Let's climb the performance ladder to the top

Next Generation SCADA
Ensuring the real-time monitoring and control of rapidly growing Portfolio of Renewable Assets

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E.ON Climate&Renewables GmbH

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Consistent strategy to
industrialize
renewables

From 400 to
4,800 MW

865
colleagues

Pioneer
in Offshore Wind
Global #3

Global #8
in Onshore Wind

From "an experiment" to
"a pillar of E.ON's future"

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EC&R currently operates a geographically balanced portfolio of more than 4.2 GW renewables capacity in Europe and North America

North America
2,221 MW

Portland

San Francisco

Denver

Chicago

Austin

Roscoe
Onshore
782 MW

Steven's
Croft
Biomass
43 MW

alpha ventus
Offshore
60 MW [1]

Nordic
254 MW

Rødsand II
Offshore
207 MW

Malmö

UK
451 MW

Coventry

Hamburg   Szczecin

Düsseldorf

Poland
86 MW

Germany
198 MW

Paris

Munich

France
94 MW

Milan

Italy
370 MW

La Ciotat

Rome

Iberia
516 MW

Lisbon   Madrid

Helioenergy
CSP
2x50MW [2]

Brigadel
PV
8 MW

Headquarter
Office location
Example project

Singapore
United Arab Emirates

Key facts

- Assets with 4,190 MW total capacity
- 10.2 TWh electricity produced in 2011, equivalent to demand of ~2.6m homes
- Global #8 in onshore wind
- Global #3 in offshore wind
- Present in 11 countries
- 804 employees, 36 nationalities

1   JV of EC&R (26.25%), EWE (47.5%) and Vattenfall (26.25%)
2   JV of EC&R (50%) and Abengoa Solar (50%), fully operational as of January 2012
Note   Figures as of 31 December 2011 unless stated otherwise; rounded
         Includes 53 MW PV capacity in operation in France and Italy
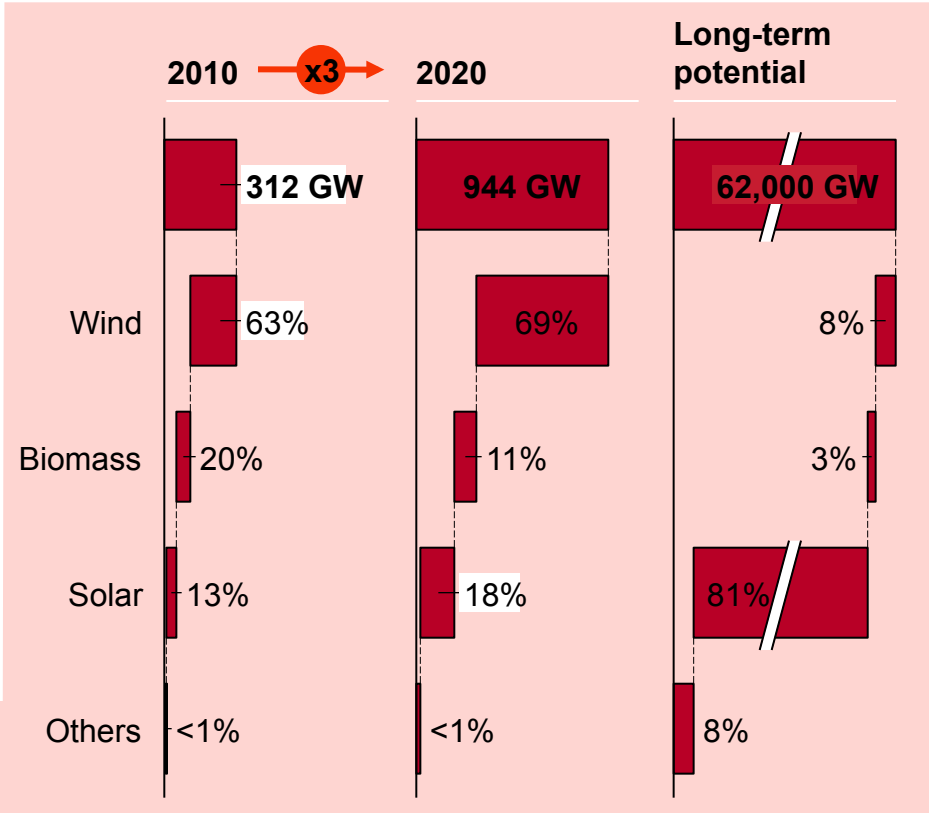   Exemplary projects to showcase each technology in EC&R portfolio.

3

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Renewables have significant worldwide potential:
Installed capacity is expected to again grow 3-fold by 2020
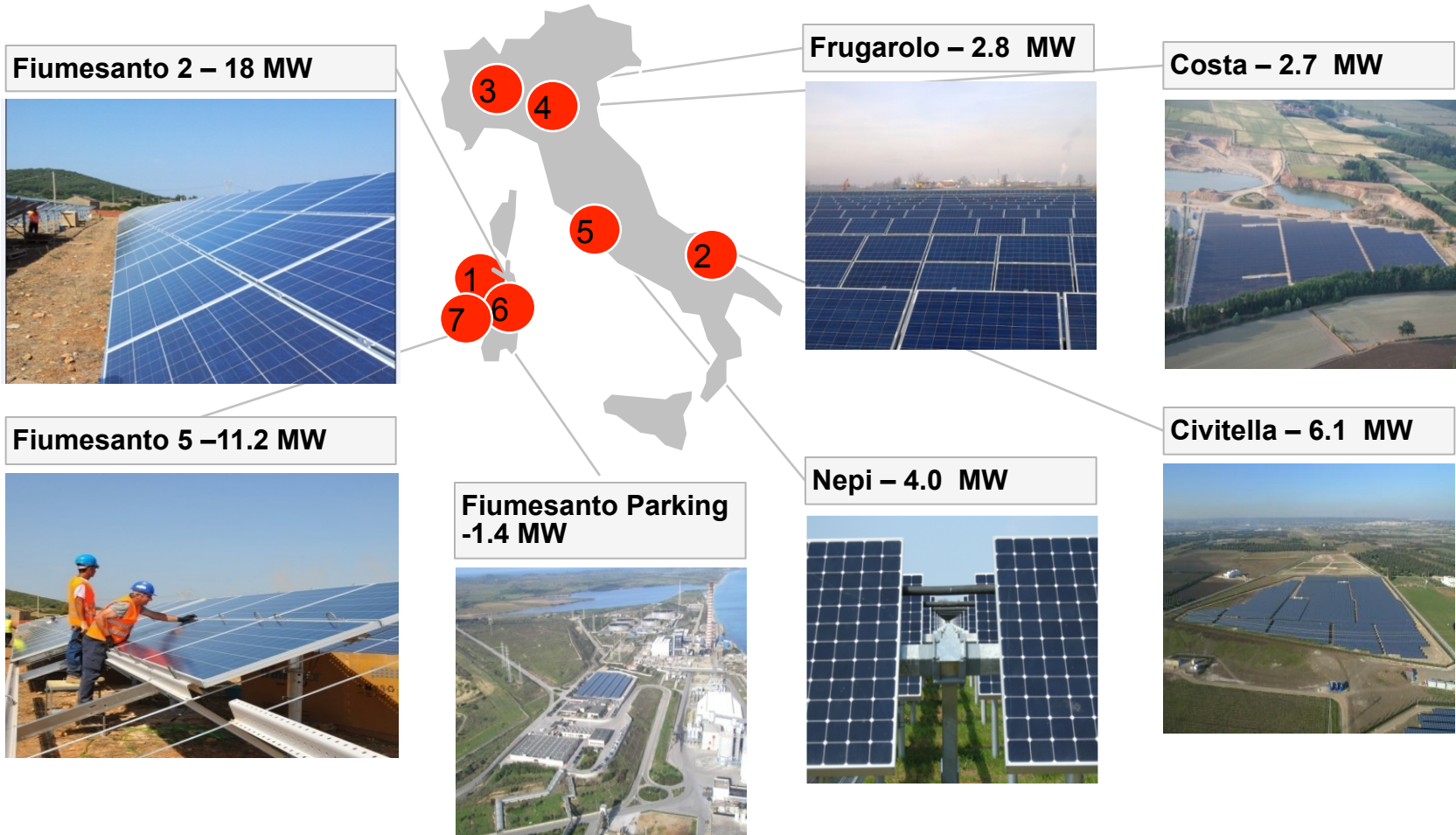
Global generation capacity

