EERA
European Energy Research Alliance

Energy 2020 - a strategy for competitive, sustainable and secure energy for Europe and the SET-Plan

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ERF
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EU 2020 and 2050

The European Council in 2007 adopted energy and climate change objectives for 2020

- reduce greenhouse gas emissions by 20%, rising to 30% if the conditions are right (US, CN)
- increase the share of renewable energy to 20%
- make a 20% improvement in energy efficiency

The European Council in 2009 gave a long-term commitment to the decarbonisation path with a target for the EU and other industrialised countries of 80 to 95% cuts in emissions by 2050 relative to 1990 levels

2020 targets

On track for the 20% target for renewables

Renewables 2008:

- 10% of energy (>20% by 2020)
- 45% of electricity (>60% by 2020)

2009: 62% of new electricity generation capacity was from renewables, mainly wind and solar.

Long way from achieving the objective set for energy efficiency

Energy 2020

- EU is deeply dependent on energy imports from few regions
- Energy production causes 80% of the EU greenhouse gas emissions
- It will take decades to steer our energy systems onto a more secure and sustainable path
- Decisions to set us on the right path are needed urgently

Energy 2020

Energy 2020:

A strategy for competitive, sustainable and secure energy

€1 trillion needed next decade to modernise Europe's energy installations and infrastructure

Energy 2020

The 2020 strategy provides a European framework for energy policy based on five pillars of action:

1. **Efficiency and savings**: Average energy savings for a household could amount to €1 000 per year
2. **Free movement of energy**: Fragmented energy markets undermine security of supply, inhibits competition, innovation and investments
3. **Secure safe and affordable**: Empowering consumers and ensuring adequate safety and security
4. **Technological shift**: step change in research and innovation
5. **International partnership**: exploit EU geopolitical strength and speak with one voice

1 Efficiency and savings

1. Buildings and transport
2. Industrial efficiency improving competitiveness
3. Efficiency in energy supply
4. National Energy Efficiency Action Plans

2 Free movement of Energy

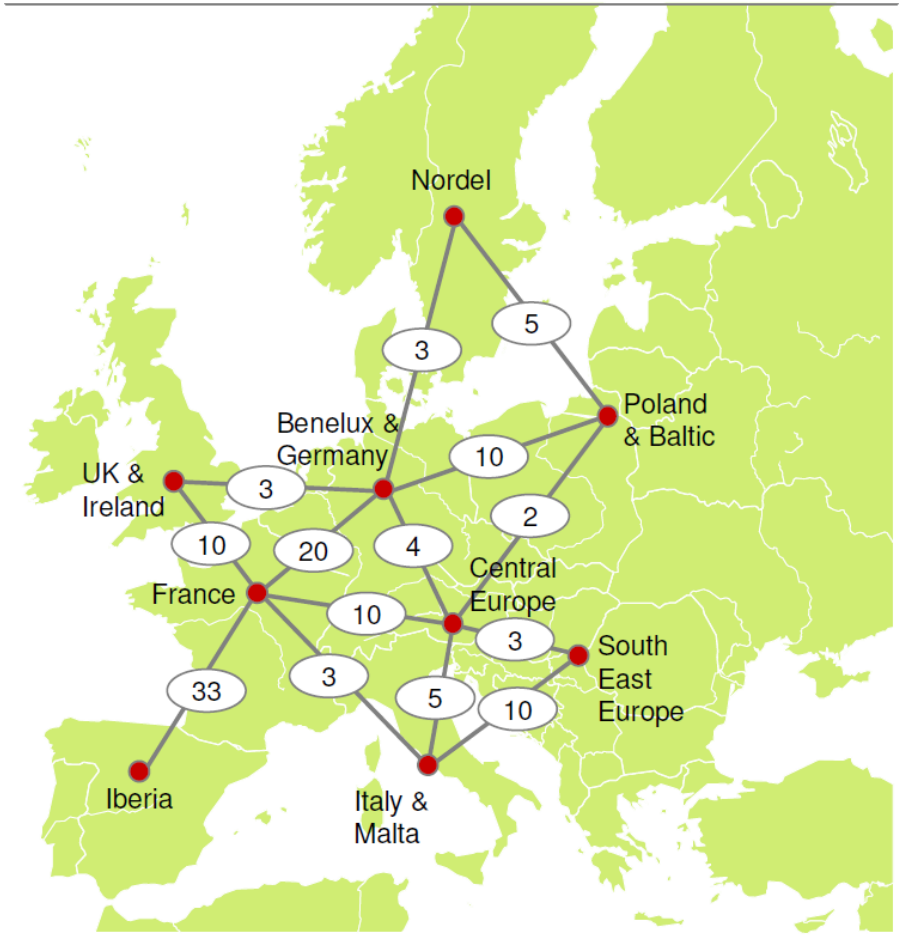
1. Internal market legislation
2. Blueprint of European infrastructure for 2020-30
3. Streamlining permit procedures and market rules for infrastructure developments
4. Providing the right financing framework

