ON; IEA; BTM; California Institute of Technology; World Energy Council; World Energy Assessment; Roland Berger Strategy Consultants

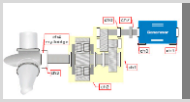
“Boutique to Industrial” will stay our fundamental driver


SCADA[1]


Optimized spare part concept


CMS[3] and predictive maintenance


Access to critical equipment and tools


Proper and complete documentation

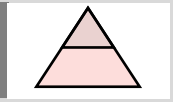
2011 target availability 98%

2011 target O&M cost reduction -10%

Scale of projects and harmonized WTG[2] use

Spare part pooling

Widen O&M contracts



Optimized share of 3rd party O&M

O&M framework agreement

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

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

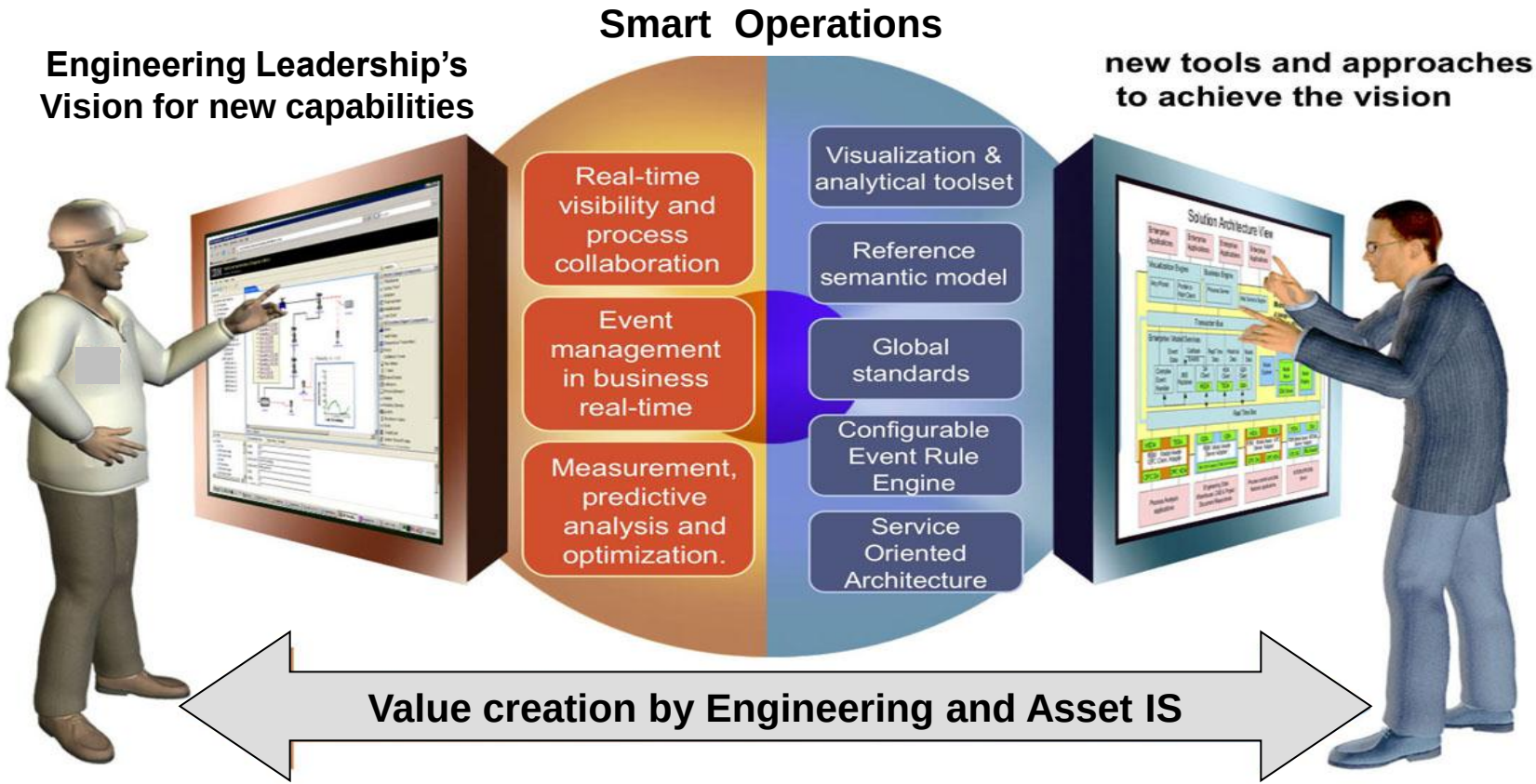
Asset and Power Generation Optimisation:
- Asset Optimization & Component level inventory management on global level
- Proactive spare parts management
- Asset Insurance management
- Speedy emergency response
- Energy Scheduling and Load Forecasting

