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Smart Grids European Research Programmes

European Commission, DG Research
Patrick Van Hove

EU Drivers: Energy and Climate Policy

Sustainability: 2020 objectives (binding!)

- ✓ 20% of renewable energy in the EU's overall energy mix
(Translates into 30-35% of electricity from Renewables)
- ✓ 20% efficiency gains with respect to business as usual
- ✓ 20% reduction in GHG emissions

2050 objectives

- ✓ Decarbonised power supply

Security of supply

- ✓ Reduce dependence on energy imports, reliability

Competitiveness:

- ✓ Market-based approach to drive overall efficiency

Strategic Energy Technologies Plan

Energy – Climate objectives require new technology answers

- ✓ SET Plan as the technology pillar supporting policies
- ✓ Accelerate development and deployment of low-carbon technologies
- ✓ Joint initiatives European Commission – EU Member States

European Industrial Initiatives: public-private partnerships

- ✓ Electricity grids, Wind, Solar, Carbon capture and storage, Bio-energy, Nuclear, Smart cities, Hydrogen & fuel cells

European Energy Research Alliance (EERA)

- ✓ Electricity grids, Wind, Solar- PV & CSP, Carbon capture and storage, Biofuels, Marine energy, Geothermal, Materials for nuclear

SET Plan open to international cooperation

European led Smart Grids R&I Initiatives

SET Plan EEGI

- ✓ First priority is the 2020 perspective – system integration
- ✓ Networks are in the lead – they need to implement the solutions

SET Plan EERA Research Alliance

- ✓ Preparing the EEGI after 2020

Strategic Agenda 2035 (Smartgrids platform)

- ✓ Includes opportunity-driven research

Upstream research: European Research Council

Education and training & link to research and innovation (KIC)

- ✓ Preparing tomorrow's generation of engineers

SET Plan Materials initiative – including for Electricity Grids

European Electricity Grids Initiative: SET Plan EEGI

External Drivers in 2020 perspective: Demonstrate and validate the technologies to:

- ✓ Integrate 30-35% of variable renewable electricity
- ✓ Co-ordinate planning and operation of the pan-European network
- ✓ Guarantee a high-level of reliability
- ✓ Improve energy efficiency of the overall electricity supply system
- ✓ Engage users in efficiency and active demand

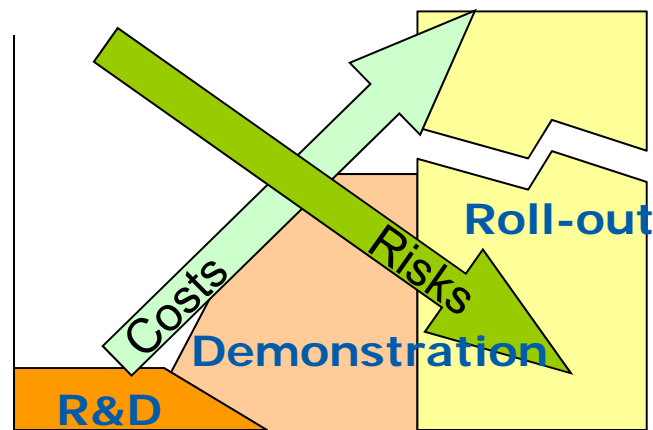
Internal drivers :

- ✓ Replace ageing infrastructure
- ✓ Integrate new sources requesting connections
- ✓ Support demand side technologies for active participation
- ✓ Reduce overall costs of the power system (CAPEX + OPEX)
- ✓ Enable electrification of the transport sector
- ✓ Increase network flexibility towards 2050 objectives

Research according to timing?

EEGI in 2020 perspective: unlocking smart grids deployment

- ✓ Many technology blocks are available, demonstrated in pilots
- ✓ Innovation in system integration
- ✓ Need for large-scale demonstrations to validate the integration
- ✓ Reduce risks of new technology deployment



- ✓ Analyse results of demonstrations and business cases
- ✓ Prepare replication and scaling up



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Research according to actors and roles: EEGI structure