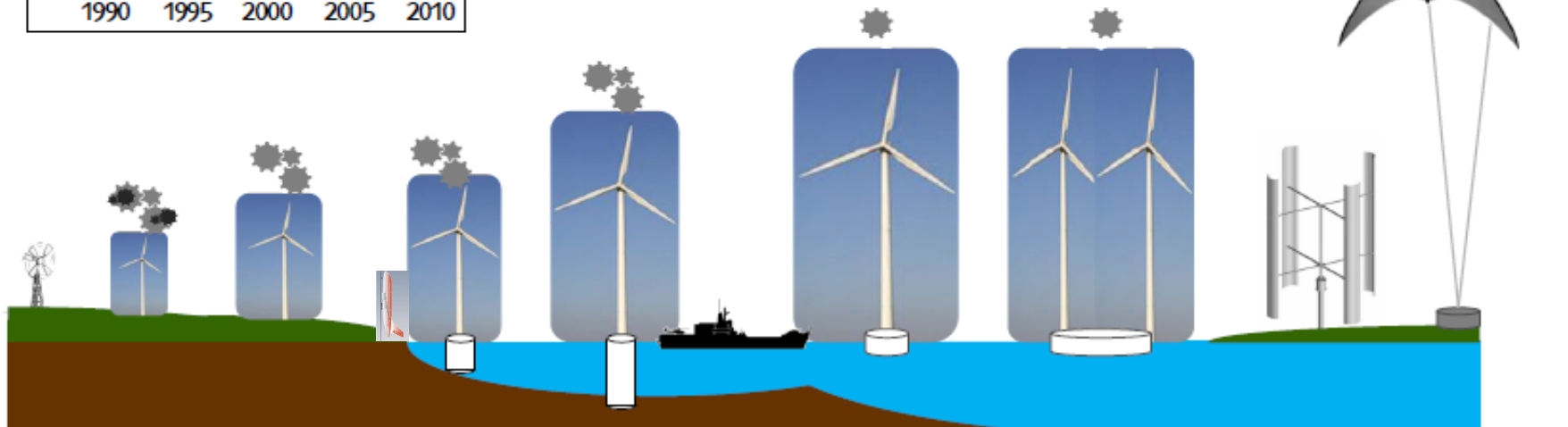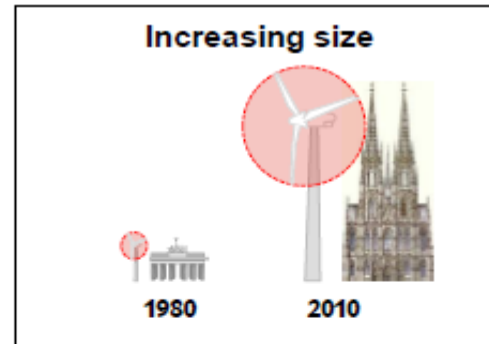|	2010	2020
	4,900 GW	**6,800 GW**
Oil	8%	5%
Coal	32%	29%
Gas	26%	25%
Nuclear	8%	7%
Hydro	18%	19%
Renewables	7%	14%
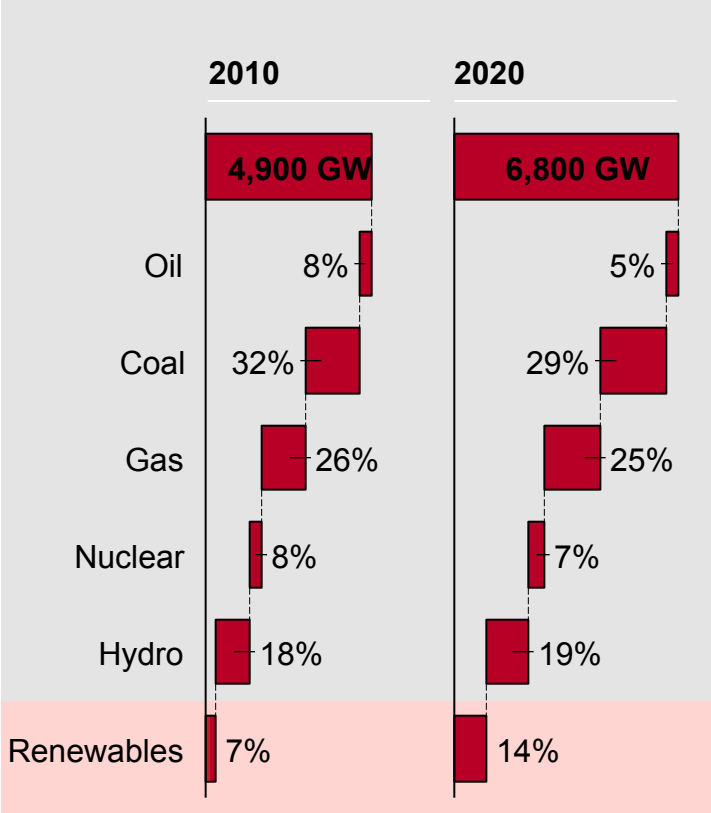
Global renewables capacity