Grid expansion requirement example: threefold increase required for the 60% RES pathway

Centre of gravity

60% RES, 20% DR

Total net transfer capacity requirements
GW (existing + additional)



Interconnection	Capacity additional + (existing), GW	Annual utilization %
▪ UK&Ireland-France	8 + (2)	75
▪ UK&Ireland-Nordel	0 + (0)	0
▪ UK&Ireland-Benelux & Germany	3 + (0)	83
▪ France-Iberia	32 + (1)	83
▪ France-Benelux & Germany	14 + (6)	78
▪ France-Central-Europe	7 + (3)	93
▪ France-Italy&Malta	0 + (3)	92
▪ Nordel-Benelux & Germany	0 + (3)	75
▪ Nordel-Poland&Baltic	4 + (1)	60
▪ Benelux & Germany-Central-EU	0 + (4)	74
▪ Benelux & Germany-Poland&Baltic	9 + (1)	81
▪ Central-Europe-Poland & Baltic	0 + (2)	77
▪ Central-South East EU	1 + (2)	80
▪ Central-Europe-Italy	0 + (5)	58
▪ South East EU-Italy	9 + (1)	79
Total	**87 + (34)**	

3 Secure, safe and affordable energy

1. Making energy policy more consumer-friendly
2. Continuous improvement in safety and security (oil, Nuclear, H_2, CO_2,…)

4 Making a technological shift

1. Implementing the SET Plan (EERA, EII)
2. Four new large-scale European projects (Grids, Storage, Biofuel, Smart Cities)
3. Ensuring long-term EU technological competitiveness (€1 billion frontier research, ITER, Materials)

- Without a technological shift, the EU will fail in its ambitions to decarbonise electricity and transport by 2050 .
- Emissions Trading System is an important driver supporting deployment of low-carbon technologies.
- New technologies will reach markets quicker and more economically if they are developed through collaboration at the EU level.

5 Strong international partnerships

1. Integrating energy markets and regulatory frameworks with our neighbours (Participation, Stem carbon leakage)
2. Partnerships with key countries (suppliers and transit)
3. Strengthen EU position in promoting low-carbon energy globally
4. Promote legally binding nuclear-safety, security and non-proliferation standards worldwide

SET-plan

SET-Plan: technology pillar of EU's energy and climate policy

Goals:

- Accelerate knowledge development, technology transfer and up-take
- Maintain EU industrial leadership on low-carbon energy technologies
- Draw on science to achieve the 2020 Energy and Climate Change goals
- Contribute to worldwide transition to a low carbon economy by 2050

SET-plan pillars

- **European Industrial Initiatives (EIIs)**
  - industry, research, member states and Commission
  - risk-sharing, public-private partnerships
  - rapid development of key energy technologies
- **European Energy Research Alliance (EERA)**
  - aligning R&D activities of individual research organisations
  - addressing SET-Plan priorities
  - joint programming at EU level

The SET-Plan has two major timelines

- **2020**: accelerate the development and deployment of cost-effective low carbon technologies.
- **2050**: contribute to limiting climate change to a global temperature rise of 2°C, by reducing EU greenhouse gas emissions by 80 - 95%.
- Lower the cost of low-carbon energy
- Put the EU's energy industry at the forefront of the rapidly growing low-carbon energy technology sector.

