ALSTOM Grid

Solutions for Development and Integration of Smart Grids

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Complete Offering in Clean Energy & Transportation Infrastructures

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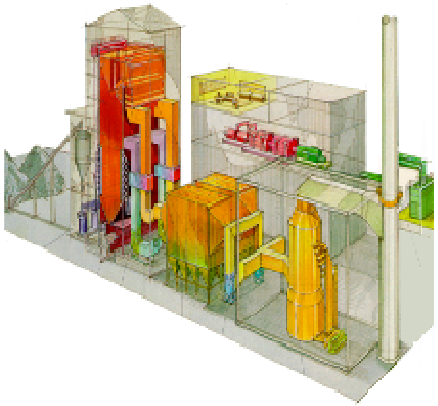


Products & Services

Power

- Nuclear, thermal & Renewable
- Carbon Capture & Storage
- Automation

Grid

- HVDC
- Network management
- Substations

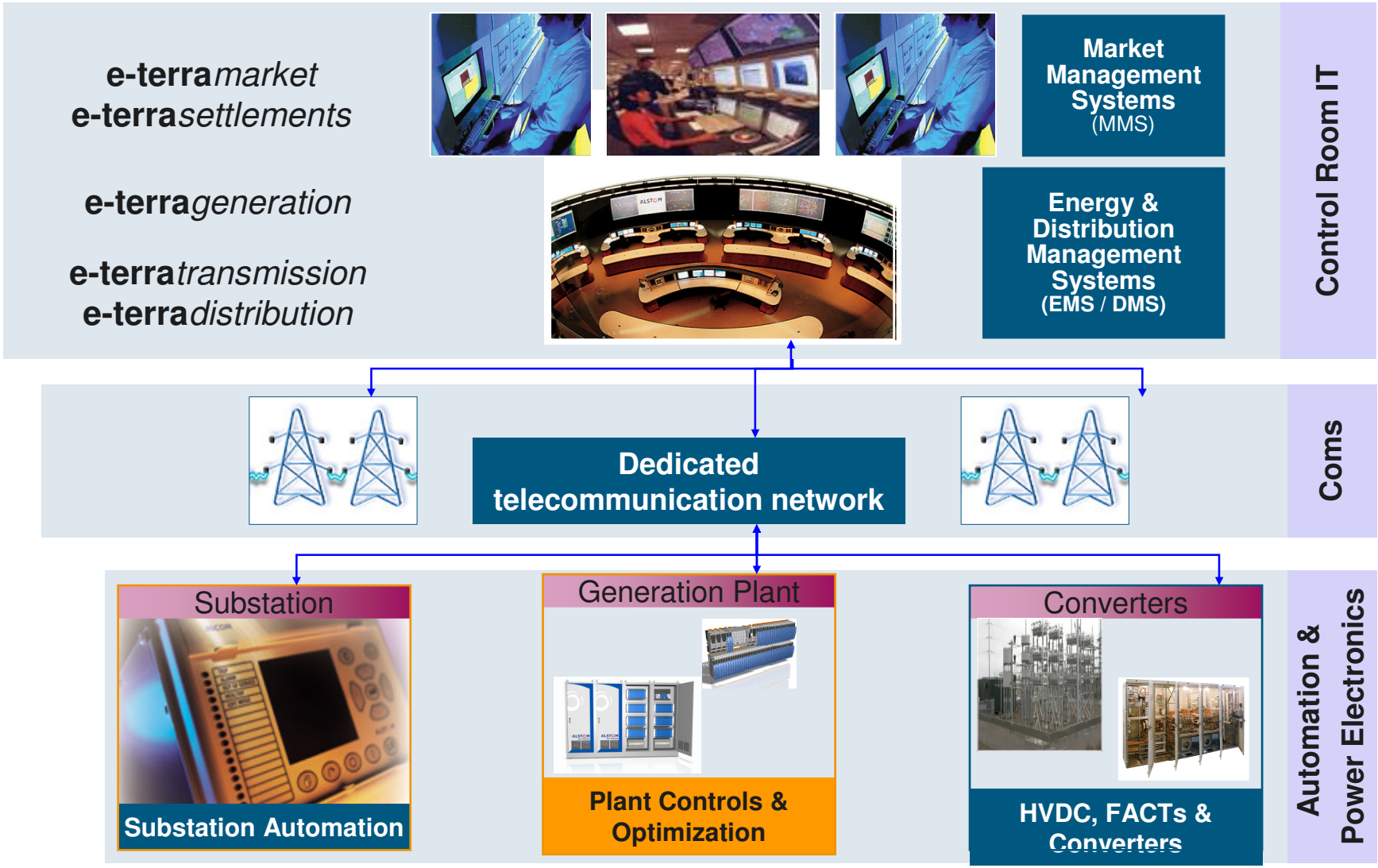
Transport

- Rolling Stock
- Infrastructure & systems
- Systems & Services

Transversal Technologies

- Power Electronic Converters
- Automation & Embedded Controls
- Energy & Asset Management Software