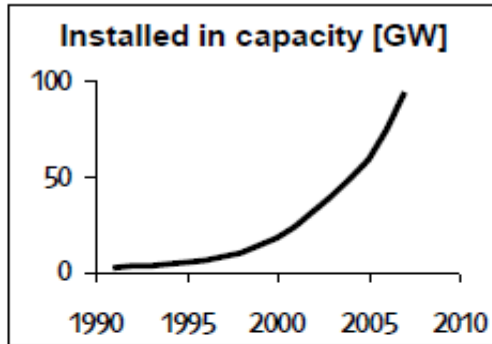|	2010 ×3	2020	Long-term potential
	312 GW	**944 GW**	**62,000 GW**
Wind	63%	69%	8%
Biomass	20%	11%	3%
Solar	13%	18%	81%
Others	<1%	<1%	8%

Sources BNEF, IHS Emerging Energy Research (July 2011 Base Case), World Energy Council

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In Italy, 7 parks with a total capacity of ~46 MW were commissioned within only 1.5 years … but NA will

Fiumesanto 2 – 18 MW

Frugarolo – 2.8 MW

Costa – 2.7 MW

Fiumesanto 5 –11.2 MW

Fiumesanto Parking -1.4 MW

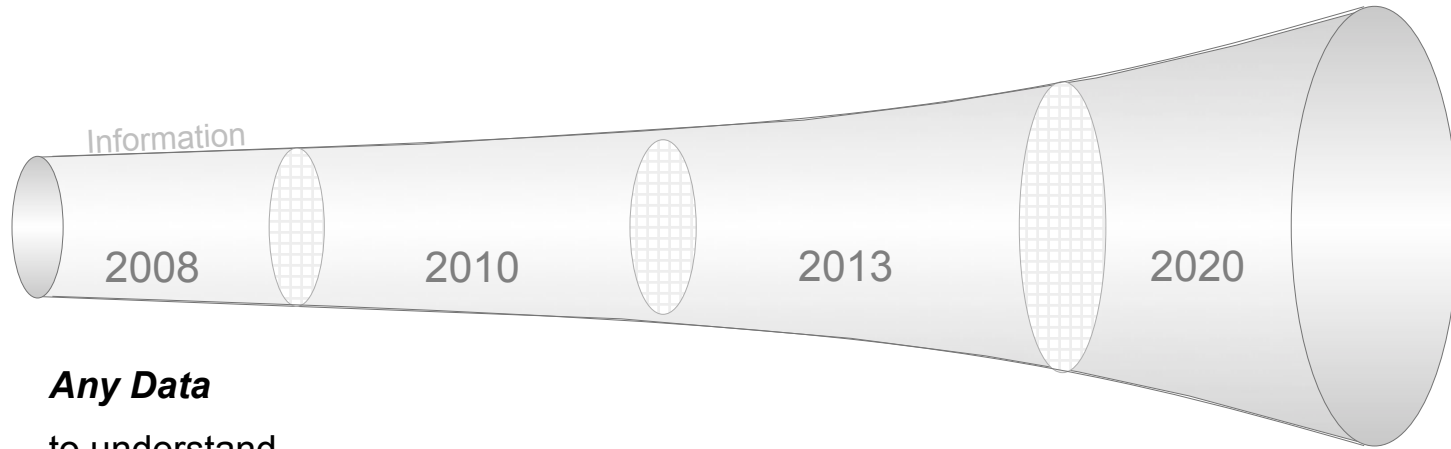**Nepi – 4.0 MW**

Civitella – 6.1 MW

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Global Wind Market: A rapid evolution