SET-Plan Biofuels

Aim

- greenhouse gas emission savings of 60 % for bio-fuels

Activities

- 30 demonstration first-of-a-kind industrial plants, with large global market potential for numerous biomass resources
- longer-term research and demonstration

SET-Plan CCS

Aim

- Develop and demonstrate most promising CCS technologies
- Commercial viability of CCS under the EU Emission Trading Scheme by 2020.

Activities

- 12 industrial-scale CCS projects by 2015
- research programme building on and complementing the CCS demonstration activities

SET-Plan Elec. Grid

Aim

- Enable the transmission and distribution of up to 35 % of electricity from renewables by 2020
- Accommodate 100 % decarbonised electricity production by 2050
- Integrate national networks into a European market based network
- Ensure high quality of electricity supply
- Engage customers as active participants
- Anticipate electrification of transport

SET-Plan Elec. Grid

Activities

- Integrated R&D and demonstration programme
- Network of up to 20 large-scale demonstration projects covering diverse geographical, social and climatic conditions
- Monitor project progress according to common indicators and to enable successes to be replicated across Europe.

SET-Plan Fuel Cells & H

Aims

- enable mass market introduction in the timeframe 2015-2020

Activities

- long-term, pre-competitive R&D;
- large-scale demonstration projects in
  - road transport,
  - stationary power generation
  - hydrogen production and infrastructure
- development of regulations, codes and standards and life-cycle assessment

SET-Plan Nuclear

Aims

- Design and construct generation IV reactors
- First demonstration reactors expected 2020

Activities

- Develop sodium cooled fast reactor (SFR) and alternative designs using lead or gas-cooled technology (LFR, GFR).
- Pilot fuel fabrication for the start of operation of demonstration plants.
- Coordinated R&D programme for reactor safety, performance, lifetime management and waste management,

SET-Plan Smart Cities

Aims

- Support cities and regions that pioneer radical reduction of greenhouse gas emissions.
- Symbiosis of industries
- Waste as resource
- Attractive compact living
- Resource efficient
- Transport efficient

SET-plan Solar

PV and CSP

Aims

- Reduce cost of electricity
- Integration
- Substitute scarce materials

SET-plan wind

Aims

- Reduce cost of electricity
- Off shore, including deep water
- Integration
- Wind farms as virtual power plants
- Map resources
- 10-20 MW prototypes
- New concepts
- Manufacturing
- Installation in hostile conditions

Wind

- **Off-shore**
- Integration
- New concepts
- Manufacturing and installation
- Wind resources and conditions
- Reliability