ALSTOM Smart Grid Critical Technologies



Alstom Grid's technologies and solutions are at the heart of the Smart & Super Grid

Alstom Grid is N°1 leader in Network Management Solutions

New applications deployed for Smart Grid network management

On-line stability

Renewable integration

Integrated DMS

Eco-Cities

Electric Utility Evolution

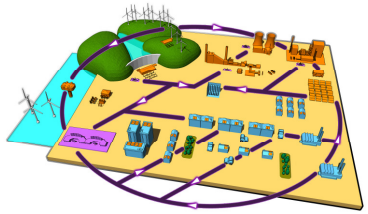
Classic

- Vertically integrated
- Cost-based operation
- Physical infrastructure

Competition

- Open grid access
- Genco divestiture
- Wholesale electric mrkt

Smart-Grid



- Distributed intelligence
- Customer choices
- New energy eco-system
- Micro-grid

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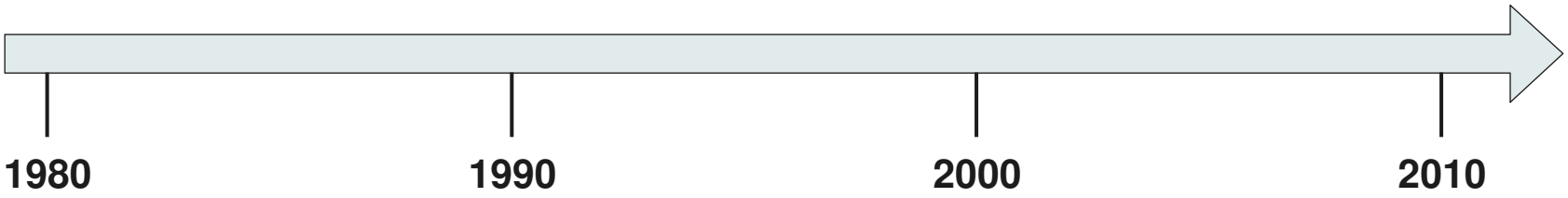

SmartGrid : supply to end use

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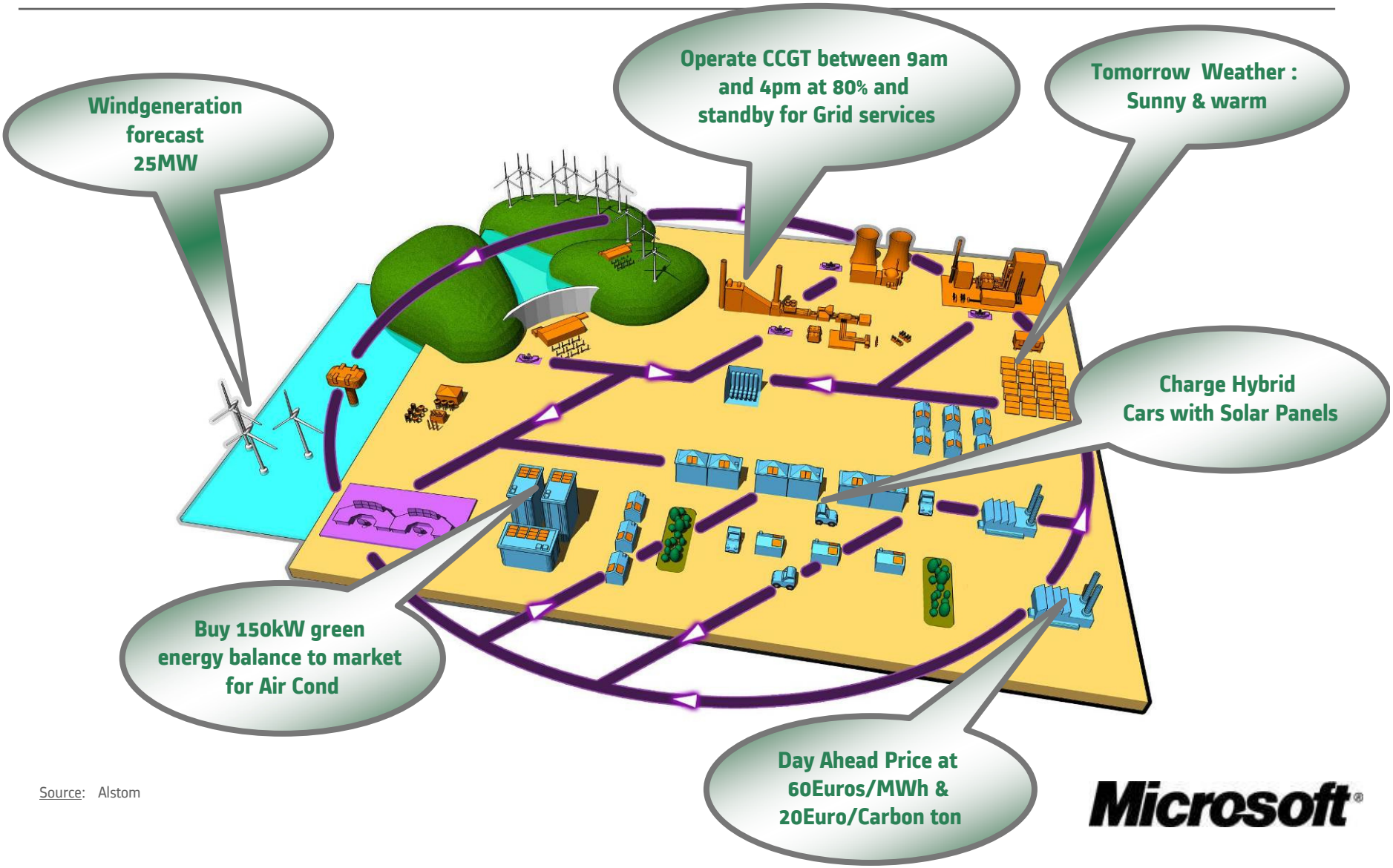