From now to 2020 every 25 minutes 1 wind turbine needs to be erected

Evolving challenges in the SCADA Architecure

Time

Information

2008   2010   2013   2020

Scope

Any Data
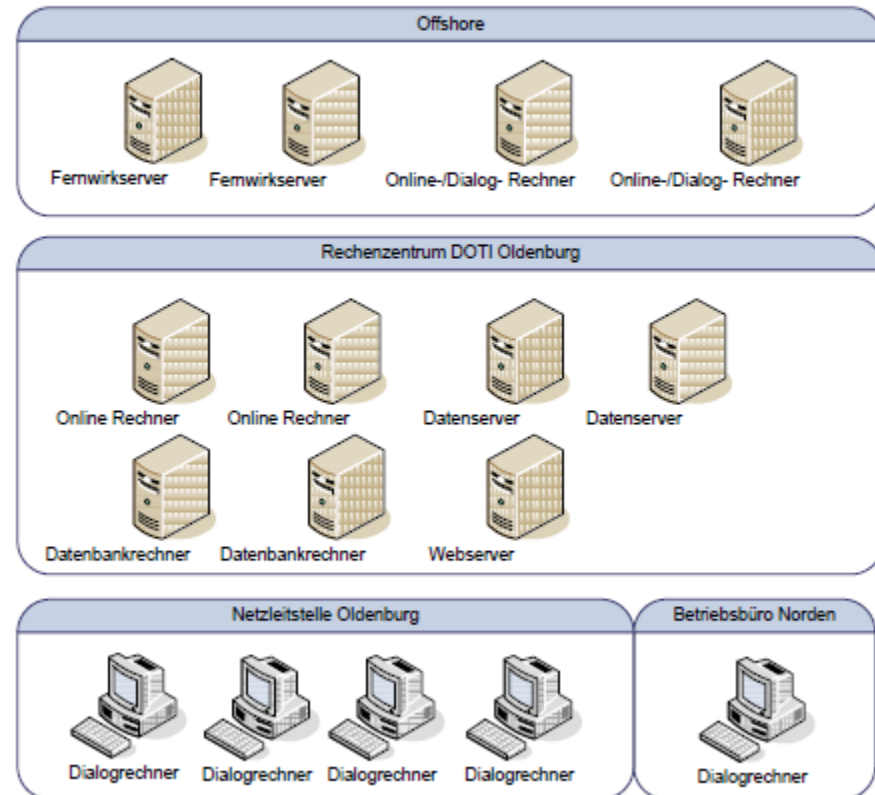
to understand

and build

Business

medium
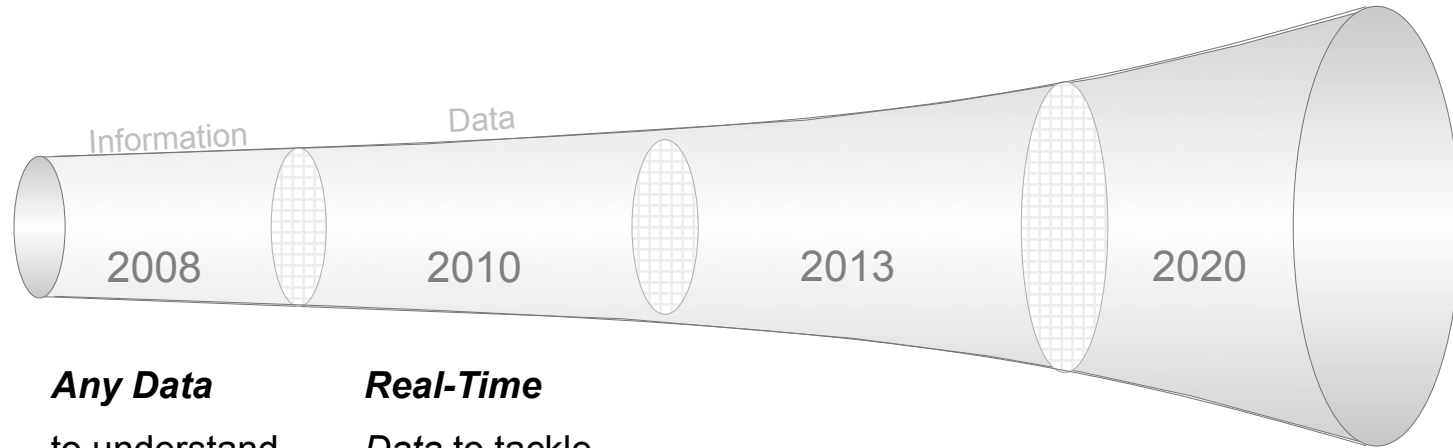
OPC, USB, email …

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System Landscape for 12 Windturbines in 2008

Each Windpark was built autark and enabled to perform the local required operation.

- Data Collection
- Reporting
- Data Visualisation

Evolving challenges in the SCADA Architecure

Time

Information   Data

2008   2010   2013   2020

Scope

Any Data
to understand
and build
Business

Real-Time
Data to tackle
performance
Yields and to
Steer

medium

Paper, email …   OPC, IEC…

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Interface and Naming Standardisation …IEC 61400-25

2011, first implementation in a productive live environment

REpower Systems

REguard Interface B IEC 61400-25

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OSIsoft

5 Wind Energy Converters

1 Meteo Station

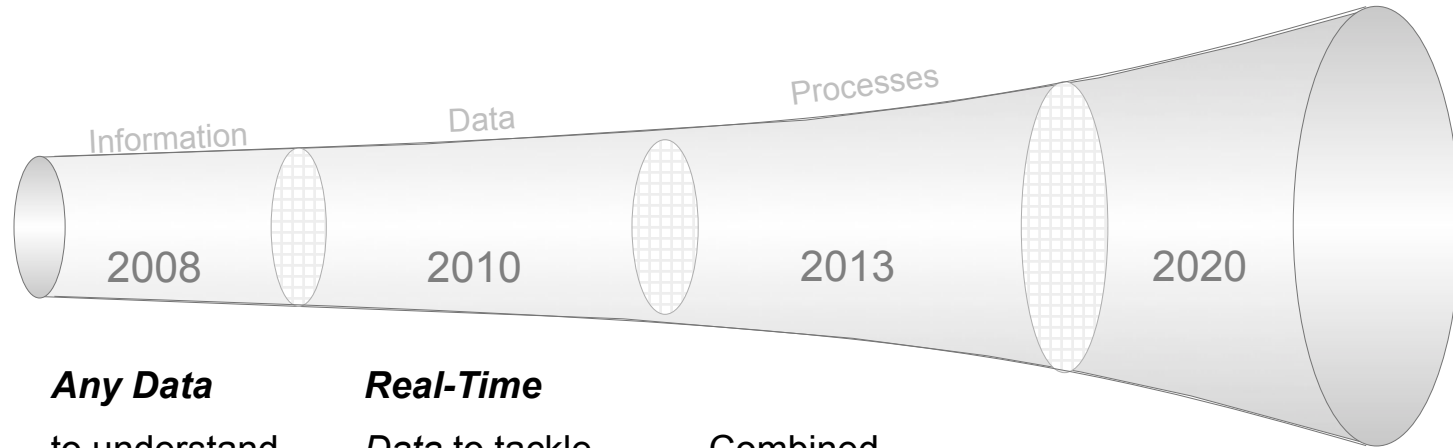**1 Power Management Unit**

100% pure

IEC 61400-25

MMS

100%

satisfied customer

"As one of the world's leading operators of wind turbines, we were interested in obtaining practical experience with the IEC standard as soon as possible", commented Uwe Fischer, Head of Asset Information Systems at E.ON Climate & Renewables. "Thanks to the collaboration*, we found that the interface meets the requirements of even major operators* ..."

(http://offshorenieuws.nl/2011/09/20/repower-develops-system-to-harmonise-wind-farm-management-systems/)

Evolving challenges in the SCADA Architecure

Time

Information   Data   Processes

2008   2010   2013   2020

Scope

Any Data	*Real-Time*	Combined
to understand	*Data* to tackle	*bidirectional*
and build	performance	*Real-Time*
Business	Yields and to	Data to predict
	Steer	Power, Failures
		and allow Control

