# SmartECR Business Value Through Real-Time Data

Presented by

Uwe Fischer

E.ON

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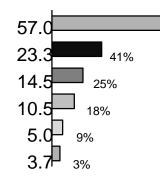


- Company Overview
- SmartECR Scope
- SmartECR Challenges
- SmartECR Solutions
- Next Steps

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

### • E.ON Group (2010)<sup>1</sup>

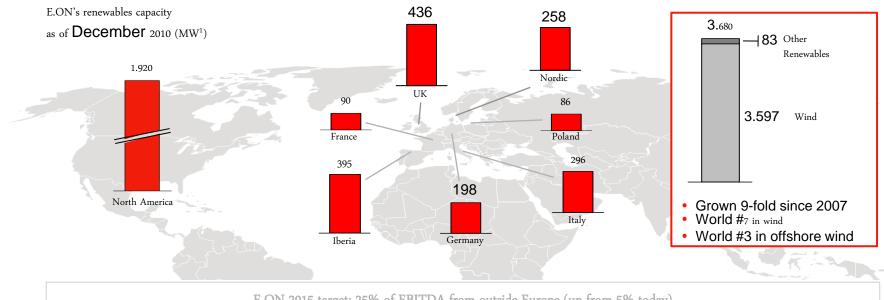
- Adj. EBITDA >€13bn
- Adj. Net Income ~€5.1bn
- Employees >88,000
- Capacity (GW)<sup>2</sup>
- Coal
- Gas
- Nuclear
- Hydro
- Other Renewables





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

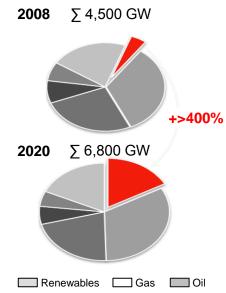
## E.ON operates 3.680 MW renewables capacity in Europe and North America – and eyes further regions to grow



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

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

Global capacity (GW)



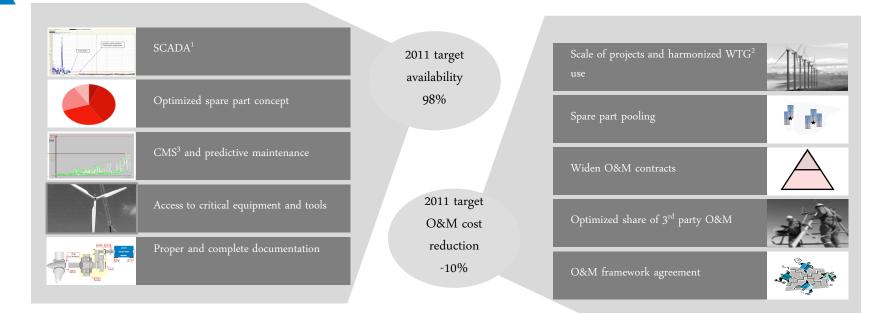
Hydro

	Wind	Biomass	Solar	Marine
Global capacity [GW]	<b>154 900</b> 2009 2020	<mark>50</mark> 110	160	2
Long-term feasible potential worldwide [GW]	~5,000	~2,000	~50,000	~5,000
Qurrent technology maturity	Adva	næd	Step changes in technology possible	Proof-of-concept & technologytracking

Nuclear

Coal

## "Boutique to Industrial" will stay our fundamental driver



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

<sup>1</sup> Supervisory Control And Data Acquisition <sup>2</sup> Wind Turbine Generator <sup>3</sup> 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:

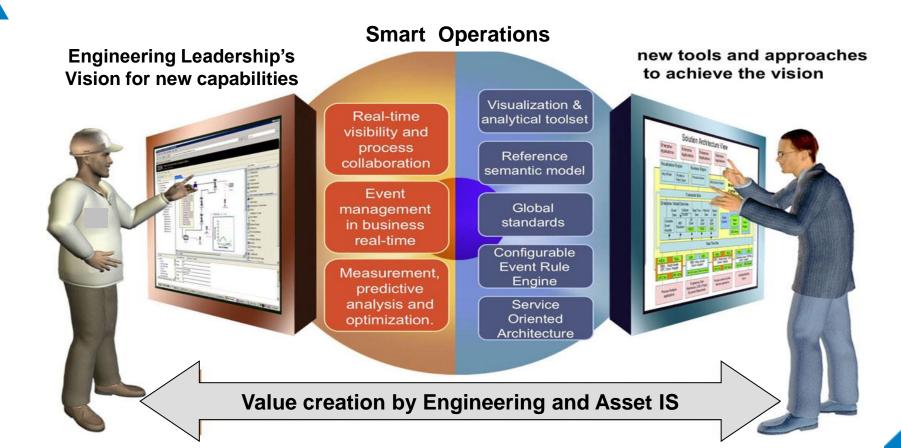
- Uncover trends, patterns from turbine errors
- Historical Analysis of Turbine performance
- Modelling and Simulation of optimal site location
   based on historic wind directions
- Comparison of actual power curves w.r.t. to OEM
   power curves

