DERlab

Overview of strategies and goals of smargrid in Europe

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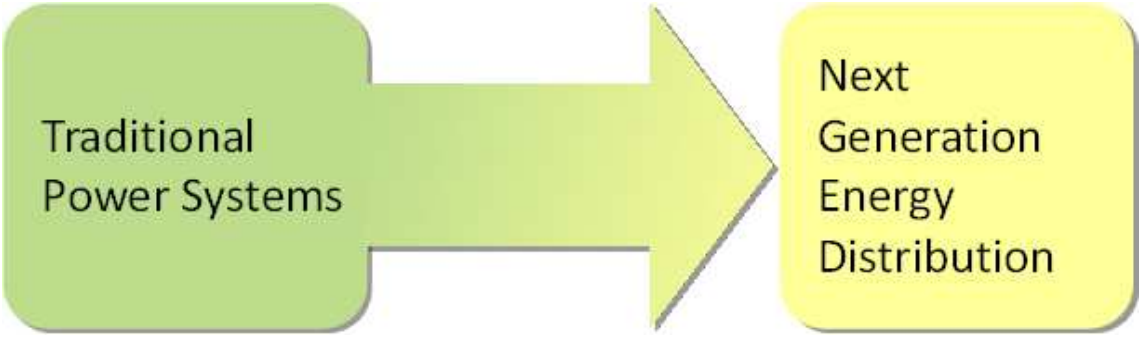
BACKGROUND

- Traditional Power Systems
- Next Generation Power Systems
- Challenges

BACKGROUND



Current power systems are evolving from the traditional „top-bottom“ structure to intelligent, bidirectional energy distribution systems

BACKGROUND

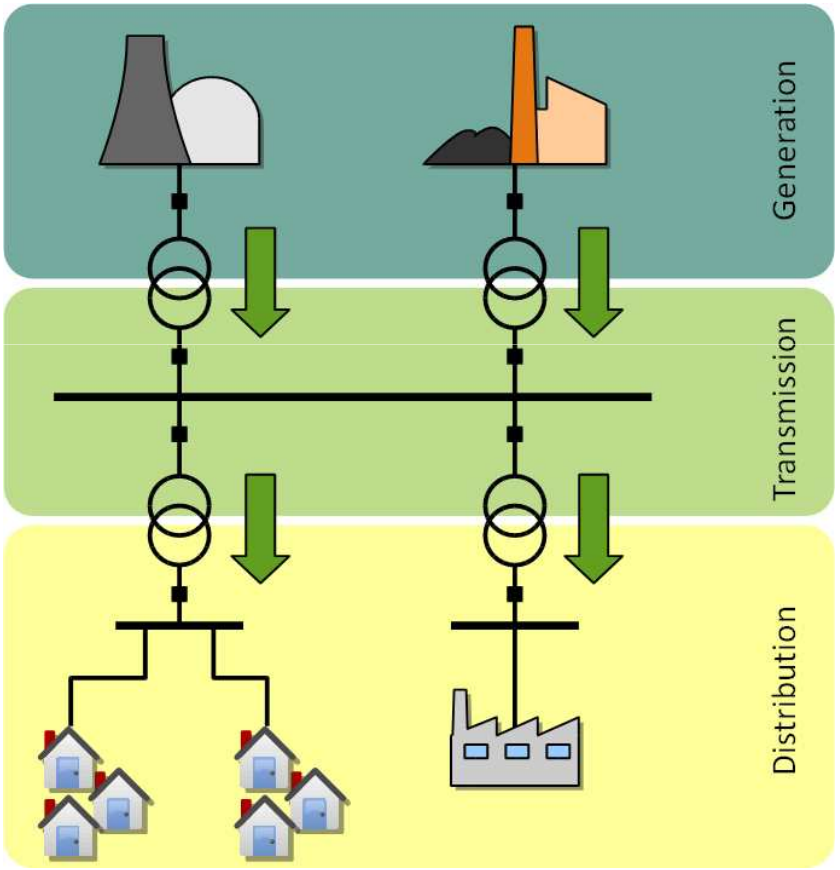
Traditional Power Systems

The „Top-Bottom“ Structure

Traditionally, energy flows from large-scale plants to end-users:

- Dispatch control
- Operation
- Protection
- Security of supply
- Metering...