medium

Paper, email …   OPC, IEC…   OPC, SOAP ….
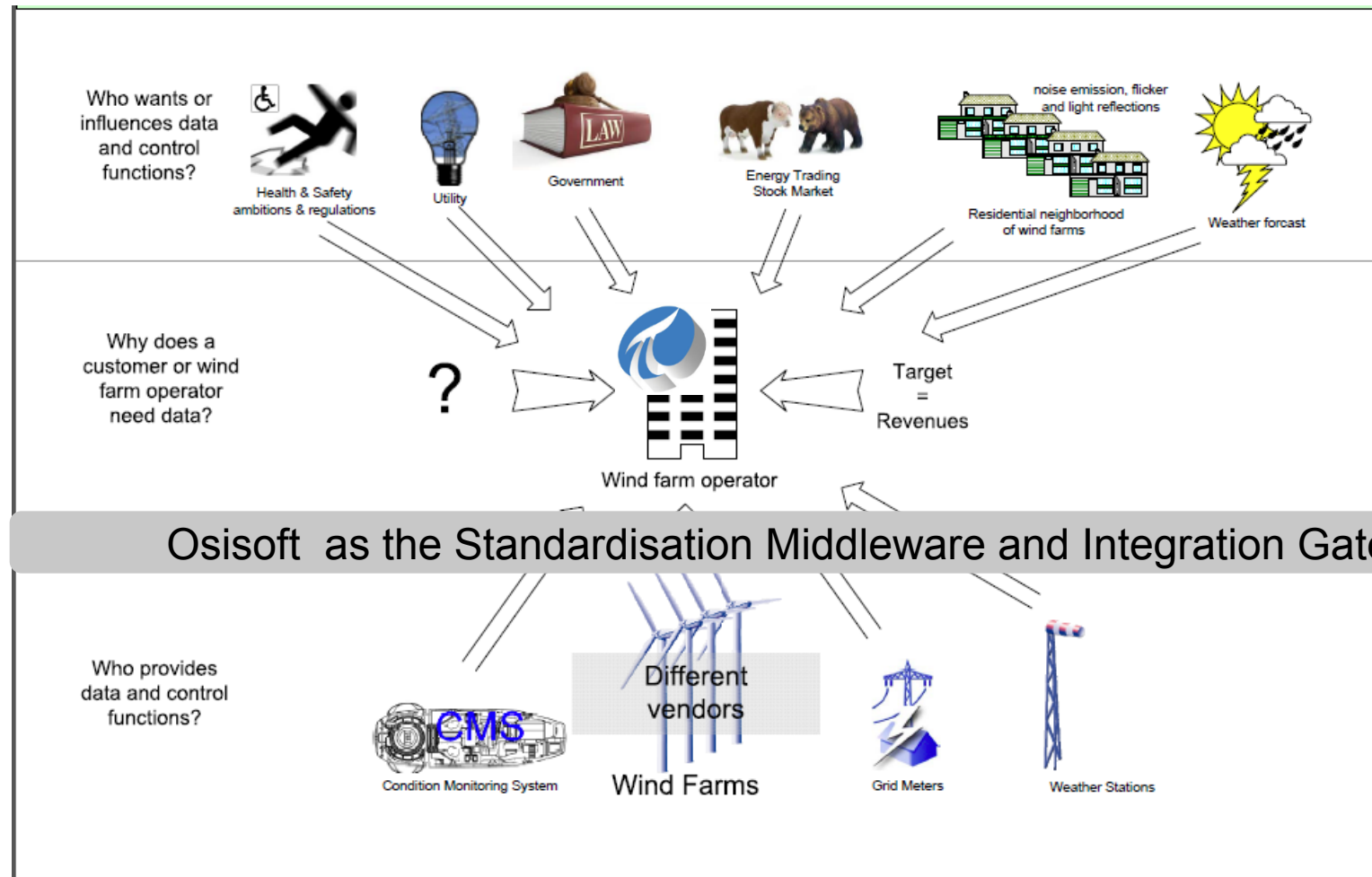
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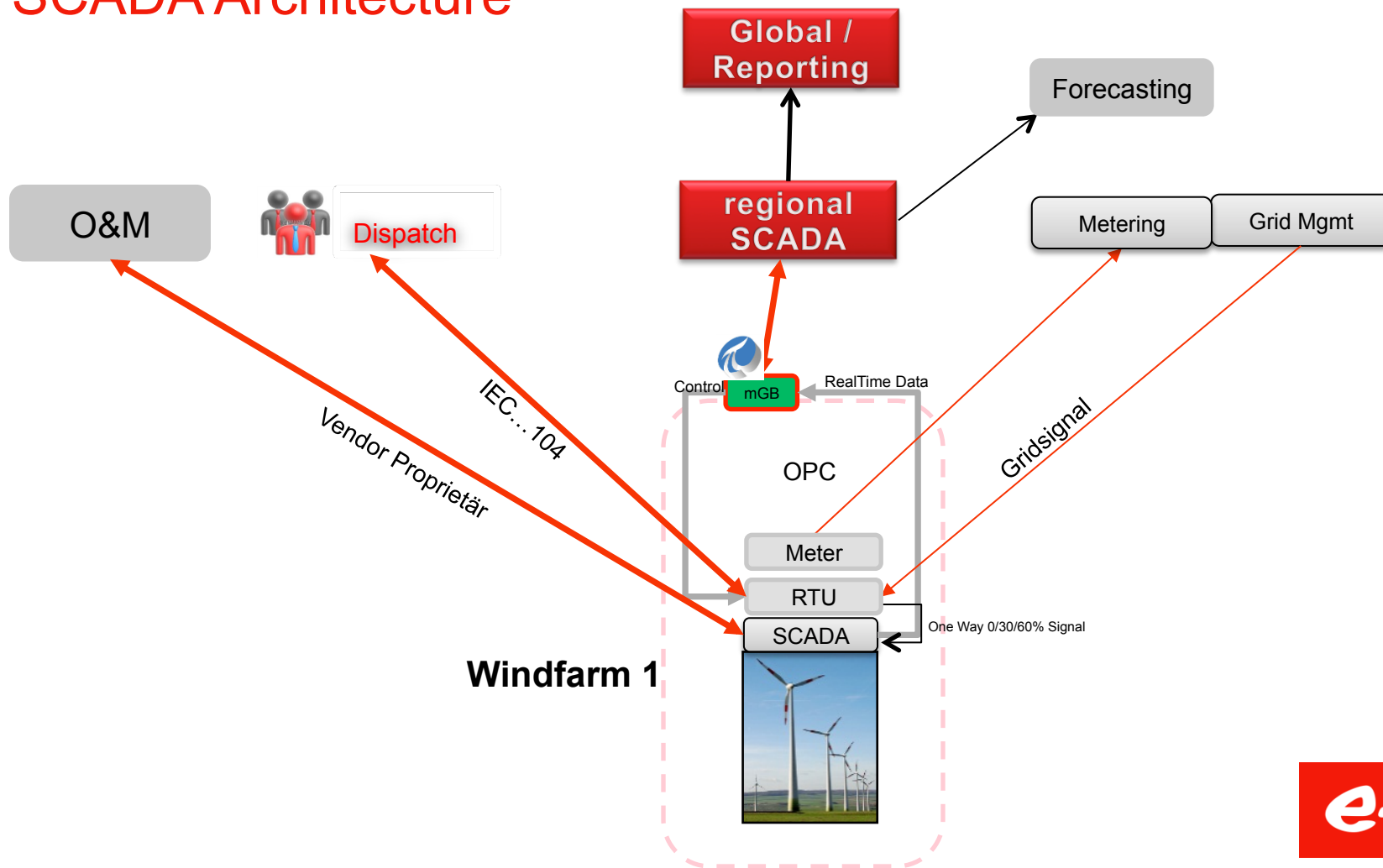# A Windfarm Operator is faced with different requests from various stakeholders and needs customized info's