## **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

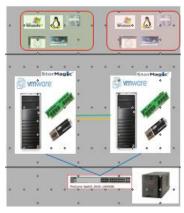
## It's all about bridging engineering know-how with Asset Information Systems



## **SmartECR an Enterprise SCADA and Information Platform**

Central - SmartECR Platform

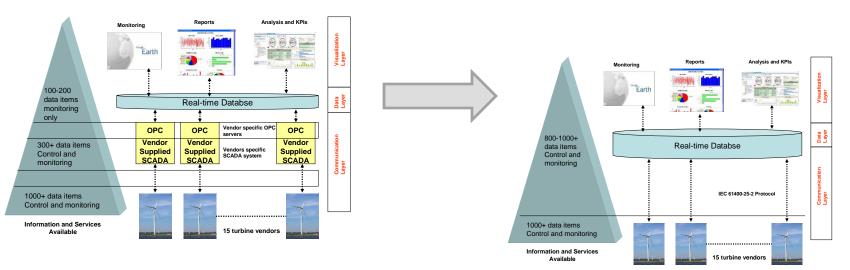
## Decentral Greenbox



#### Operations Analysta Partners Web Mobile Device Web Service Email Service FTP Export Menalization Service Presentation Services (Channel) Laver Generator Controls Workflow Engine Report Engine Analytics Dashhnar Asset Optimisation (Coonos & Java) (Cognos)-(Java) (Coonos & Java) Application Services Laver naryuos nuo (sars) Extract, BORAS SET SCADADC PEDATAH -Basisian ransfo ECRC ON FIG 112 PIOPC Server ECRSYSLOG 0.00 Data Layer Operational · Data do no fin T Rewaged Care a real ALC: NO. PI 8y stem 0e 60101 Coloradore Coloradore Erers. Uners Web Service XML FTP OPC Excel Import SOL -1144

## Simplified architecture with IEC 61400-25-2

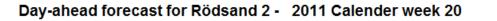
- -Standardisation → Cost reduction
- -Simplified networking → Security
- -Reduced complexity → increased reliability
- -Single data conversion per asset → accuracy and unlimited data
- -Distributed SCADA 2.0 → endless possibilites ... e.g. professional services



## 

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	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

## **Dayahead Forecasting per Turbine**



Dayahead Forecasting per Turbine         Day-ahead forecast for Rödsand 2 - 2011 Calender week 20         Developer/ responsible:       Uwe Fischer         EC&R Central Team         Quality controlt:       EC&R Nordic         Forecaste       Wind Power         Vind       Deviation (real- Power (forecast) (MW)         Forecaste       Wind Power (forecast) (MW)         Example 1       Spot production- price         Price Nordic       Imbalance production- SALES         Spot production- production- production- price       Balancing costs for over- production- production- price														
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	Quality controll:	Niels Emsholm	EC&R Nordic								L L	7 7 2.		
							Imbalance price	Balancing costs for	Balancing costs for			norna		
			Wind		Spot	production-	production-	over-	under-	Total		11/1		
Forecaste		Wind Power	Power	Deviation (real-	price	PURCHASE	SALES	productio	productio	balancing		Forecasi		
d day	Forecasted hour	(forecast) [MW]	(real) [MW]	forecast) [MW]	[€/MWh]	(EUR/MWh)	(EUR/MWh)	n [€]	n [€]	costs [€]	Accuracy	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	125,73			
	16:00:00-17:00:00	28,88	61,71	32,83	52,42	59,98	52,42		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	11,43			
	18:00:00-19:00:00	48,94	136,22	87,28	52,91	62	52,91		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	15,99			
	20:00:00-21:00:00	81,70	85,17	3,48	53,28	63,93	53,28		0,00	0,00	3,48			
	21:00:00-22:00:00	101,03	85,98	-15,05	54,84	62,7	54,84		118,31	118,31	15,05			
	22:00:00-23:00:00	113,87	87,11	-26,76	55,32	62,7	55,32		197,47	197,47	26,76			
	23:00:00-00:00:00	127,78	96,42	-31,35	53,28	62,53	53,28		290,01	290,01	31,35			
TOTAL	CW20 2011	TOTAL 13.293	TOTAL 13.565	TOTAL 271	AVERAGE 54.62	AVERAGE 58.75	AVERAGE 52.24	TOTAL 7.770	TOTAL 4.919	TOTAL 12.688	TOTAL			
TUTAL	CW20 2011	13,293	10.505	2/1	54,62	50,75	əz,24	1.110	4.919	12,000	64,28%			