...still think in this way



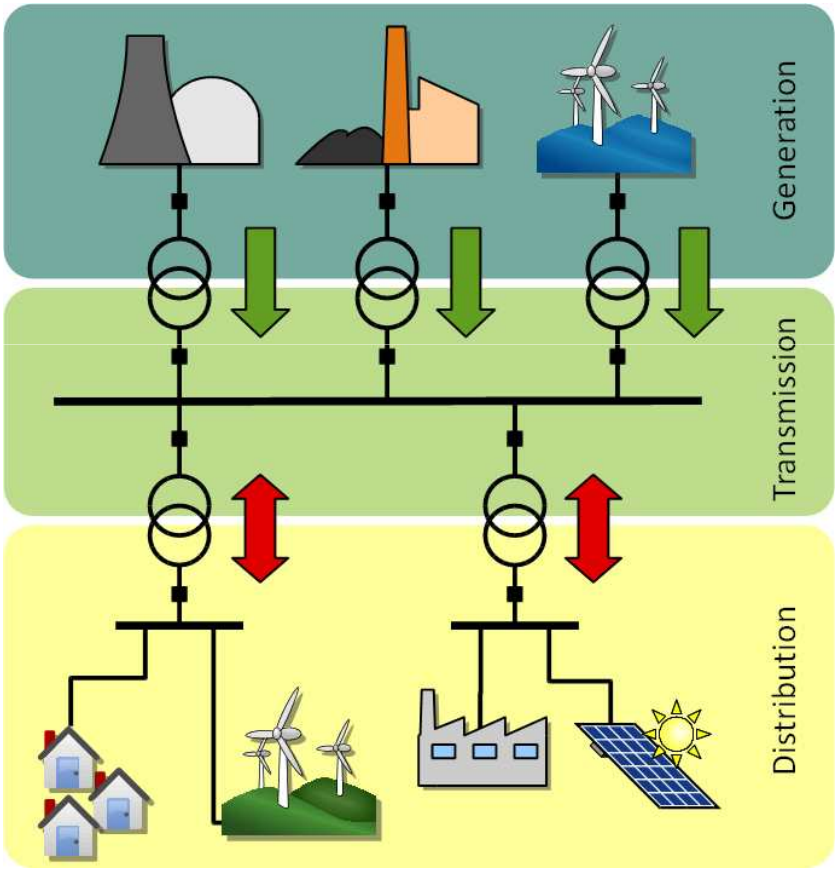
BACKGROUND

Next Generation Power Systems

The „Bidirectional“ Paradigm

Network operators are urged to *transform* their energy systems to allow for the new players:

- Distributed Generation
- Active Consumers (Prosumer)



BACKGROUND

Challenges

Traditional

- Optimize asset utilization and operate efficiently
- Reliability and security of supply
- Power Quality

Next-generation grid operation

- Increase in the global power demand
- Enable active participation of consumers in electricity markets
- Provide consumers with greater information and choice of supply (Market liberalization)
- Protection of the environment
- Increase in the penetration of stochastic energy sources
- Increase in the use of non-linear loads
- Facilitate the connection and operation of generators of all sizes and technologies
- Developing decentralized architectures

SMARTGRID VISION

- Defining the vision: US Case
- Defining the vision: European Case
- Global approach
- Smargrid Definition

DEFINING THE VISION: US Case

US Case main actors involved

The Modern Grid Initiative (MGI)