Source: Alstom

Microsoft

Key Drivers for Smart Grids

1. Maximize CO2 free energy and reduce environmental impacts

E.g.: Europe over 50% of generation investment until 2020 is in renewable energy

- Enable renewable grid connection and improve thermal generation flexibility
- Maximize dispatch of intermittent renewable generation (wind, solar)
- Integrate distributed generation, eco-buildings and electric vehicles
- Develop new energy storage capabilities

2. Improve energy efficiency across the value chain

E.g.: USA, $4.6Bn federal investment in smart grid technology deployment

- Optimize real-time CO2 free energy delivery to end-users
- Maximize energy flow in constrained and aging grids
- Enable end-users dynamic participation to the market (“prosumers”)
- Integrate smart metering and demand side information integrate

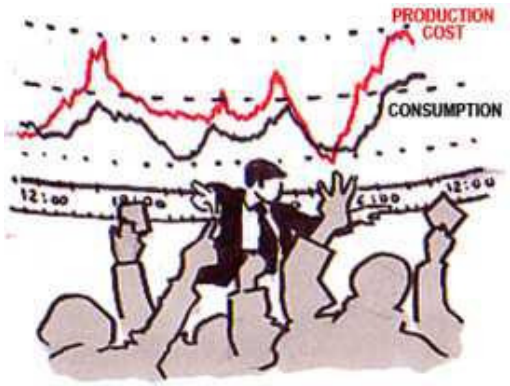
3. Increase Grid Reliability and Stability

E.g.: Annual costs of power interruptions to US electric consumers: $79Bn

- Estimate Grid Asset condition through real-time and react accordingly
- Prevent transmission blackouts and minimize outages in distribution
- Monitor Grid stability / oscillations and implement Defense plans/Grid self healing

Driver 2. Improving system wide energy efficiency

Managing demand response could help decrease peak consumption from 5 to 20%!



Smart homes can monitor, control and adjust local consumption… and generation !

Consumers become pro-sumers contributing to green energy generation

Electric vehicles will call for new network infrastructure and load management systems