#### TARGET

Balancing costs [€/MWh]:

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13

TBD

**Executive Dashboards** 

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						KP1	Overview EC8	R Global							
KPIs Wind Generation			EC&R T	otal		Americ	.a	Central Eur	ope	Iberia		Nordic		United Kin	gdom
rtfolio View	Unit	Actual	Budget	Δ abs.	۵%	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual	Budget
t Generation (Last Hour)	Givh	0.40	0.67	-0.27	-40.72	0.37	0.51	0.00	0.01	0.02	0.00	0.00	0.03	0.01	0.11
t Generation (YTD)	GWh	813.99	2,844.80	-2,030.80	-71.39	343.01	2,133.95	15.78	87.72	63.69	0.00	0.00	25.81	391.51	597.33
talled Capacity	GW	2.80	2.80	0.00	0.00	1.49	1.49	0.27	0.27	0.43	0.43	0.21	0.21	0.40	0.40
ad Factor	56	7.18	25.11	-17.93	-71.41	5.68	35.33	1.45	8.07	3.62	0.00	0.00	3.08	24.33	37.12
erage Availability	YTD %	91.29	95.10	-3.81		82.47	95.10	0.00	95.10	89.58	95.10	0.00	95.10	95.99	95.10
timated Revenue	•	12.50	0.00	12.50		10.45	0.00	0.00	0.00	1.21	0.00	0.00	0.00	0.84	0.00
M Costs/MWh	YTD C	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BM Costs/MW	YTD C														
at Revenue	YTD €	169,153.76				330.95		0.00		0.00		0.00		168,822.81	
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Global

ECBR: America 658.66 MW / 44.08 % CONTRACTOR OF KPI Overview EC&R Region Net Generation Installed Capa... Load Factor Average Availability (VTD %) O&M Cost (YTD €) Lost Revenue (vTD €) MTBF (VTD Days) MTTR (VTD Days) KPIs Wind Generation Last Hour (MWI (%) (10) Ste Budget A A% Actual Actual Actual Actual Actual (ctus) Actual Actual Budget Actual Champion 77.65 40.79 36.66 90.36 126.50 8.59 32.53 95.10 2.18 0.00 0.00 0.01 0.68 8.77 0.30 Forest Creek 0.00 45.30 -45.30 -100.00 124.20 . 30.53 B5.10 0.00 0.00 6.57 Inadale - Phase 67.25 59.64 7.61 12.76 151.00 9.75 0.00 95.10 1.89 0.00 0.00 0.00 0.00 7.92 -1.50 -18.94 34.50 99.95 **95.10** 0.18 0.00 0.00 0.00 0.00 Munnevile 6.42 16.06 0.00 65.93 142.50 1.85 0.00 Panther Creek - Phase I 65.93 8.76 99.99 95.10 0.00 198.10 0.00 Panther Creek - Phase I 63.38 90.66 -27.27 -30.08 115.50 11.31 \$5.10 1.78 0.00 112.96 0.00 0.00 99.95 -6.29 70.87 -77.13 -108.83 199.50 2.22 99.99 95.10 -0.18 0.00 0.00 0.00 0.00 Panther Creek - Phase II Pyron 57.48 85.17 -27.68 -32.50 249.00 5.26 99.95 95.10 1.61 0.00 7.32 0.00 0.00 Roscoe 68.70 -28.26 -41.14 209.00 5.1 96.75 95.10 1.13 0.00 0.00 0.00 0.00 40.44 Sand Bluff 0.00 32.91 -32.91 -100.00 90.00 0 0.00 95.10 0.00 0.00 0.00 0.00 0.00 52.50 0.00 0.00 0.00 5.79 0.00 Stony Creek 0.00 11.63 -11.63 -100.00 95.10 0.00 YTD Generation Overview EC&R Key Issues and Achie Region Issues 07 Region Issues 08 Region Issues 09 Region Issues 10 Region Issues 11 Split of Downtime (Day) Feb Mar Apr May Jul Aug Gate Jan Feb Jun Sep Ort 📕 Others 'inc curtailment' 📒 Planned Maintenance 📘 Unplanned Maintenance G Internet 14 - 1 100%