Smart Grid Task Force

GridWise™

GridWise™ Architecture Council

GridWise Alliance

Intelligrid

DEFINING THE VISION: US Case

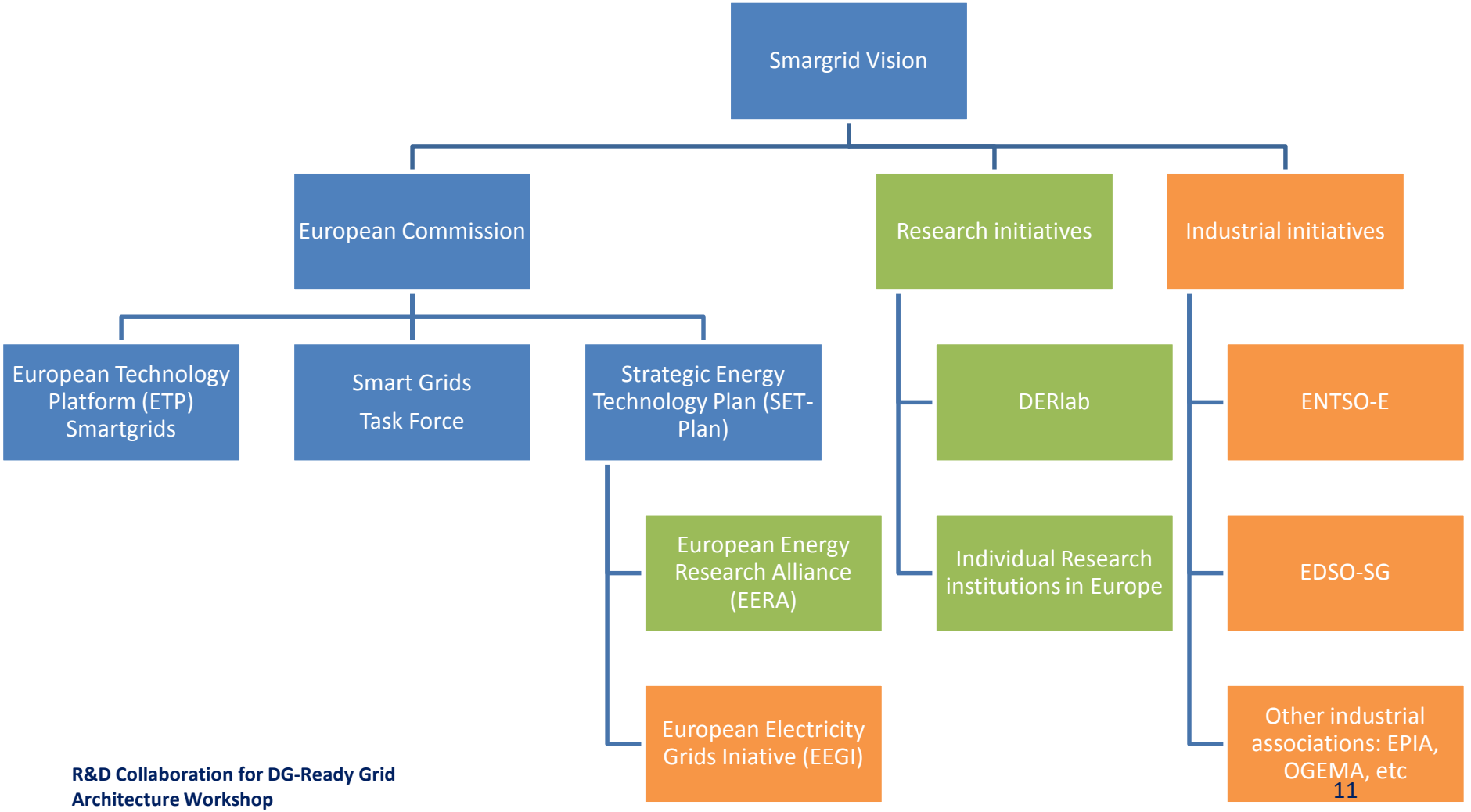
Defining characteristics in the US case*:

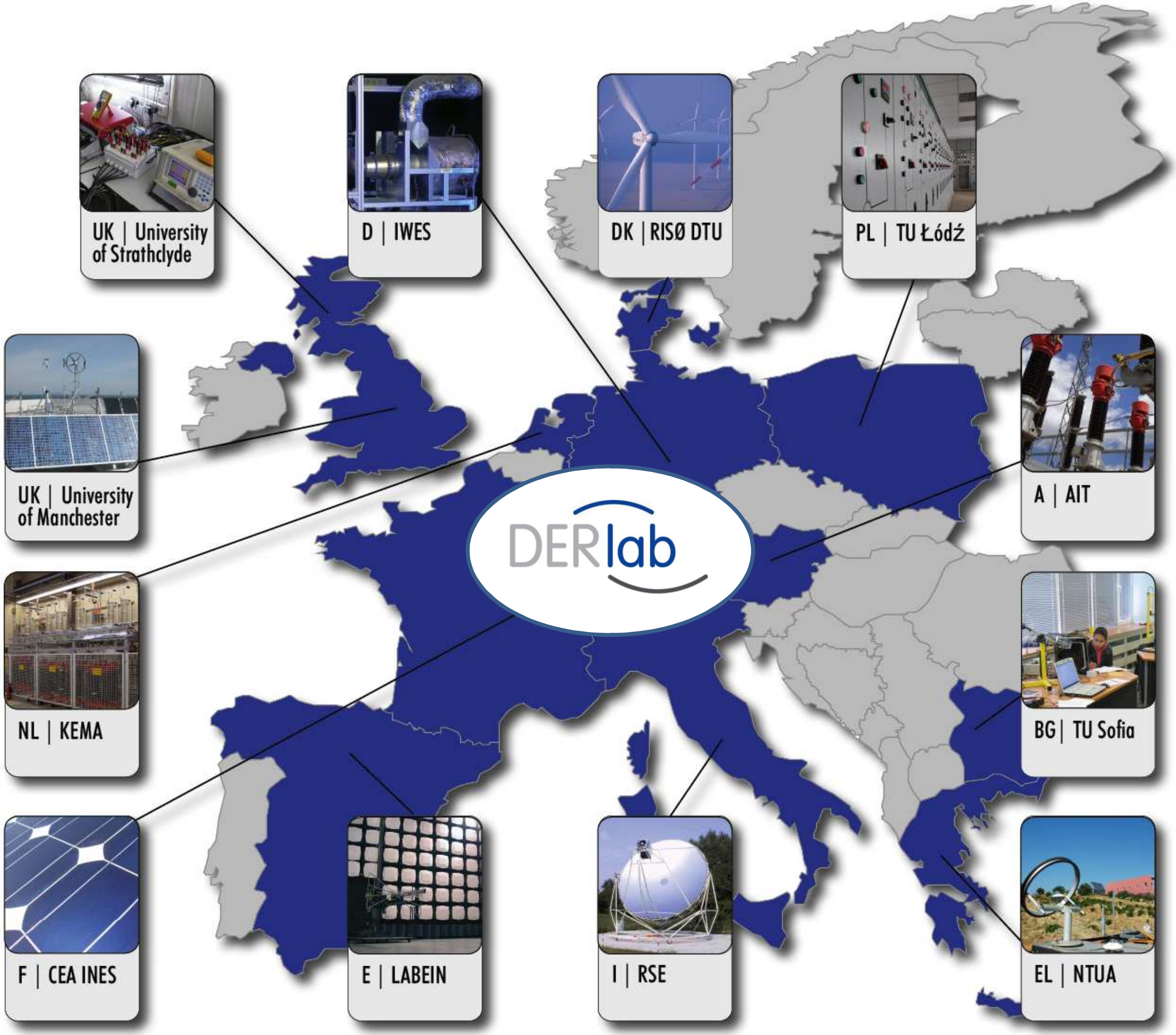
- Enables informed participation by customers;
- Accommodates all generation and storage options;
- Enables new products, services, and markets;
- Provides the power quality for the range of needs;
- Optimizes asset utilization and operating efficiently; and
- Operates resiliently to disturbances, attacks, and natural disasters.

*U.S. Department of Energy, *Smart Grid System Report*, July 2009.

DEFINING THE VISION: European Case

European Case main actors involved





European Distributed Energy Resources Laboratories (DERlab) e.V.

DEFINING THE VISION: European Case

Aims of the SmartGrids – the Vision in the European case

1. Provide a user-centric approach and allow new services to enter into the market;
2. Establish innovation as an economical driver for the electricity networks renewal;
3. Maintain security of supply, ensure integration and interoperability;
4. Provide accessibility to a liberalized market and foster competition;
5. Enable distributed generation and utilization of renewable energy sources;
6. Ensure best use of central generation;
7. Consider appropriately the impact of environmental limitations;
8. Enable demand side participation (DSR, DSM);
9. Inform the political and regulatory aspects;
10. Consider the societal aspects.