Capacity doubled every 3. to 4. years

World 2010: 1.7 % of electricity production

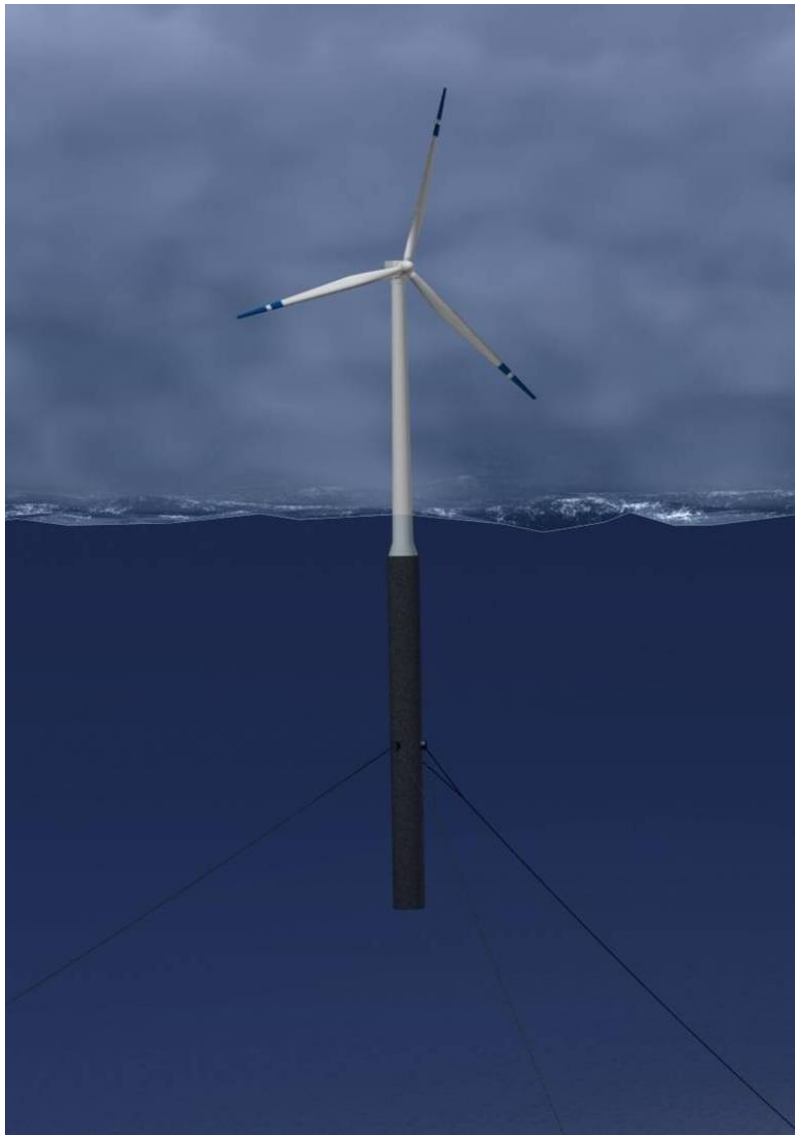
Denmark 2010: 20 %

Denmark 2025: 50 %

World 2050: 12-25 %

Strategic Research Agenda
Turbine design

- **Aerodynamics**
- **Aeroelastics**
- **Stability**
- Control
- Materials
- Structures
- Electrical
- **Hydrodynamics**