Regional

## SmartECR recognizes loss production & notifies operator

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## **Mobile Device based Dashboard**

## Blackberry

Personalitaria	_					
	a	Prod (MW)	Load (%)	(MW)	Turbines	Stopped
		873.9	31.0	2803.0		
	/	669.9	45.0	1494.2	938	0
	urope	8.5 11.9	3.0 3.0	268.8 434.9	143 417	0
		50.3	24.0	207.0	90	0
	United Kingdom		33.0	398.1	271	1
	Childed Kingdon.	155.5	55.0	576.1	2/1	-
		Prođ (MW)	Load (%)	Cap (MW)	Unit #	Stopped Unit #
	Solar Total					
	France (PV)					
	Italy (PV)					
	Spain (CSP)					
	US (PV)					
	ECR Portfolio	1		scription		
	Turbines	2713			Production	
	Sites	131			oad as a pei Fotal capaci	
	Capacity (MW)	3042			Number of t	
			Sto	pped WTO	# = Numbe	r of
					J ber of units	
			Sto		# = Number	of
	L					

### Android Tab



## Weekly PDF Report by Email

61

30

United

Kingdom

43

Nordic

21

Region

Italy

Iberia

60

40

20

0

America

Central

Europe

#### EC&R Global Operation Weekly Report

	Weekly (from 02.02.2011 to 09.02.2011)													
Region	Installed Capacity Actual [MW]	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



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America

Central

Europe

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64

Nordic

10

Region

Italy

Iberia

38 35

United

Kingdom



## Monthly Report HSSE Report

#### EC&R HSSE Monthly Report

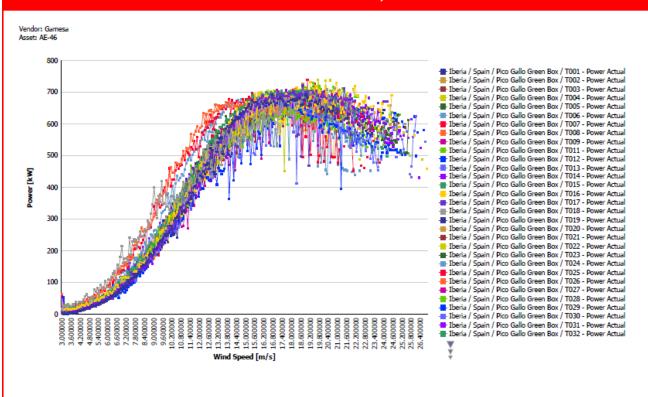
Reported by:	EC&R UK 2010 September Bradford Ga	-													
Provider Type	Hours Worked	Lost Days	Fatal Incidents	Fatalities	Lost Time Incidents	Restricted Work Cases	Treat	dical tment ises	First A Case	s	Environ- mental Incidents	Property Or Business Continuity Damage	Harm To Business Reputation	Near 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)			0	Fat	alities 's			Provi Typ		L	TIF	TRIF	LTISR		
			0		tricted Work		E	Employ	ees		0.00	0.00	0.00		
			0		lical Treatm	ent Cases	C	Contrac	tors		0.00	0.00			
			5 22		t Aid Cases Ir-misses		C	Combin	ed		0.00				
Incident Severit (combined)	ty		0	Sev	erity stage 3 erity stage 2			Incid Serve	erity			Property Or Business Continuity Damage	Harm To The Environ- ment	Harm To Business Reputation	Security
			0	Sev	erity stage 1	L		3			0	0	0	0	0
								2			0	0	0	0	0
								1			0	0	0	0	0
Potential Severi (combined)	ity		0		erity stage 3 erity stage 2			Poter Serve			rm To eople	Property Or Business Continuity Damage	Harm To The Environ- ment	Harm To Business Reputation	Security
			0	Sov	erity stage 1			3			0	0	0	0	0
			Ŭ	Jev	ency stage i			2			0	0	0	0	0
								1			0	0	0	0	0
							-				· · ·				• • •

Dec 20, 2010

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5:11:17 PM

## **Real Power Curves**



EC&R Power Curve Actual by Vendor

## **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

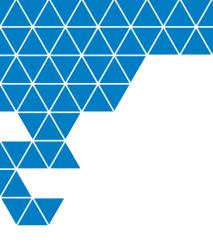


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# Thank you