GLOBAL APPROACH

Identifying the main characteristics of the Smartgrids

1. Optimization of system operation by allowing demand to play an active role

2. Facilitation to include distributed resources

3. Increase reliability and quality of the service

4. Increase the efficiency of the whole electricity chain

SMARTGRIDS DEFINITION

"The smart-grid is an electricity network that can intelligently integrate the actions of all users connected to it —generators, consumers and those that do both— in order to efficiently deliver sustainable, economic and secure electricity supplies."

ETP Smartgrids

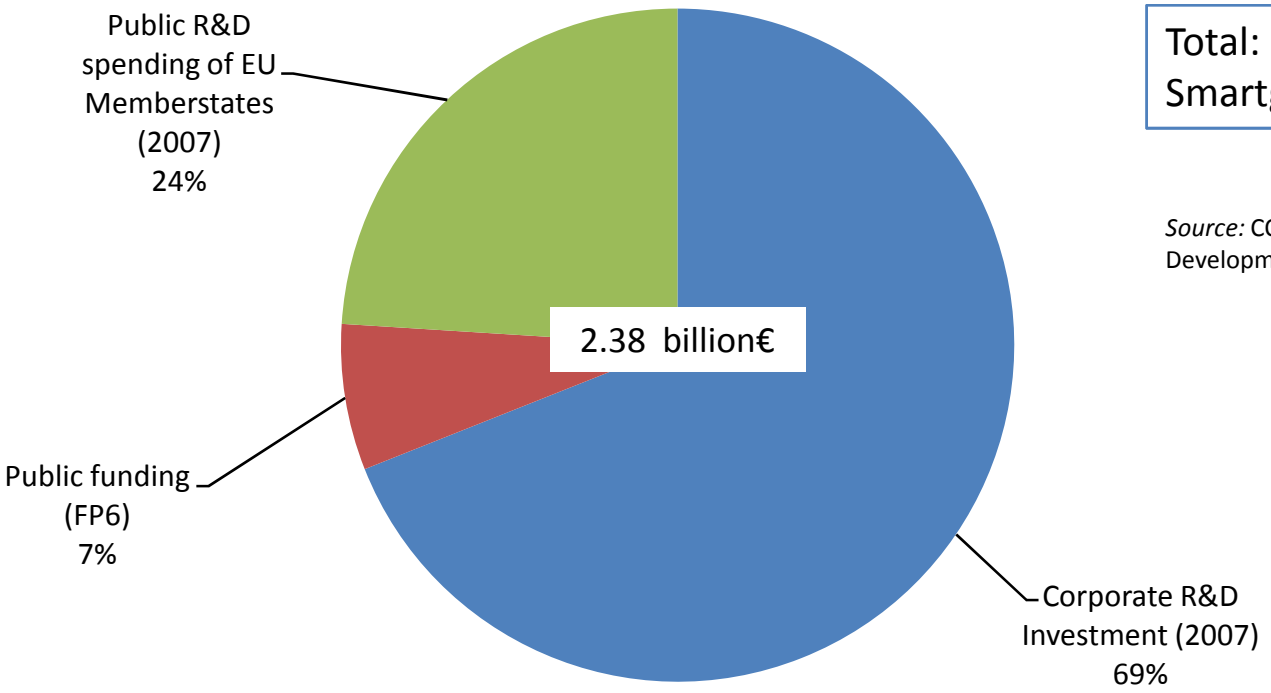
DEPLOYMENT PRIORITIES

- ❑ Context and figures
- ❑ US Case
- ❑ European Case
- ❑ Research areas in Smartgrids