The Grid of the 21st century: towards a two-way flow of energy and information

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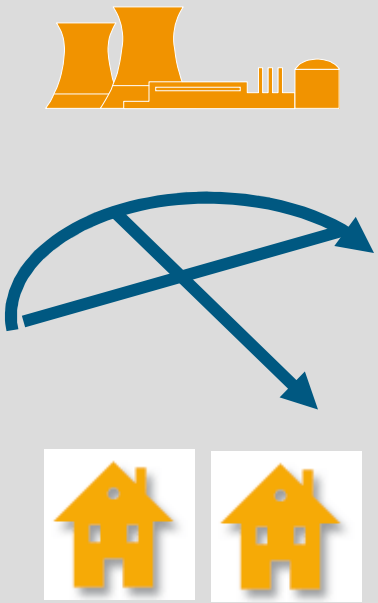
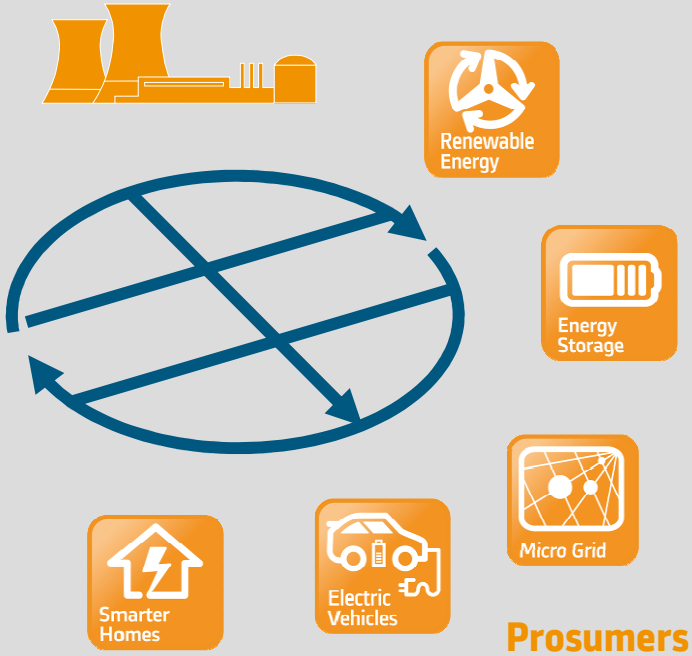
From a traditional top-down network...

Centralized generation



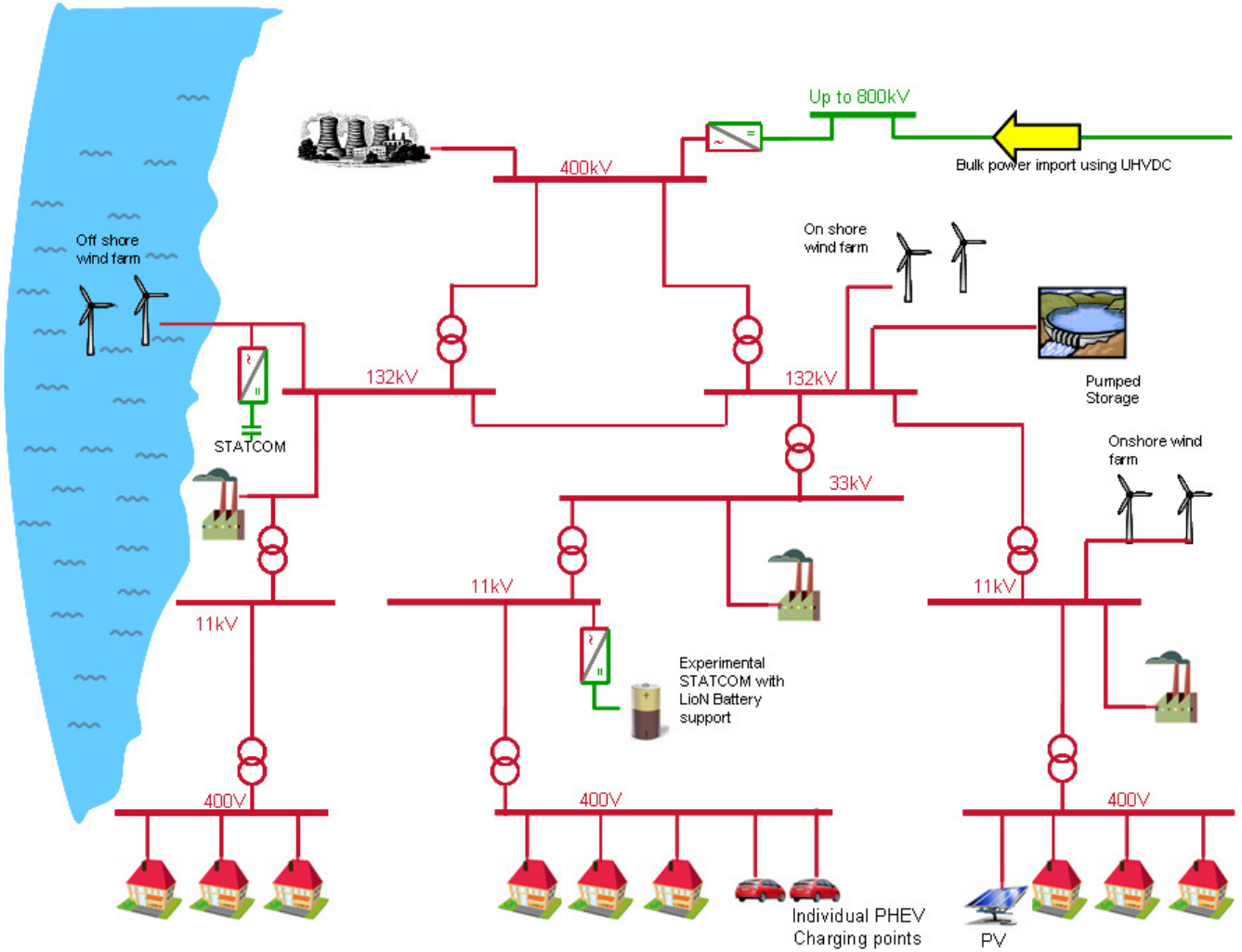
... to a meshed network with two-way flow of energy and information