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

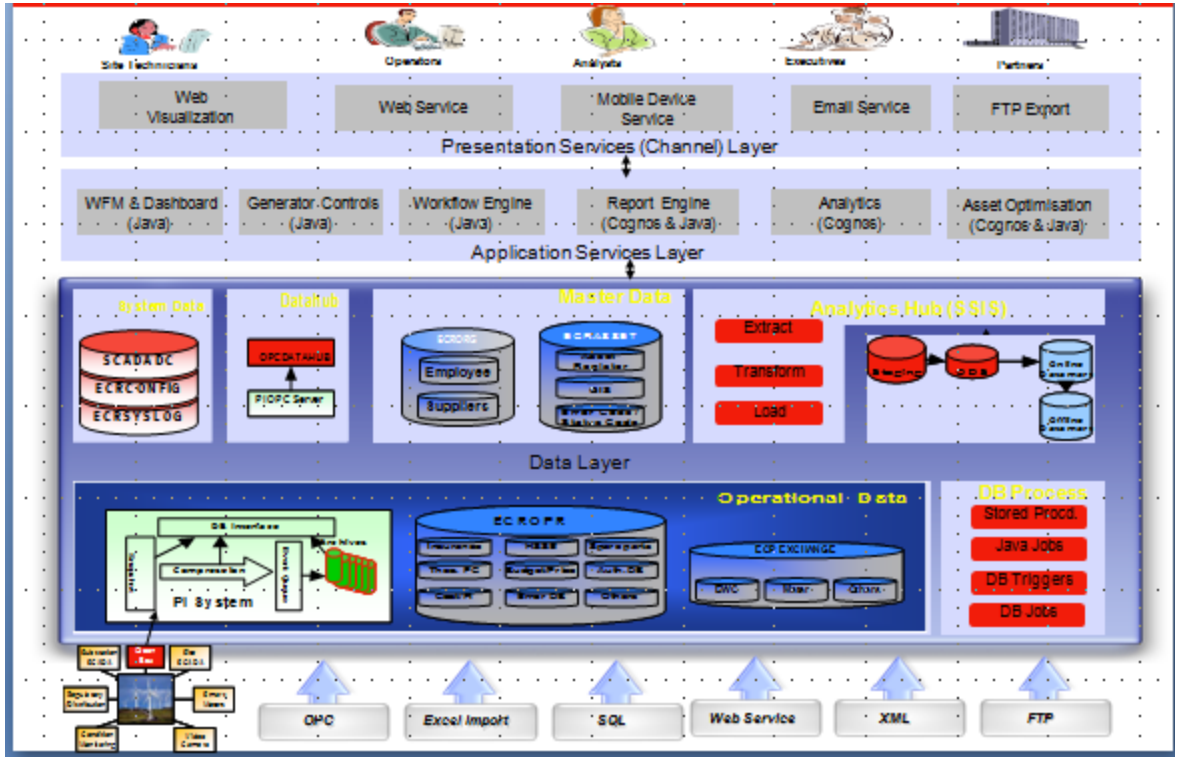
Globally **dispersed** enterprise with regional ‘boutique’ shops	Globally **Integrated enterprise with industrial scale**
Reporting of operational data via Xcel	**Real-time reporting** of operational data
Unique SCADA system for each wind park / Hydro plant	**Single system for monitoring & control**
Diverse Turbines with unique controlling philosophy	**Common reference semantic model** to acquire, normalize data and error/alarm codes
Diverse hardware and network infrastructure	**Standard Hardware and Network** for interface to global system
Reactive maintenance and procurement	**Proactive maintenance and spare parts inventory management**
Manual process for Site authorization and field force management	**Automated** wind park authorization and field force management