DEPLOYMENT PRIORITIES

Context and figures

R&D Investment in 2007 in non-nuclear SET-Plan priority technologies

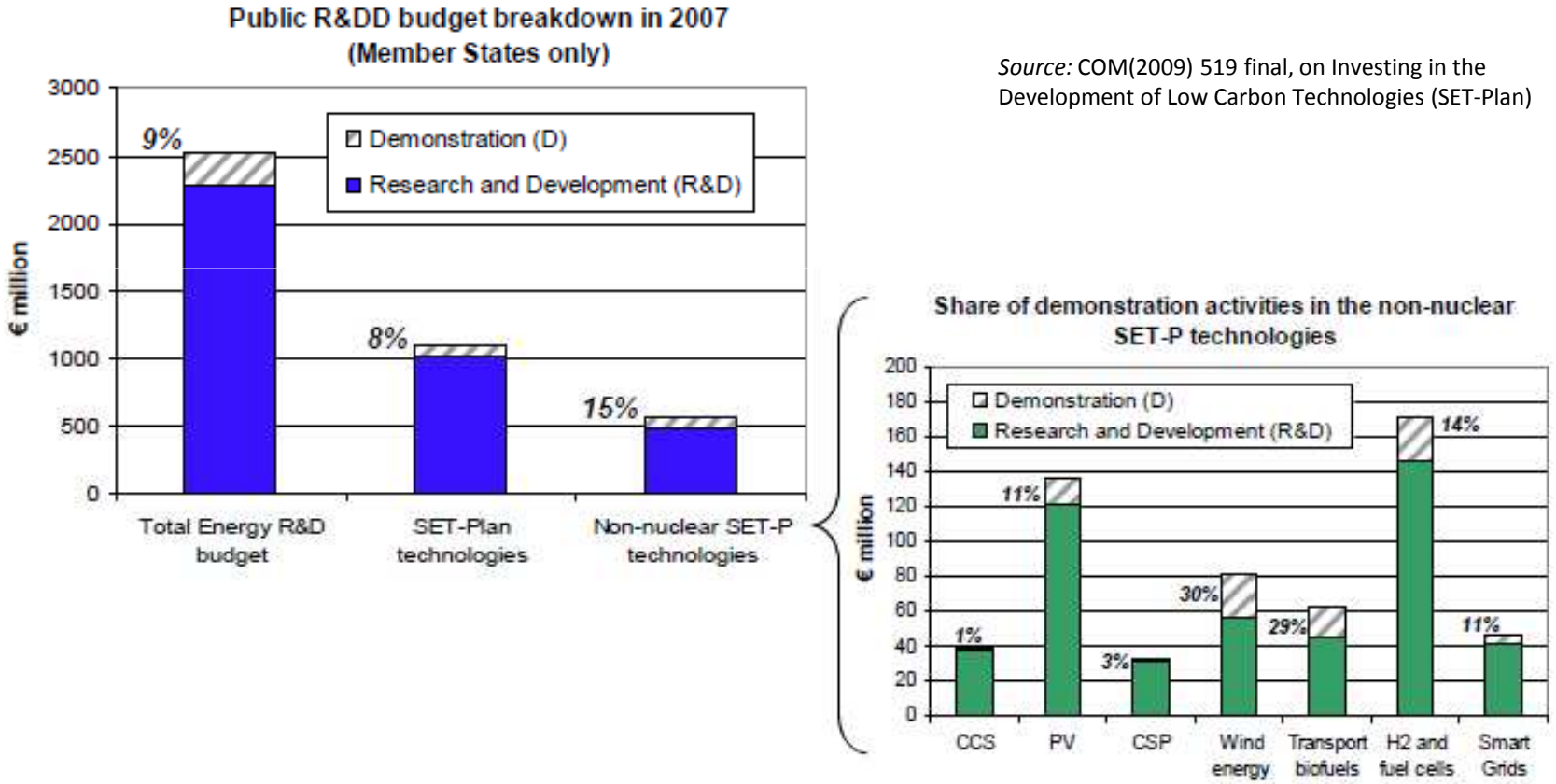


Total: 2.38 billion€
Smartgrids: 188 million€

Source: COM(2009) 519 final, on Investing in the Development of Low Carbon Technologies (SET-Plan)