Multi Tier – Multi System
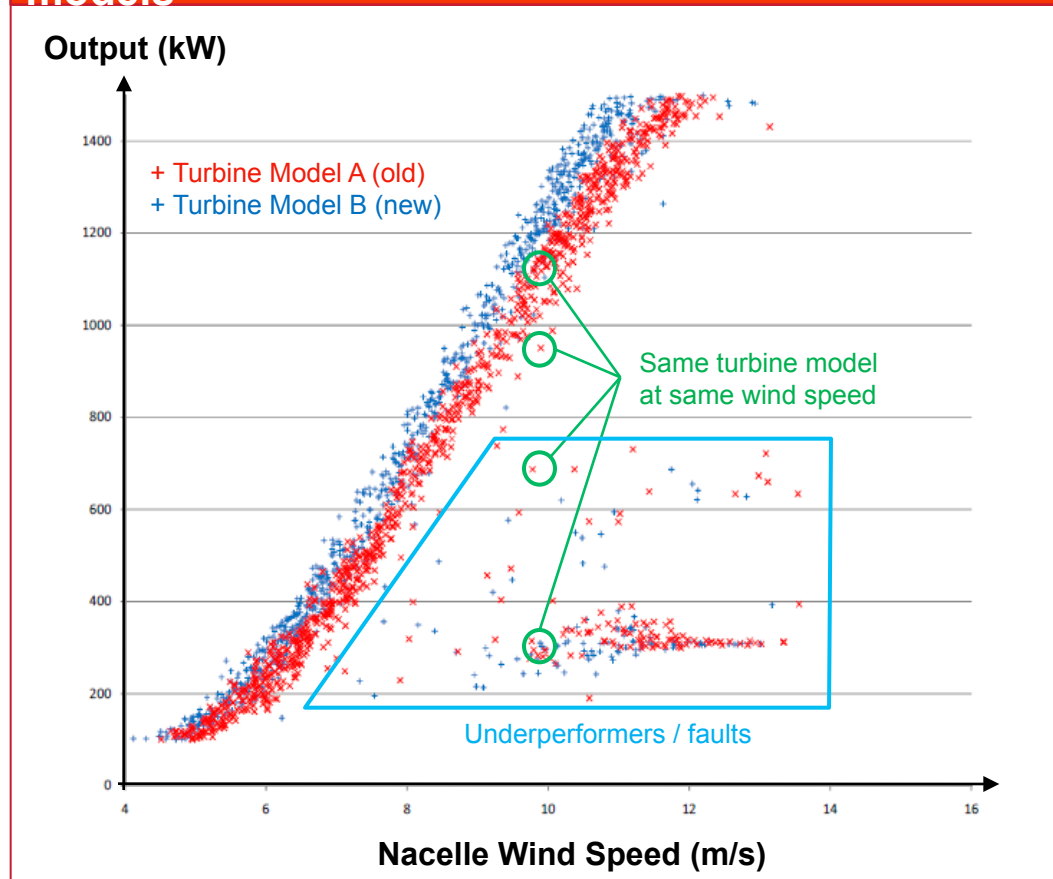# SCADA Architecture

= Control

= Information

mGB = miniGreenbox

Global / Reporting

Forecasting

regional SCADA

O&M

Dispatch

Metering

Grid Mgmt

Control   mGB   RealTime Data

IEC...104

Vendor Proprietär

OPC

Gridsignal

Meter

RTU

SCADA

One Way 0/30/60% Signal

Windfarm 1

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At 98% availability the challenge is to find the next challenge

Performance of two wind turbine generator models

Output (kW)

+ Turbine Model A (old)
+ Turbine Model B (new)

Same turbine model at same wind speed

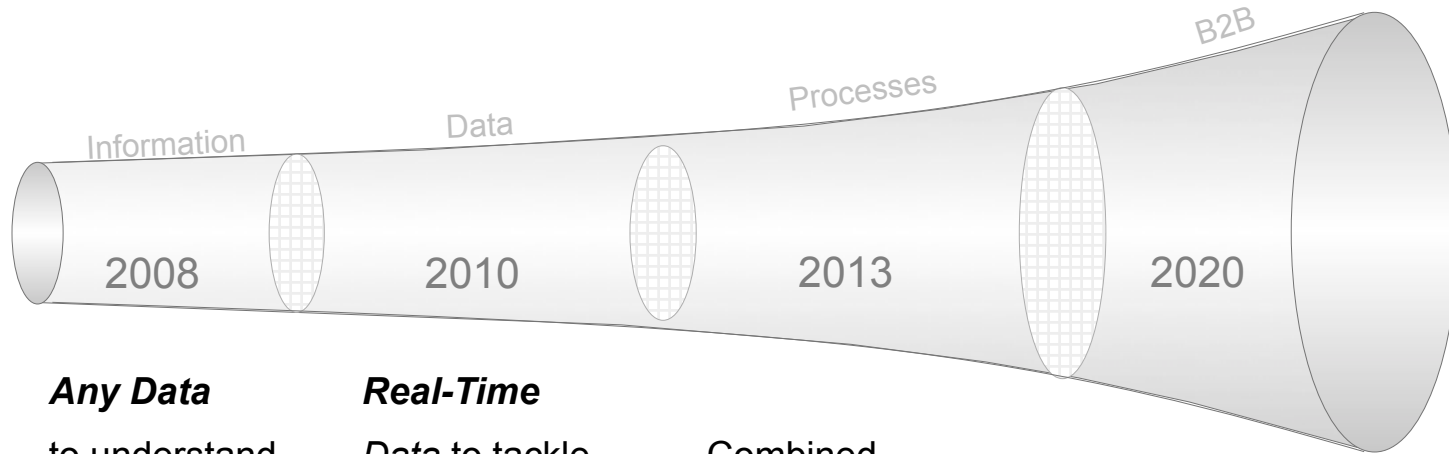Underperformers / faults

Nacelle Wind Speed (m/s)

Challenge

Improving turbine underperformance:

- 15–30% difference in output at same wind speed
- 5–10 times the potential of improved availability