Centralized + Distributed generation

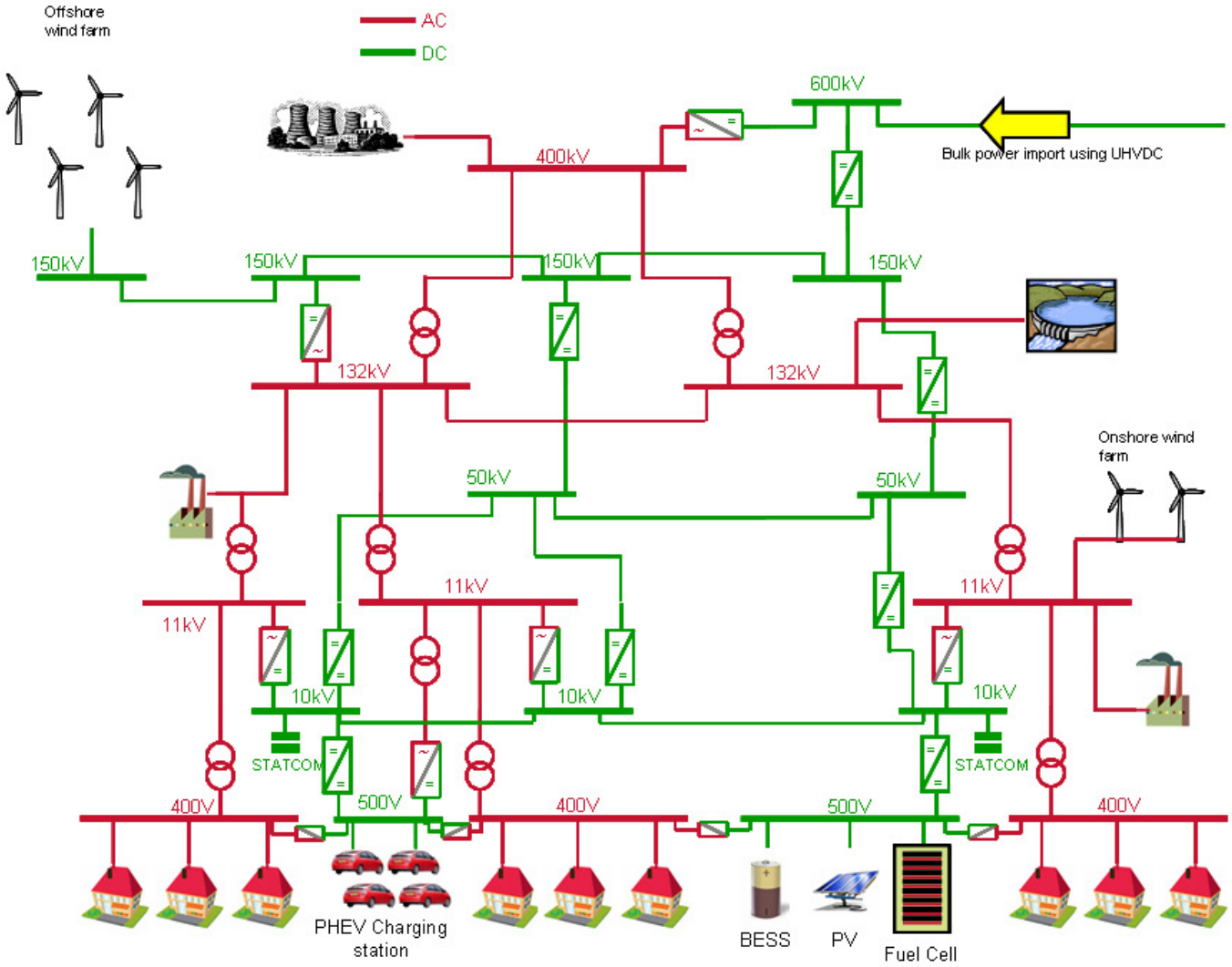


Prosumers

Todays AC Grids



Future : Hydrid AC/DC Grids



New requirements for Distributed Energy Balancing at City Scale

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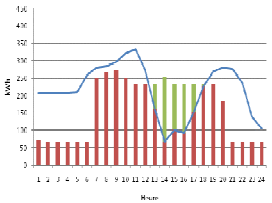
new energy solutions
EMBIX
FOR SMARTER CITIES