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

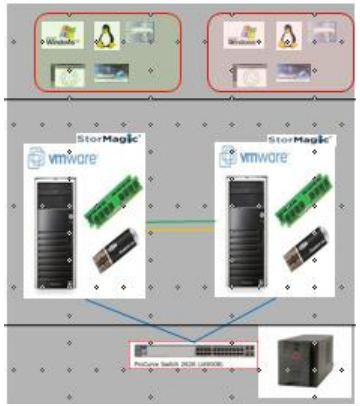


SmartECR an Enterprise SCADA and Information Platform

Central - *SmartECR Platform*

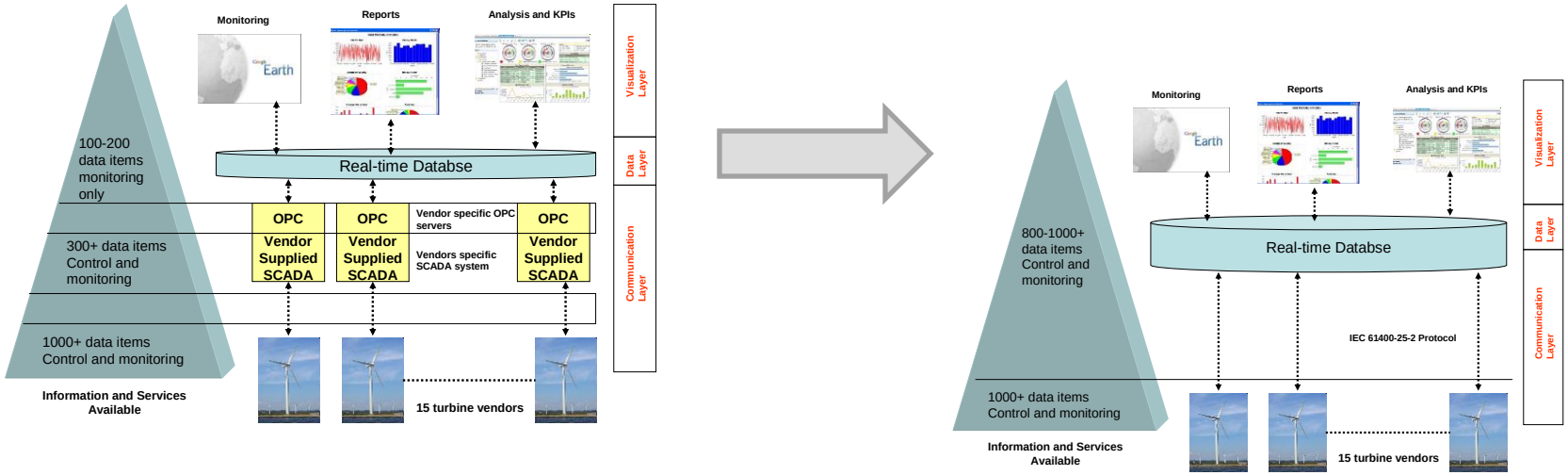


Decentral
Greenbox

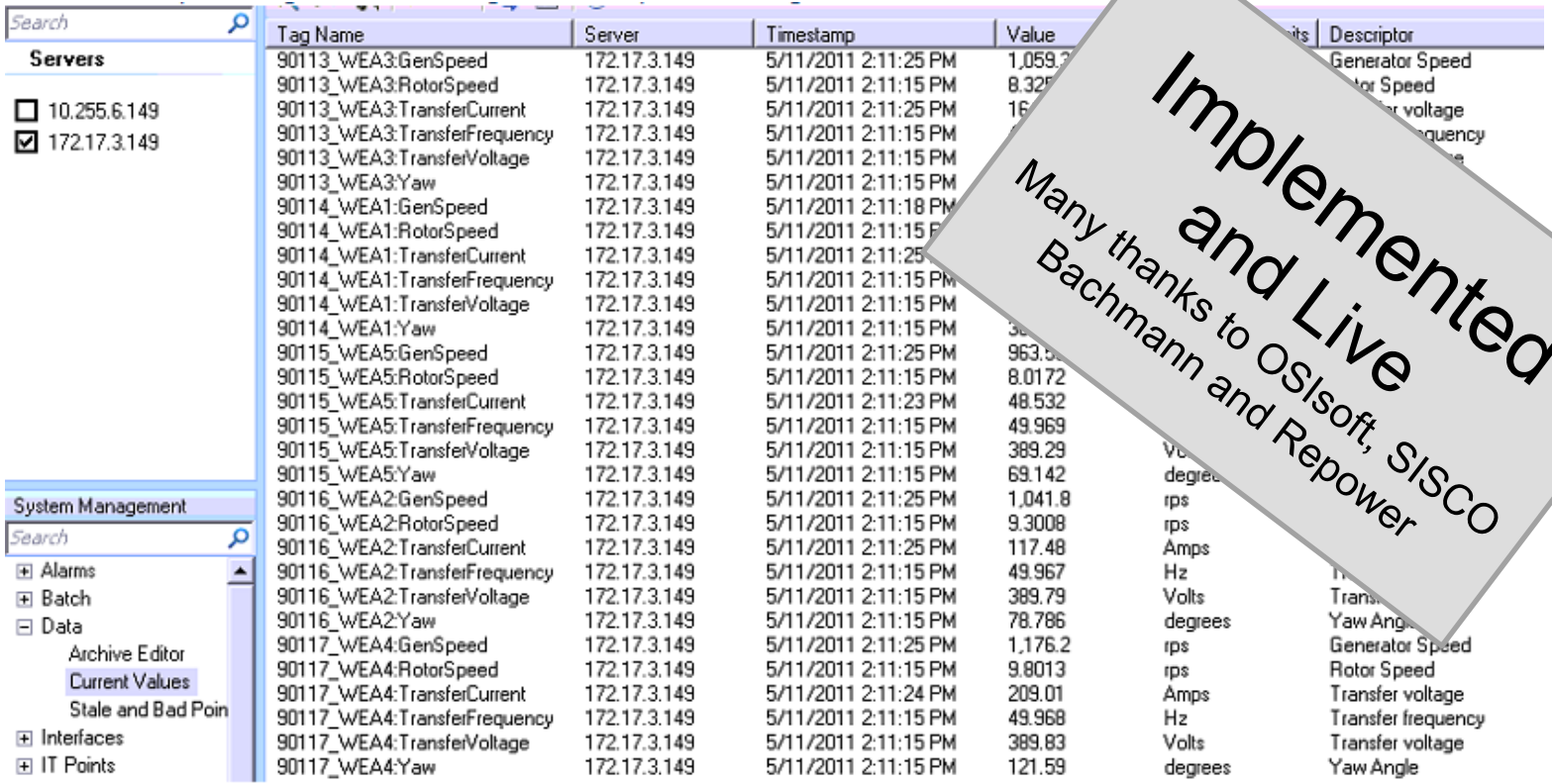


Simplified architecture with IEC 61400-25-2

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