Evolving challenges in the SCADA Architecure

Time

Information	Data	Processes	B2B
2008	2010	2013	2020

Scope

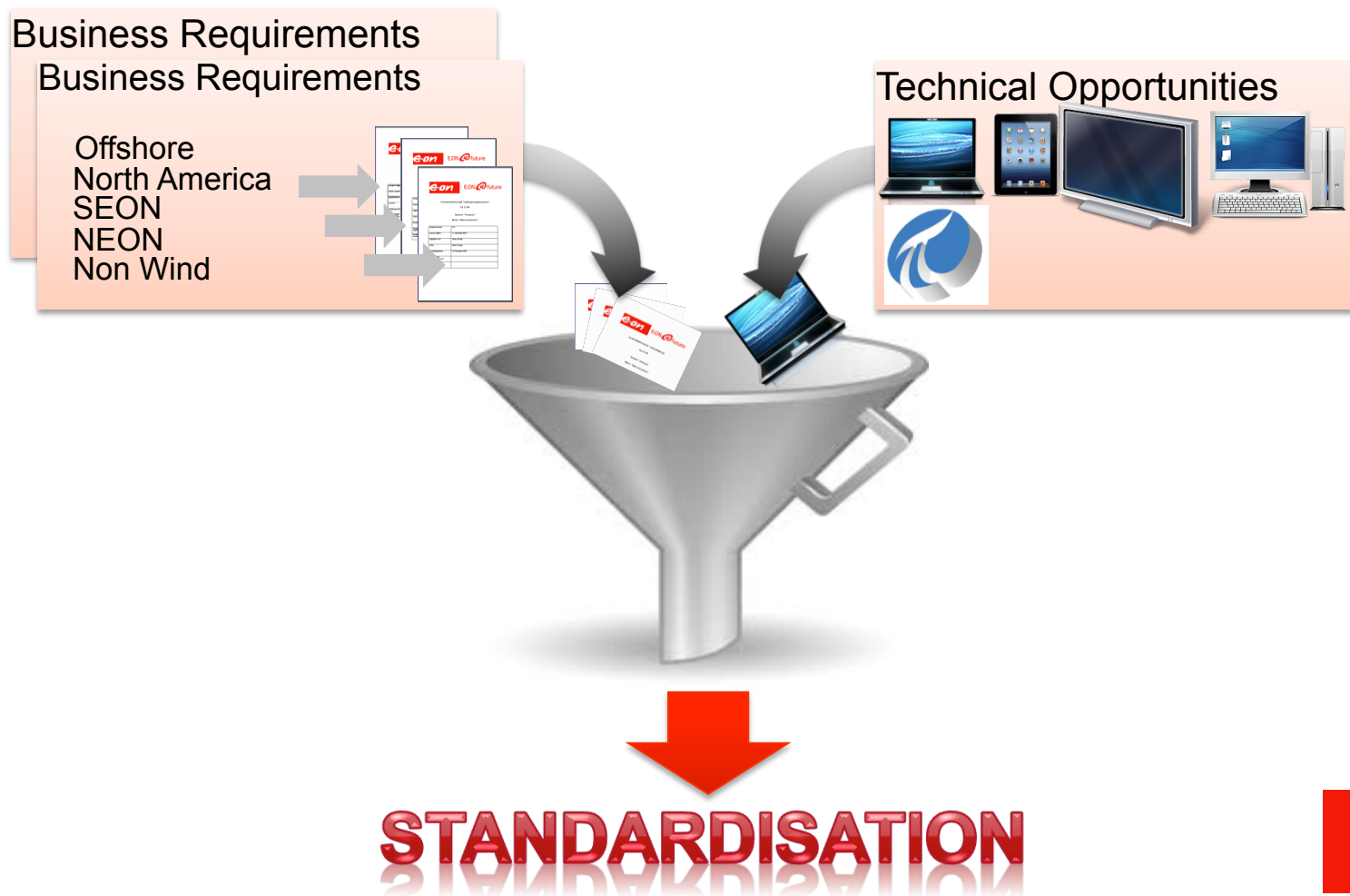| *Any Data* to understand and build Business | *Real-Time* *Data* to tackle performance Yields and to Steer | Combined *bidirectional* *Real-Time* Data to predict Power, Failures and allow Control | Automated, Integrated, *Control Data Exchange* And distributed Data handling to enable the SmartWorld and intercompany Interaction |

medium

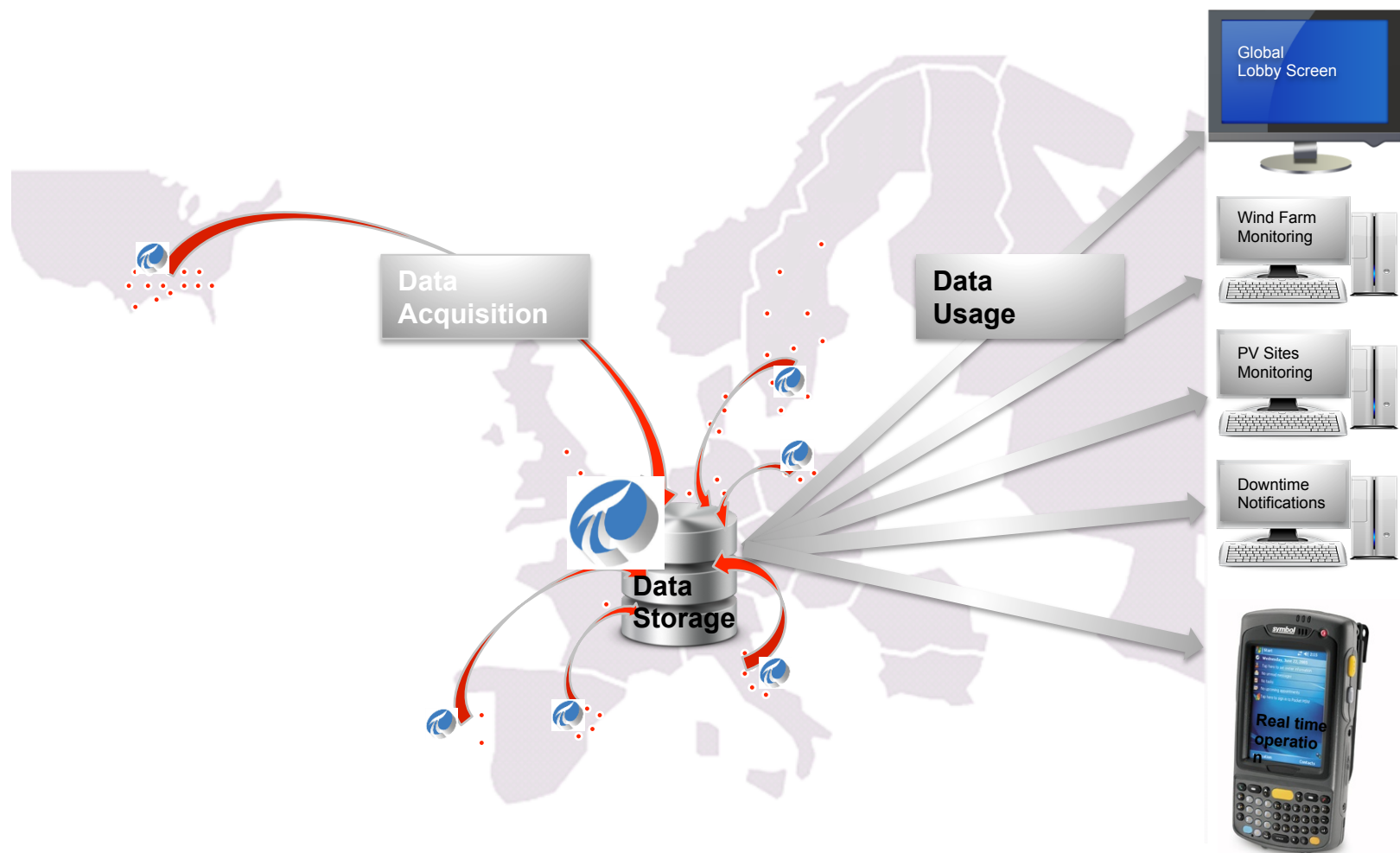| Paper, email … | OPC, IEC… | OPC, SOAP …. | Osisoft PI, B2B Integration (SOAP… |