DEPLOYMENT PRIORITIES

Context and figures



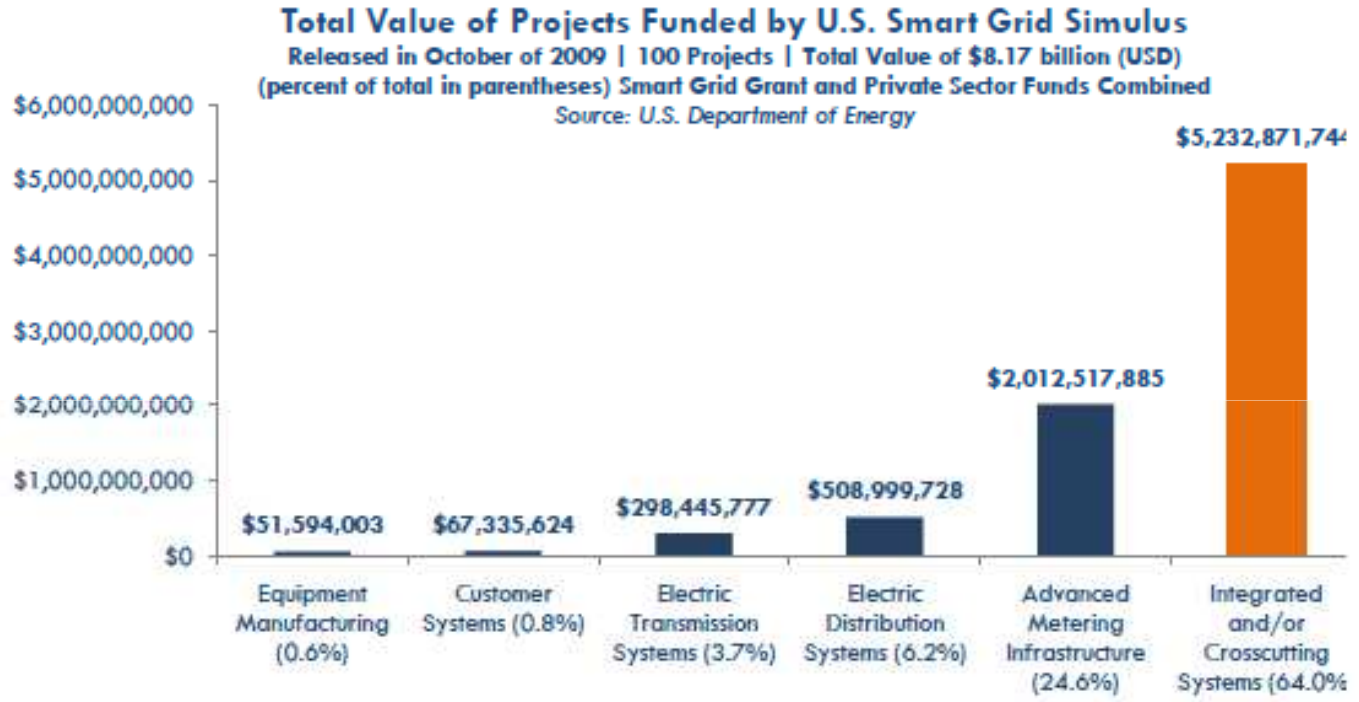
Source: COM(2009) 519 final, on Investing in the Development of Low Carbon Technologies (SET-Plan)

DEPLOYMENT PRIORITIES

Context and figures

Total: 8.17 billion$

Smartgrid Technologies: 2.9billion$



Smart Grid Segment*	Total Projects	Smart Grid Grant Award Amount	Private Sector Funding Contribution	Total Smart Grid Project Value	Percent of Total
Advanced Metering Infrastructure	31	$818,245,749	$1,194,272,136	$2,012,517,885	24.6%
Customer Systems	5	$32,402,210	$34,933,414	$67,335,624	0.8%
Electric Distribution Systems	13	$254,260,753	$254,738,975	$508,999,728	6.2%
Electric Transmission Systems	10	$147,990,985	$150,454,792	$298,445,777	3.7%
Equipment Manufacturing	2	$25,786,501	$25,807,502	$51,594,003	0.6%
Integrated and/or Crosscutting Systems	39	$2,150,505,323	$3,082,366,421	$5,232,871,744	64.0%
Total	100	$3,429,191,521	$4,742,573,240	$8,171,764,761	100%

Source: Smart Grid: 2010 U.S. Project Spending. ZPryme Consulting.