Ecocities / ecodistricts / Portfolio of smart buildings

Generation & storage management

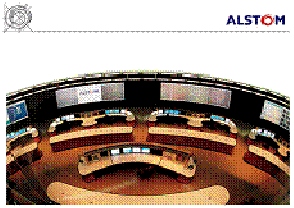
Real-time monitoring & benchmarking



Demand response management

URBAN POWER™

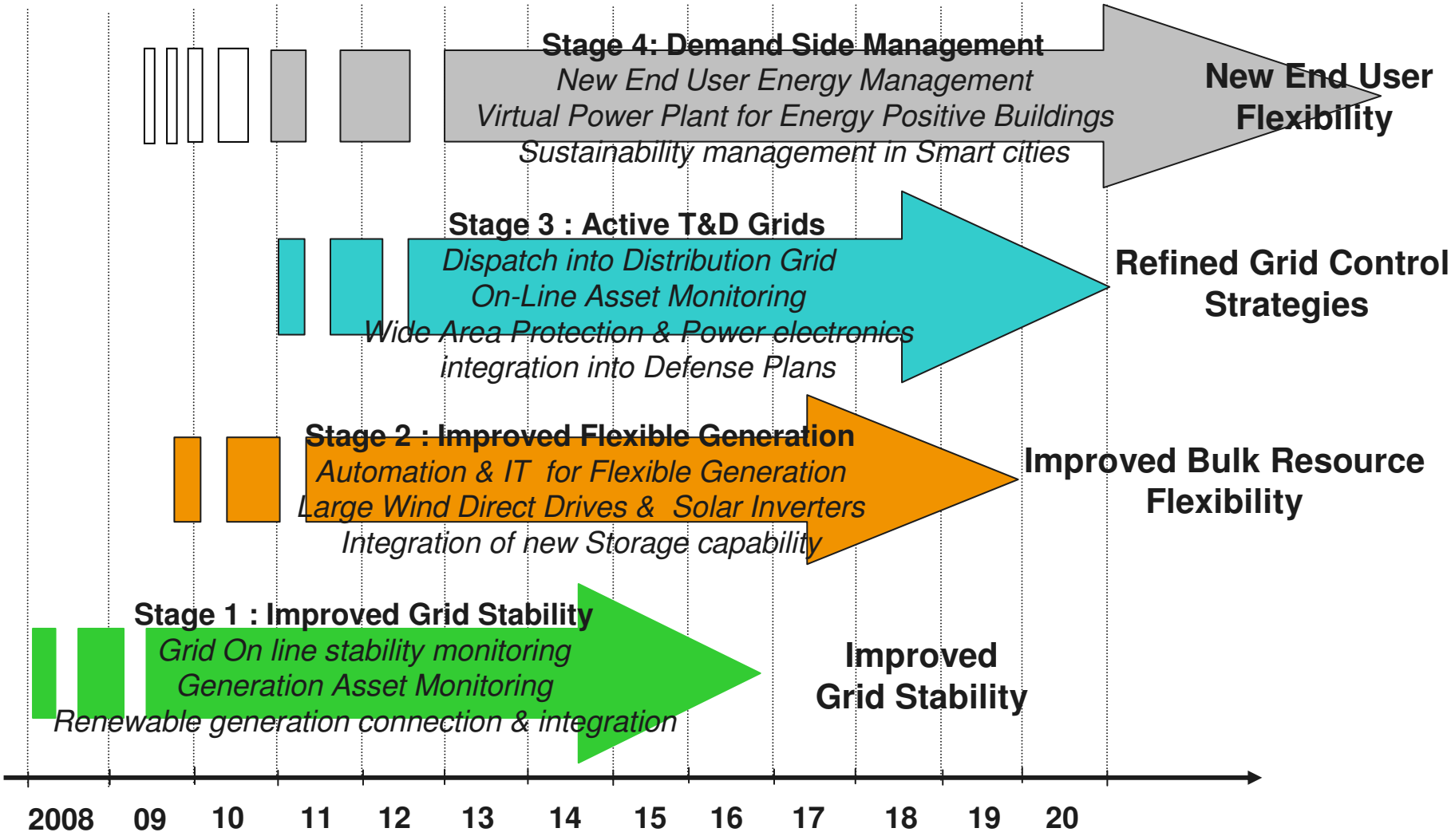
TSO/DSO Interfaces



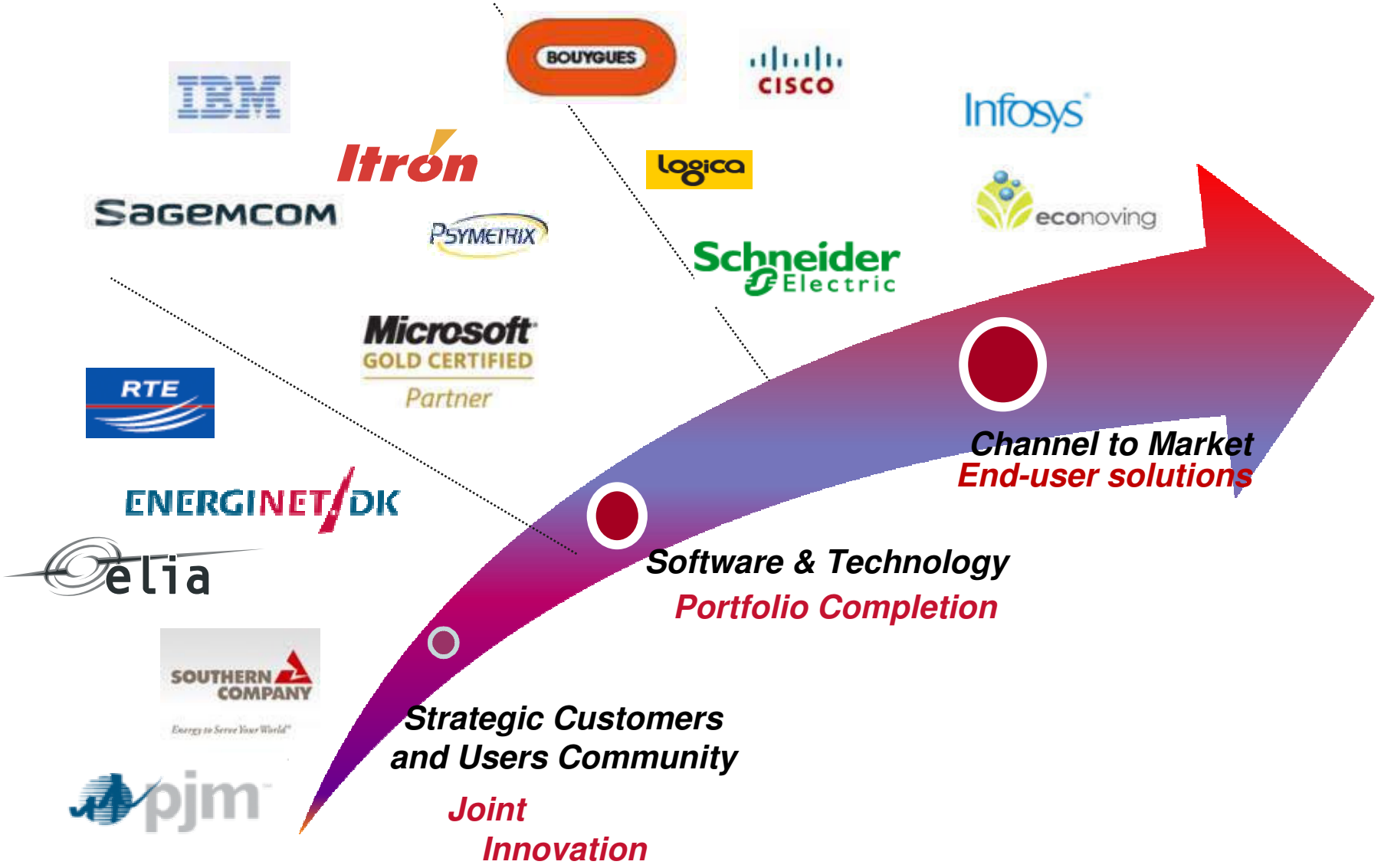
Integrated green mobility

Real-time carbon footprint measurement

High Level Smart Grids Roadmap



Partnerships : development of an ecosystem of partners to leverage Smart Grid synergies



Typical demonstrations currently developed in Europe

- **Example: TWENTIES EC project**
  Objective: prepare European networks for a massive wind penetration (26 partners, led by Red Electrica de Espana)

Integrate intermittent generation	***DEMO: Services by wind farms***
	DEMO: Flexible demand
Prepare offshore grids roll-out	***DEMO: DC breaker***
	DEMO: Storm control for wind farm
Make grids flexible	***DEMO: WAMS and advanced operational tools***
	DEMO: Novel FACTS and network management