…IEC 61400-25-2 ➔ From Strategy to Reality



Implemented and Live

Many thanks to OSIsoft, SISCO Bachmann and Repower

Dayahead Forecasting per Turbine

Platform allows easy implemtation and ROI of < 1 month

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

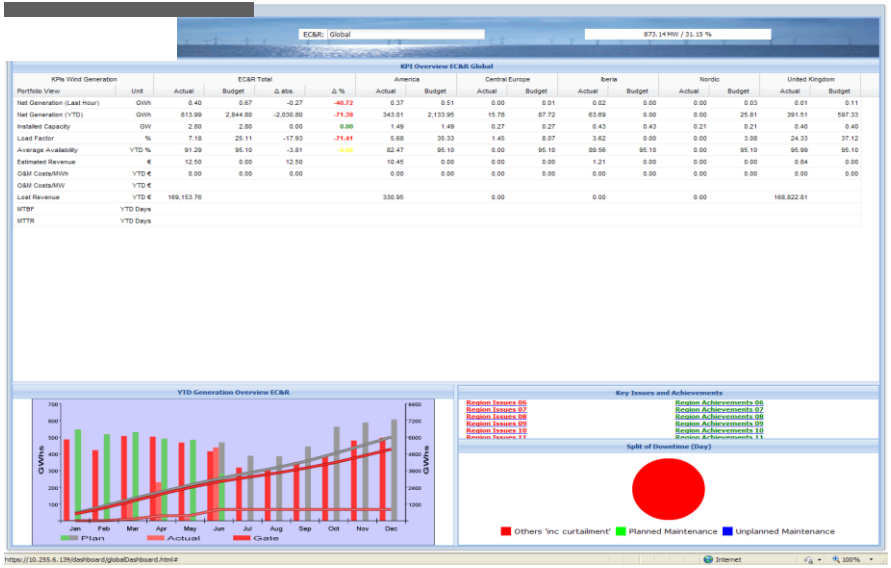
Developer/ responsible: Uwe Fischer EC&R Central Team