DEPLOYMENT PRIORITIES

US Case: Areas

To monitor and assess progress of deployments in the United States, DOE is tracking activities grouped under six chief characteristics of the envisioned Smart Grid*:

1. Enables informed participation by customers;
2. Accommodates all generation and storage options;
3. Enables new products, services, and markets;
4. Provides the power quality for the range of needs;
5. Optimizes asset utilization and operating efficiently;
6. Operates resiliently to disturbances, attacks, and natural disasters.

*U.S. Department of Energy, *Smart Grid System Report*, July 2009.

DEPLOYMENT PRIORITIES

US Case: Areas

Smart Grid Program DOE Strategic Areas of Focus:

Capacity	Power Quality and reliability	Energy Efficiency	Operational efficiency	Clean technology
• Grid self-optimization • Demand management • Load Curtailment	• Highly differentiated reliability • Local power parks • Emergency power	• Automated efficiency • Online energy efficiency & management • EE Programs	• End to end automation • Distribution automation • Advanced metering	• Clean resource optimization • Electric vehicle management • Distributed renewables

Source: OE Peer Review Smart Grid R&D. Eric Lightner. November 2-4, 2010

DEPLOYMENT PRIORITIES

European Case: Areas

Identified priority areas:

Deployment Priority #1: Optimizing Grid Operation and Use
Deployment Priority #2: Optimizing Grid Infrastructure
Deployment Priority #3: Integrating Large Scale Intermittent Generation
Deployment Priority #4: Information & Communication Technology
Deployment Priority #5: Active Distribution Networks
Deployment Priority #6: New Market Places, Users & Energy Efficiency

Source: Strategic Deployment Document for Europe's Electricity Networks of the Future. ETP SmartGrids. April 2010.

DEPLOYMENT PRIORITIES

European Case: Areas

Optimizing Grid Operation and Use	Optimizing Grid Infrastructure	Integrating Large Scale Intermittent Generation	ICT	Active Distribution Networks	New Market Places, Users & Energy Efficiency
• WAMs and WACs • Coordinated ancillary services • steady state and dynamic simulations • Operation of power flow control systems • Regulatory issues.	• Efficient expanding EU grids • new line configuration and re-enforcement • new assets management • new components for maintaining Power Quality	• Offshore networks • cross-border issues • efficient and secure operation with large integration of RES.	• ICT infrastructure to allow monitoring, management ,control and dispatching operations • Standardized solutions and interfaces.	• Visibility of the devices • Distributed control infrastructure • Compatibility of solutions during the transition • New solutions require standardization	• Innovative Customer Interface Devices • Smart energy management of DG and DR

Areas of Focus US / Deployment priority areas EC	Capacity	Power Quality and reliability	Energy Efficiency	Operational efficiency	Clean technology
Optimizing Grid Operation and Use	X			X	
Optimizing Grid Infrastructure		X		X	
Integrating Large Scale Intermittent Generation					X
Information & Communication Technology	X	X	X	X	X
Active Distribution Networks				X	
New Market Places, Users & Energy Efficiency	X		X	X	

DEPLOYMENT PRIORITIES

Research areas

1. **Grid (Transmission & distribution)** monitoring control, and **optimization** including sensors, communications, and computer systems and software;
2. **Advanced Metering** including advanced meters, communications infrastructure, and computer systems and software;
3. Technologies to assist in the efficient **integration of DG and storage**;
4. **Consumer integration** into energy markets and grid operations;
5. **IT**, communications, and field automation projects concentrated on achieving compliance with Cyber Security standards;
6. Power electronic technologies for **quality of supply**;
7. Energy **storage devices**: Stationary and electromobility

CONCLUSIONS

- Conclusions

CONCLUSIONS

- Power systems are changing from top to down to bidirectional distribution systems;
- The smartgrid revolution has started but research in key aspects is still needed;
- The vision is clearly defined;
- Europe and US are working in the same areas → more collaboration is required.

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