SMART GRIDS
Functional level

Level 5: Smart Customers

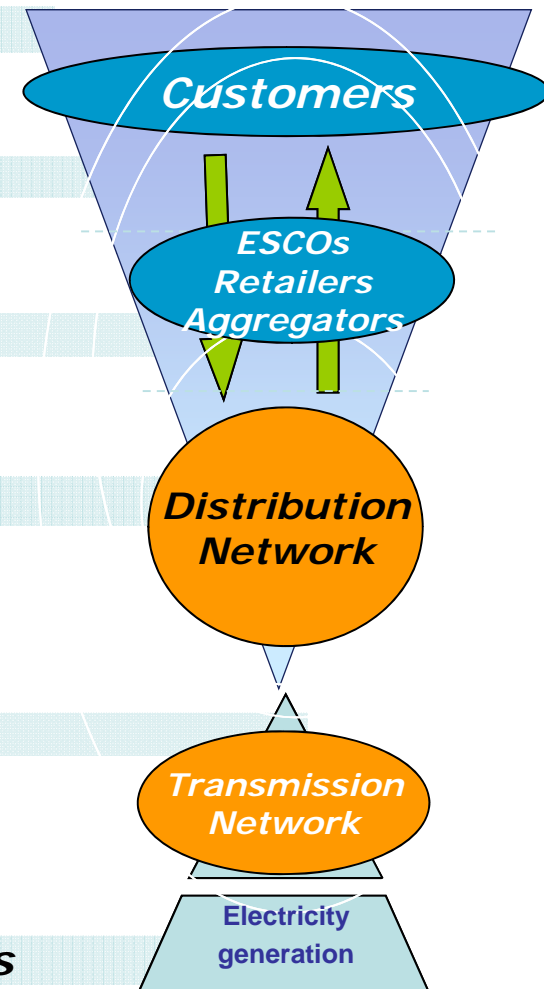
Level 4: Smart Energy Management

Level 3: Smart Integration

**Level 2: Smart distribution network
and processes**

**Level 1: Smart Pan-European
Transmission network**

Level 0: New generation technologies





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RD&D Roadmap- distribution networks

Smart Function	YEAR									Costs (M€)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Residential and commercial buildings	Active Demand Response									190
	Integration with Smart Homes									120
	Smart Metering Infrastructure								150	
	Data Processing								20	
	Integration of small DER								90	
Industrial and commercial	Integration of medium DER								150	
	Integration of storage technologies								60	
	Integration of Electric Vehicles								100	
Power distribution	Monitoring and control of LV networks								100	
	Monitoring and Control of MV networks							90		
	Tools and systems support							80		
Integration of communication	Integrated Communications Solution								50	
Total										1.200

Active Demand Response
and integration with Smart

Smart Metering Infrastructure
& Data Processing

Integration of RES, storage
and EV

Planning, monitoring and
control

Integrated communication
Infrastructure



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RD&D Roadmap – transmission networks

S F	Pan-European Grid Architectures	YEAR								Costs (M€)	
		2013	2014	2015	2016	2017	2018	2019	2020		
P A		Network architecture assessment								19	
		Develop the pan European transmission options								21	
	Power Technologies (Demonstration)	Demonstrations of Power technologies for more network flexibility								25	
		Demonstrations of Power technologies for new architectures								25	
		Demonstration of renewable integration (ct'd)								120	
m	Network Management and Control (R&D)	Tools for a Pan European network observability								12	
		Operations with stability margin evaluation								24	
		Improved training tools for improved coordination								25	
	New Market Design Options (R&D)	Pan European network reliability assessment								14	
		Tools for Pan European balancing markets								16	
		Advanced tools for congestion management								17	
Ne		Tools for renewable market integration								10	
		Tools to study market integration of active demand								11	
	Pan-European Grid Architectures(R&D)	T13	T14		Innovative approaches to improve the public acceptance of overhead lines						30
Total										560	



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RD&D Roadmap – T&D coordination

Functional Project	YEAR											Costs (M€)	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
TD 1		Increased observability of the electric system for network management and control										45	
TD 2			The integration of demand side management in TSO operations										70
TD 3		Ancillary services provided by DSOs										50	
TD 4		Improved defense and restoration plans										45	
TD 5		Joint Task force on IT system protocols and standards										20	
Total											230		

EEGI estimation of overall costs : 2,000 M €

- ✓ **Need to pool resources: EC, Member States, industry, tariffs**

Coordination of ongoing national projects

- ✓ **Mapping and clustering exercises – JRC, AIT**
- ✓ **Many demonstration projects started at national level**
- ✓ **Families of running projects to share findings**

Coordination/synchronisation of EC and MS calls for proposals

- ✓ **Families of new projects**
- ✓ **Activities promoted in FP7 WP2012, planning for WP2013**

Opportunity-driven research

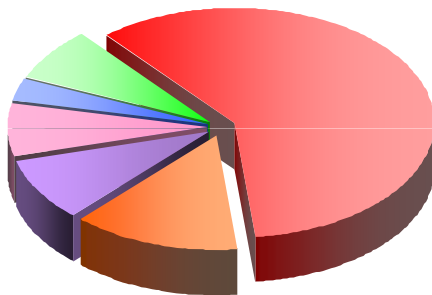
- ✓ **Research alliance, FET, etc.**

Framework Programme 7 (2007 -2013)