Quality controll: Niels Emsholm EC&R Nordic

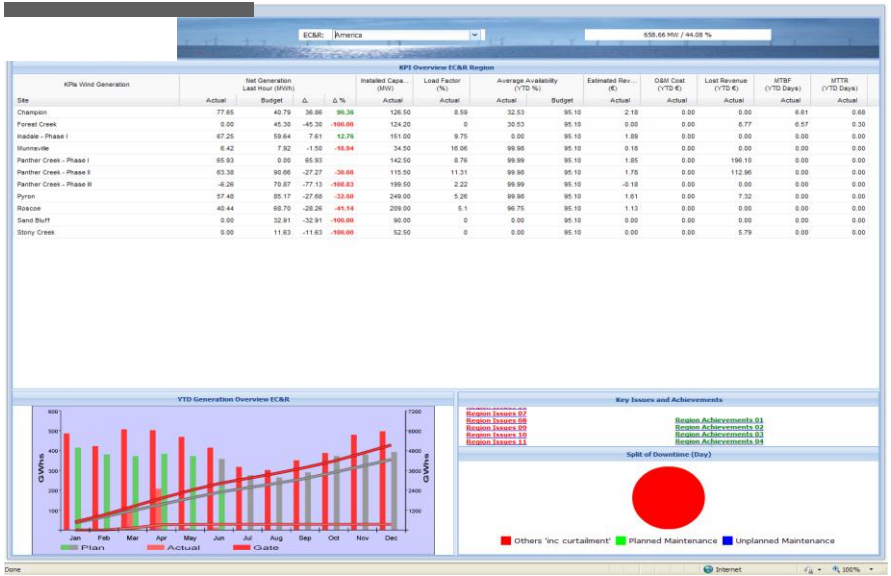
Forecasted day	Forecasted hour	Wind Power (forecast) [MW]	Wind Power (real) [MW]	Deviation (real-forecast) [MW]	Spot price [€/MWh]	Imbalance price production-PURCHASE (EUR/MWh)	Imbalance price production-SALES (EUR/MWh)	Balancing costs for over-production [€]	Balancing costs for under-production [€]	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	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

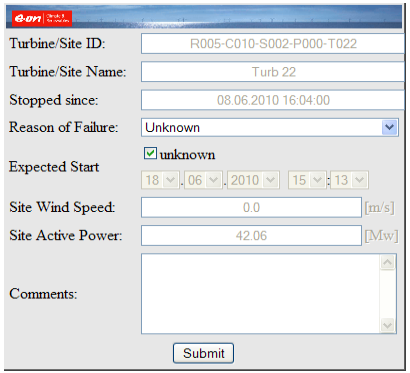


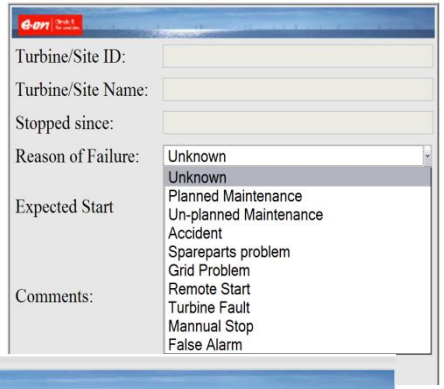
Global

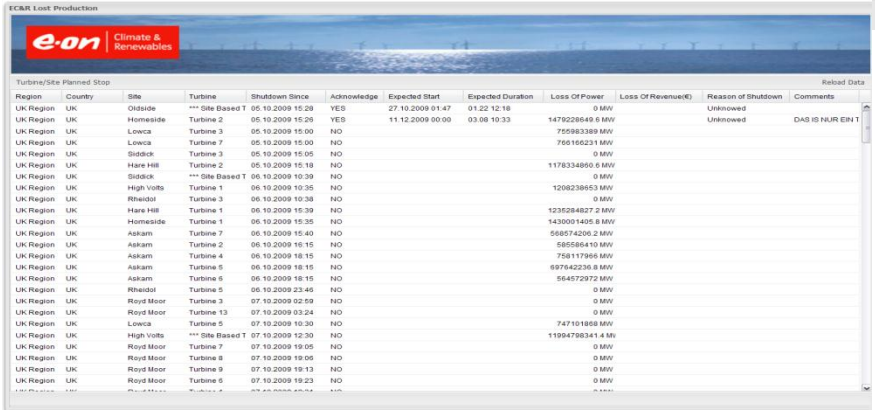


Regional

SmartECR recognizes loss production & notifies operator







Mobile Device based Dashboard

Blackberry

	Prod (MW)	Load (%)	Cap (MW)	Turbines	Stopped
[illegible]al	873.9	31.0	2803.0		
[illegible]	669.9	45.0	1494.2	938	0
[illegible]urope	8.5	3.0	268.8	143	0
[illegible]	11.9	3.0	434.9	417	0
[illegible]	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