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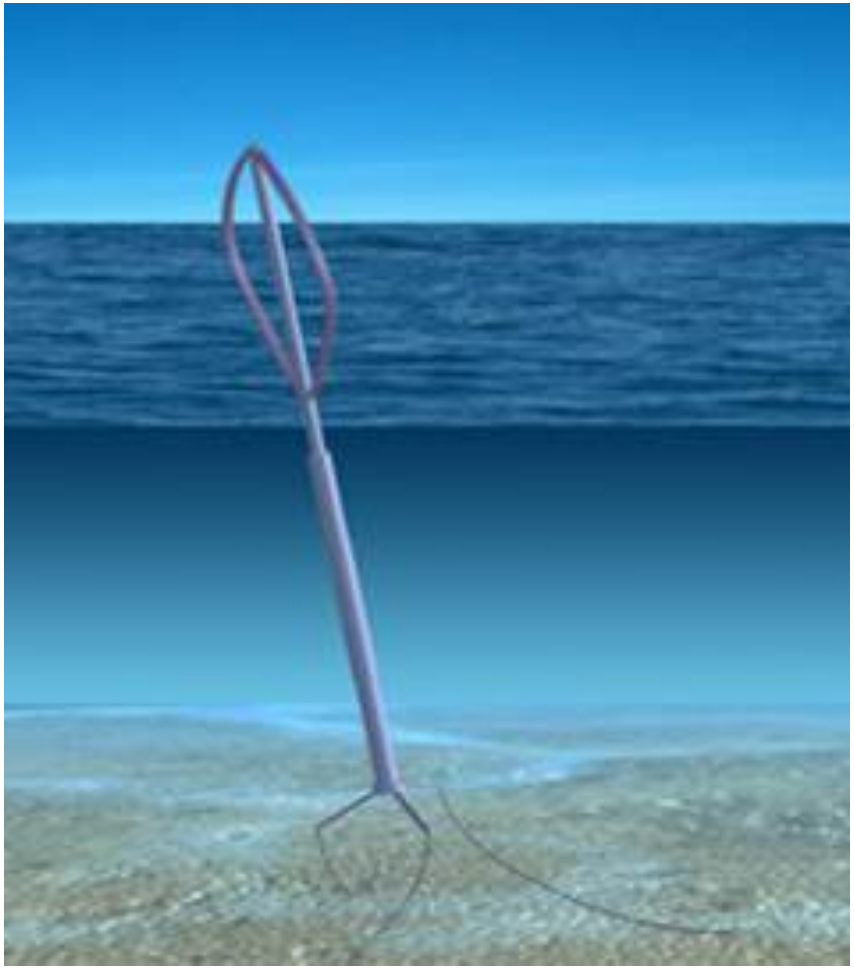
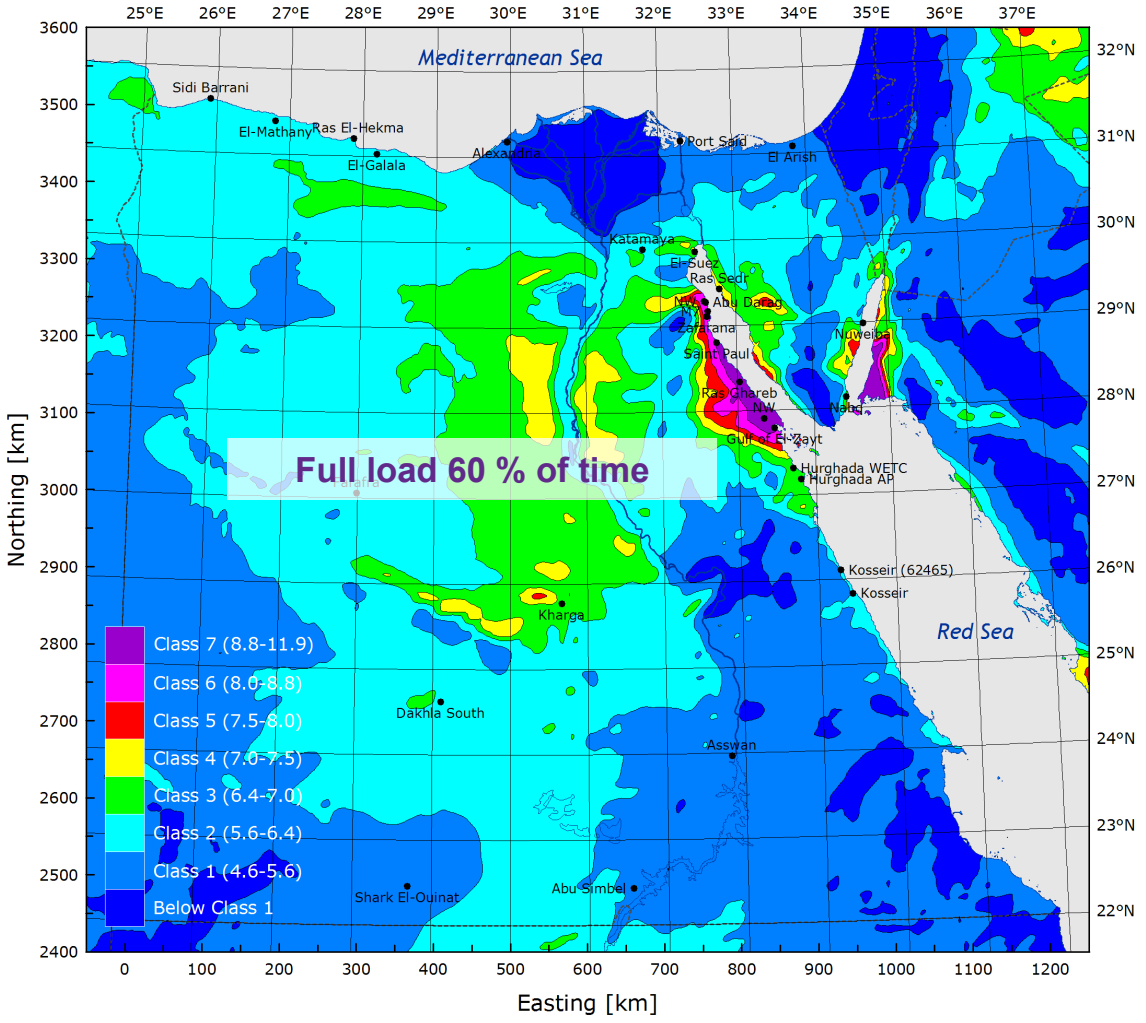