Alstom Grid involved with a budget of nearly 3 million EUR

20 20 20 Twenties
Transmitting wind

SEVENTH FRAMEWORK PROGRAMME

Grid stability improvement

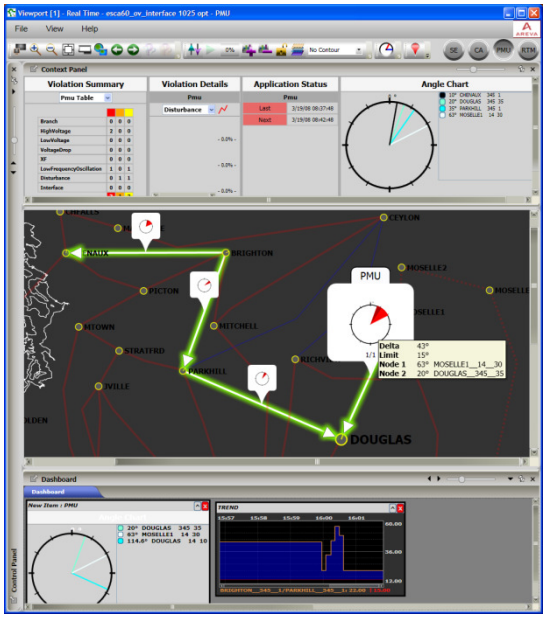
•Example: NCG, China

Customer challenge

- Prevent transmission blackouts in the context of extreme load conditions

Solution

- e-terra On-line Stability integrated with NCG Energy Management System



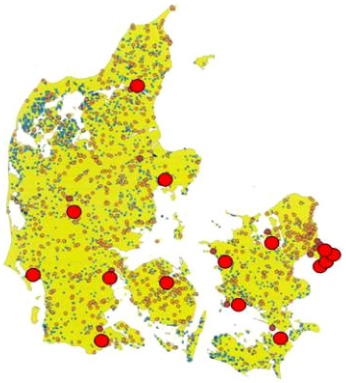
Distributed generation management

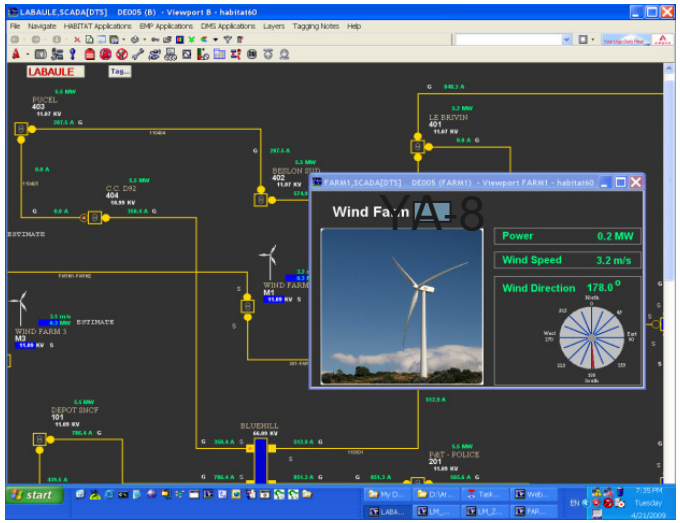
Example: Energinet.dk

Denmark - 1980

Central power plant
DCHP unit
Wind turbine

Denmark - 2010





Customer challenge

- Manage large portfolio of intermittent and distributed generation units

Solution

- e-terra Renewable Desk integrated in Energinet control center

SmartGrids Key Take aways

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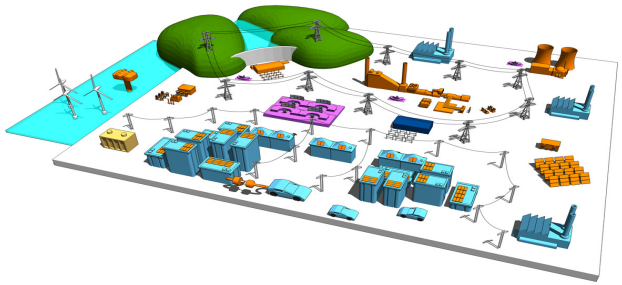
- Smart “Grid” can deliver **real-time monitoring and control** of electricity generation, transmission, distribution and demand (C&I, residential)
- Smart Grid is about **optimisation of energy dispatch,** and not only about smart meters
- All **four elements** (electricity **generation management,** transmission, distribution and demand) **need to be addressed**
- SmartGrid is likely to expand through eco city clusters
- **Standards** are key



Help to achieve 20/20/20

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