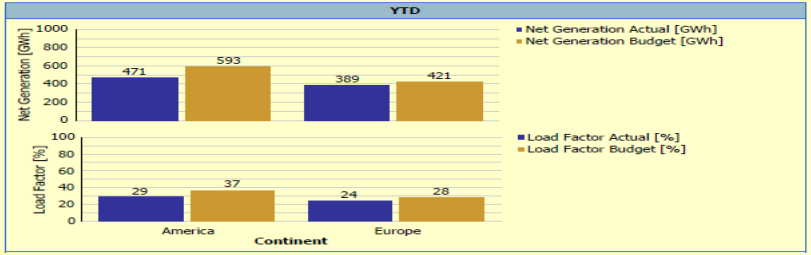
Prod (MW) = Production in MW
Load (%) = Load as a percentage
Cap (MW) = Total capacity in MW
Turbines # = Number of turbines
Stopped WTG # = Number of stopped WTG
Unit # = Number of units
Stopped Unit # = Number of stopped units

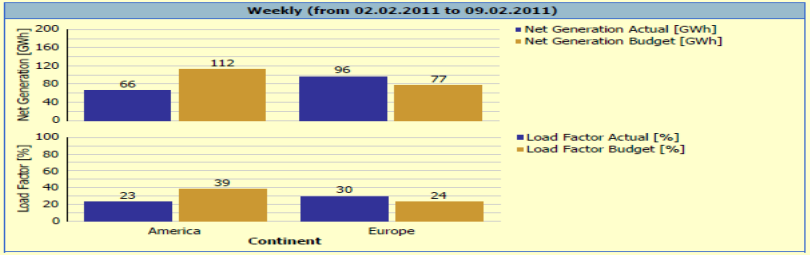
Android Tab

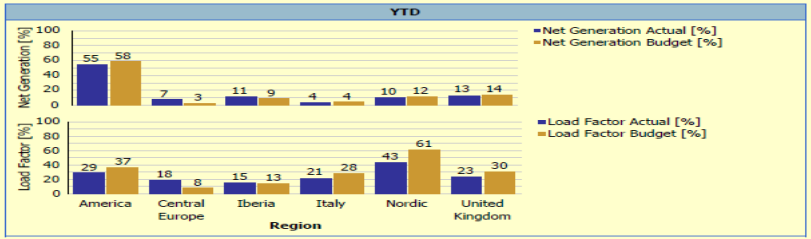
Weekly PDF Report by Email

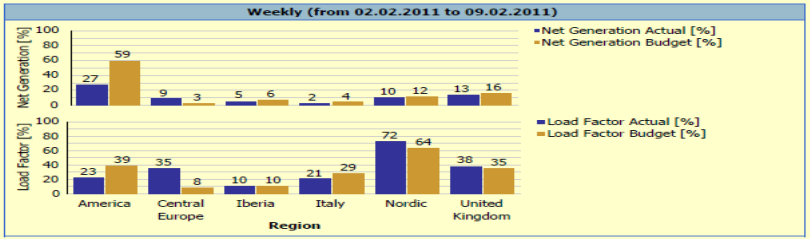
EC&R Global Operation Weekly Report

Region	YTD Installed Capacity Actual [MW]	YTD Net Generation Budget [GWh]	YTD Net Generation Actual [GWh]	YTD Net Generation Theoretical [MWh]	YTD Load Factor Budget [%]	YTD Load Factor Actual [%]	YTD Average Availability Actual [%]	YTD MTBF [YTD Days]	YTD MTTR [YTD Days]	Weekly (from 02.02.2011 to 09.02.2011) Net Generation Budget [GWh]	Weekly Net Generation Actual [GWh]	Weekly Net Generation Theoretical [MWh]	Weekly Load Factor Budget [%]	Weekly 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**









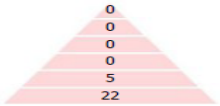
Monthly Report HSSE Report

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	Environ-mental 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