Strategic Research Agenda
Wind Conditions

- Siting
- design
- forecasting

- **Resources**
- Extreme wind
- Vertical profile
- Turbulence
- Complex terrain
- Wakes
- Offshore



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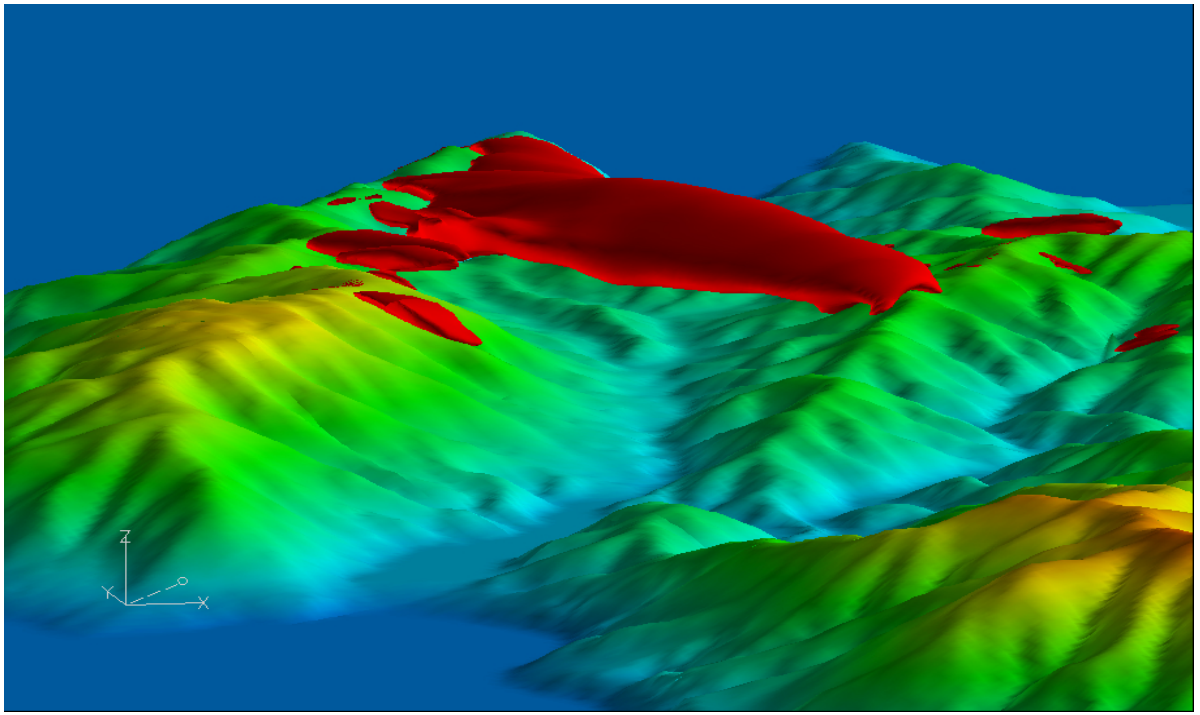

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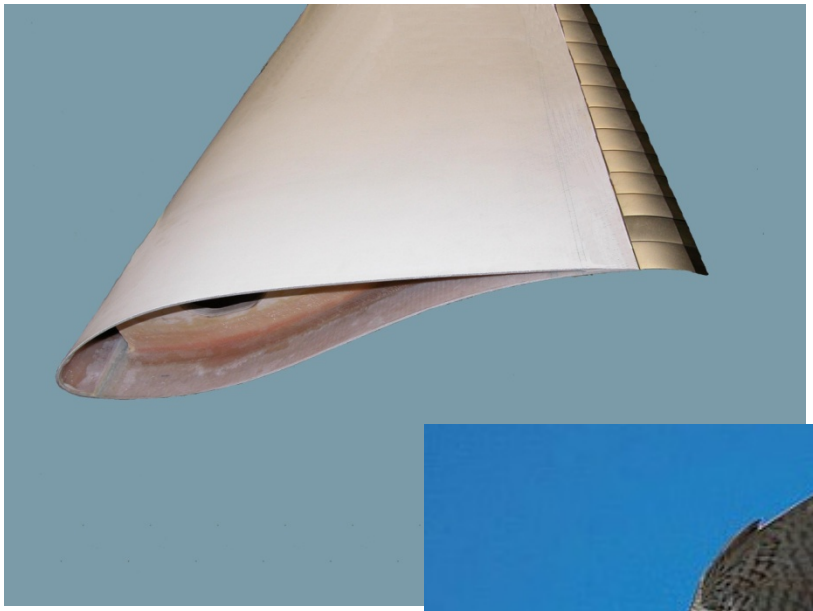