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To develop standardized fleet-wide solutions we combine business requirements with technical capabilities
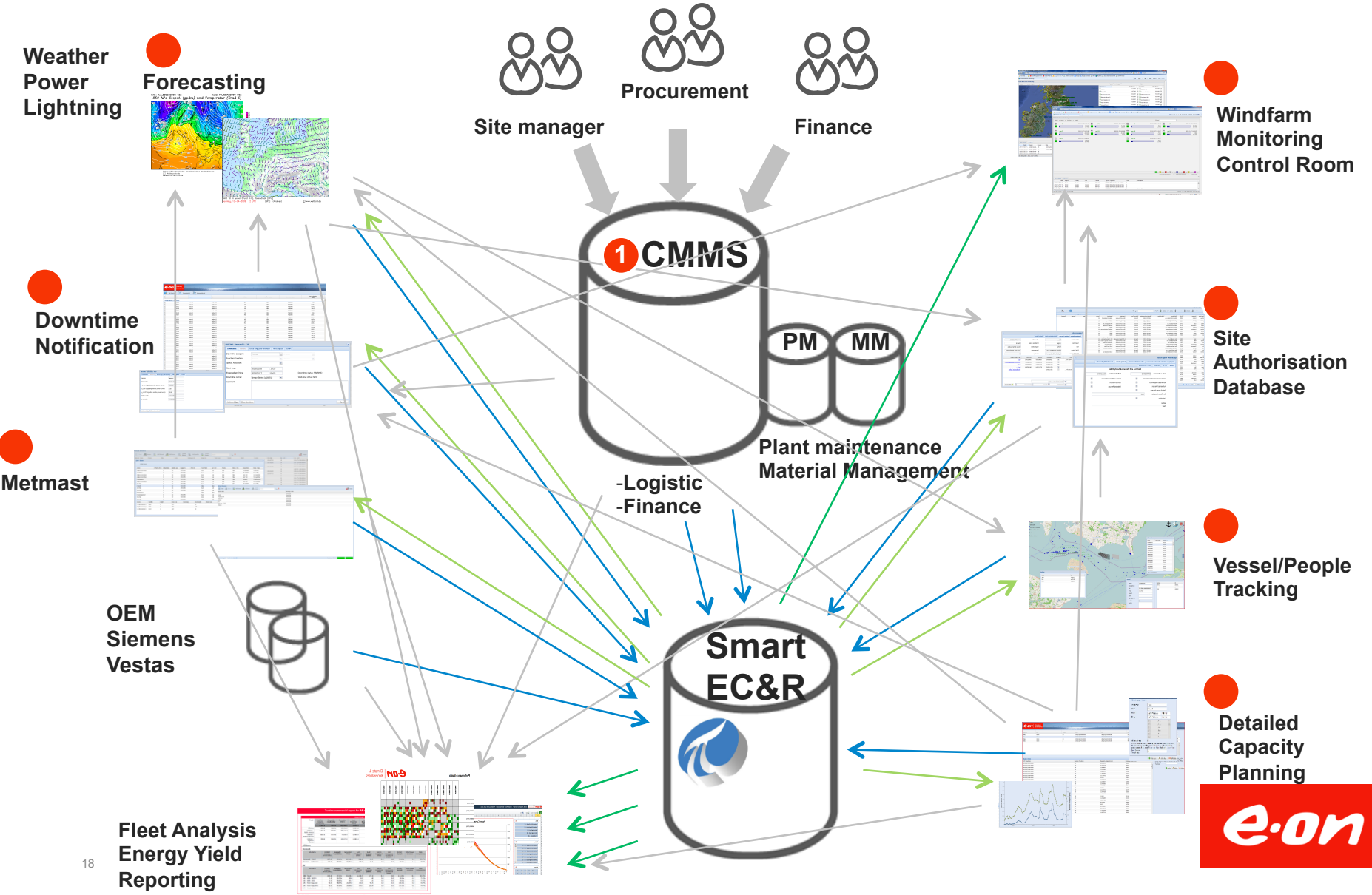
Business Requirements

Business Requirements

Offshore
North America
SEON
NEON
Non Wind

Technical Opportunities

STANDARDISATION

One Tier SCADA Architecture

Data Acquisition

Data Usage

Global Lobby Screen

Wind Farm Monitoring

PV Sites Monitoring

Downtime Notifications

Data Storage

Real time operation

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Multi HMI's and Single Data Base - Interaction of Tools

Weather
Power
Lightning

Forecasting

Site manager

Procurement

Finance

Windfarm
Monitoring
Control Room

Downtime
Notification

Metmast

CMMS

PM   MM

Plant maintenance
Material Management

-Logistic
-Finance

Site
Authorisation
Database

OEM
Siemens
Vestas

Smart
EC&R

Vessel/People
Tracking

Detailed
Capacity
Planning

Fleet Analysis
Energy Yield
Reporting

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SCADA: Technical, monitoring and automation standards

Boutique

- Standards from 15 years ago, based on stand-alone turbines

- Proprietary interfaces and monitoring systems

- Local/regional monitoring only

- No real-time overview

- Separate systems for monitoring, O&M, weather forecasts,…

- System integration on user level – no interaction between systems

- Cyber Security is not known

Industrial

- Systemic view required to realize benefits of large-scale deployment

- IEC[1] Standards
  - IEC 61850: Design of electrical substation automation
  - IEC 61400-25: Monitoring and control of wind power farms

- SCADA[2]: Integration on data level, single Business Process Database

- Comprehensive, global real-time monitoring and process control

- Renewables are part of Critical Infrastructure and appropriate measures are mandantory

Real Time Data is the currency of the future,   **osisfoft conference theme**

**linked Multi Source Real Time Data (Production,Grid, Trading)
 is the differentiator ...**

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[1] International Electrotechnical Commission [2] Supervisory Control And Data Acquisition

Scope of EC&R's multi Dimension SCADA ➜ **SmartECR**

- **Extensively standardized** Systems for all decentral SCADA Assets
  (~200 independent Data Feed from Wind, Biomass, CSP and PV Assets)

- **Single Datacenter** and centralized Security Management
  (24/7 support from European and American staff)

- **Single Real Time Database** sized for ~1.000.000 Datapoints per second
  (hourly Data Cleaning, Export and Reporting to enhance speed)

- Data Exchange Infrastructure **with all** state of the art **capabilitie**s
  (hourly exchange of Production and 72h Forecast Data with Trading and external service providers)

- **In-house Application Development** to gain the value from the Data and the Engineering and Operation expertise
  (Business Process specific Screens and Tools as a competitive advantage)

**SmartECR: customized global Business Processes
on a central PI Data Foundation**

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Questions

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