Cooperation themes

FP7
50.5 Billion €

Cooperation
32.4 Billion €



1. Health
2. Food, agriculture and biotechnology
3. Information and communication technologies
4. Nanotechnologies, materials and new production technologies
5. Energy (RTD + TREN) – 2.3 B€
6. Environment
7. Transport (including aeronautics)
8. Socio-economic sciences and the humanities
9. Security
10. Space



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Energy Theme : Overview

10 activities implemented jointly by DG RTD and ENER

Hydrogen and fuel cells

**CO2 capture and storage
technologies for zero
emission power generation**

**Renewable
electricity
generation**

**Clean coal
technologies**

**Renewable
fuel production**

**Smart energy
networks**

**Renewables
for heating and cooling**

**Energy savings
and energy efficiency**

Knowledge for energy policy making

Horizontal Programme Actions

Transmission:

- ✓ **PEGASE, ICOEUR:** Coordinated control of pan-EU network
- ✓ **TWENTIES:** Demonstration and validation of new technologies
- ✓ **REALISEGRID, SUSPLAN:** Coordinated grid planning
- ✓ **OPTIMATE:** Markets

Distribution:

- ✓ **ADDRESS:** Activate demand
- ✓ **ECOGRID-EU, GRID4EU:** Large smart grids demonstrations
- ✓ **MERGE, G4V:** Impact of electric vehicles
- ✓ **OPEN METER, DERLAB (FP6):** Standardisation

ICT infrastructure:

- ✓ **INTEGRIS, DLCVIT4IP, MIRABEL , W2E, HIPERDNO, OPENNODE**

Security:

- ✓ **AFTER, SESAME, EURACOM, ESCORTS, NI2S3**

+ - 165 M€ for grids projects (2007-2010)

FP7 Support to EEGI: 2011-2013

2011 calls: total 50M€

- ✓ **ITESLA, UMBRELLA: Transmission R&D – coordinated operation**
- ✓ **GRID+: Network of demonstration projects**
- ✓ **Storage demonstration projects - negotiations starting**

2012 calls: total 60M€

- ✓ **Families of projects:
DER integration, distributed intelligence, smart customers**
- ✓ **Planning for future electricity highways**
- ✓ **ICT for Smart energy grids:
Decision support, metering infrastructure, power electronics,
home systems, standardisation**

2013 calls:

- ✓ **Planning starting**

+ - 275 M€ EC for grids projects planned (2007-2012)

Topics for joint EU/MS actions WP2012

“Families of projects” national demonstrations/pilots supported by R&D at EC level:

- ✓ **Integration of medium-size variable distributed resources in distribution networks**
- ✓ **Enhancing electricity networks through the use of distributed intelligence**
- ✓ **Empowering smart customers to participate in active demand and energy efficiency**

Coordination among national activities:

- ✓ **Smart metering infrastructure and data processing**

R&D at European level:

- ✓ **Planning of European electricity highways**

EC-supported research on electricity networks

EC Framework Programme 6: 2002-2006

- ✓ Sustainable development, global change and ecosystems
 - ✓ Sustainable energy systems (810 M€ over 5 years)
- Electricity network projects: +- 60M€

EC Framework Programme 7: 2007-2013

- ✓ Energy (2350 M€ over 7 years)
 - ✓ Smart Energy Networks (275 M€ over 6 years)

Horizon 2020 ("EC FP8"): 2014-2020: Research & Innovation

- ✓ Excellence in the science base
- ✓ Societal challenges: Energy
 - ✓ A single, smart European electricity grid
 - ✓ ... European smart cities and communities
- ✓ Creating industrial leadership and boosting competitiveness

Some key messages

A single end-to-end electricity system

- ✓ With many actors – how to ensure their cooperation?

A very complex system

- ✓ Technologies, technologies, technologies, integration, regulation, markets, etc...
- ✓ Serving the customers: price, quality, ease of use, engagement

~~European Commission's EEGI~~



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Thank you for your attention

Patrick.Van-Hove@ec.europa.eu

EEGI Implementation plan:

<http://www.smartgrids.eu/?q=node/170>

Energy Research and innovation:

http://ec.europa.eu/research/energy/eu/index_en.cfm

Energy policy:

http://ec.europa.eu/energy/index_en.htm

SET Plan information system:

<http://setis.ec.europa.eu/>