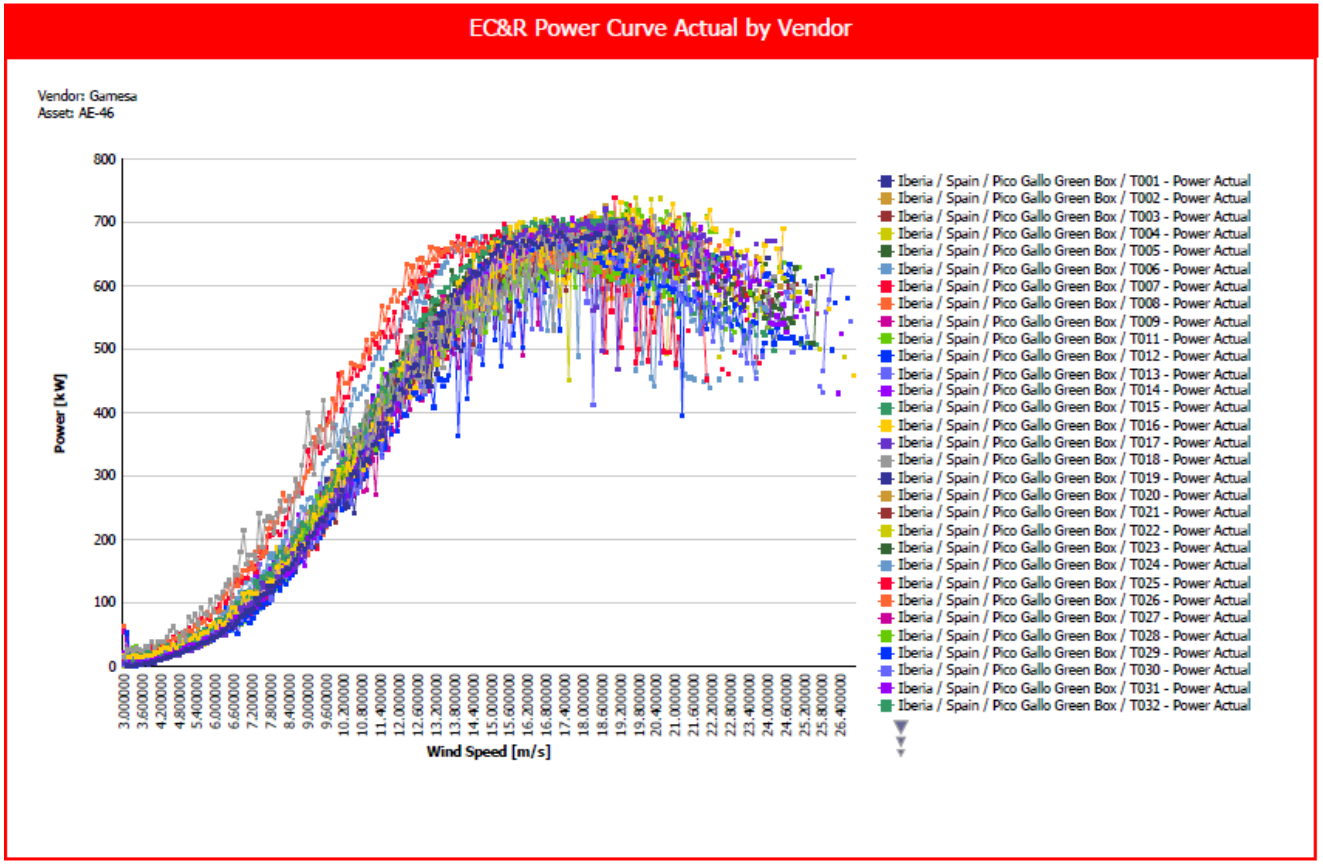
Incident Serverity	Harm To People	Property Or Business Continuity Damage	Harm To The Environ-ment	Harm To Business Reputation	Security
3	0	0	0	0	0
2	0	0	0	0	0
1	0	0	0	0	0

Potential Severity (combined)

Severity stage 3
Severity stage 2
Severity stage 1

Potential Serverity	Harm To People	Property Or Business Continuity Damage	Harm To The Environ-ment	Harm To Business Reputation	Security
3	0	0	0	0	0
2	0	0	0	0	0
1	0	0	0	0	0

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

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Thank you