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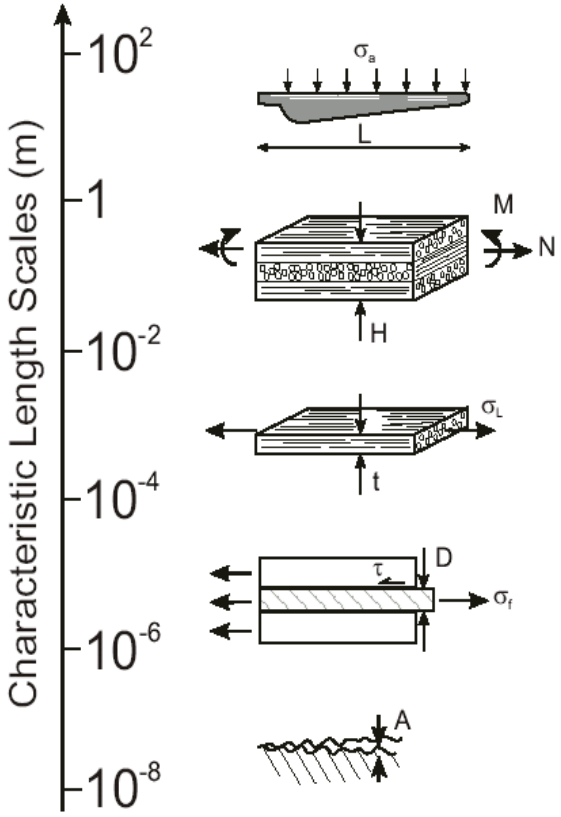
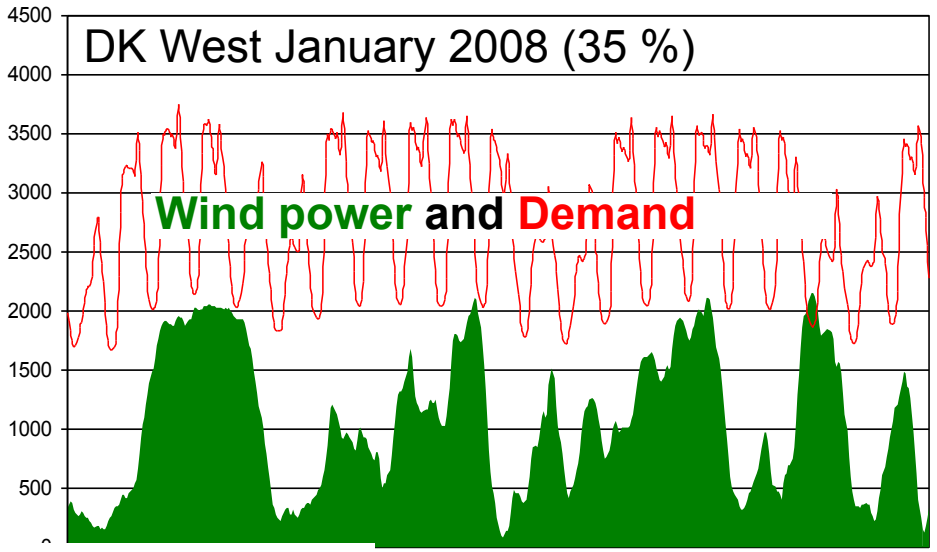
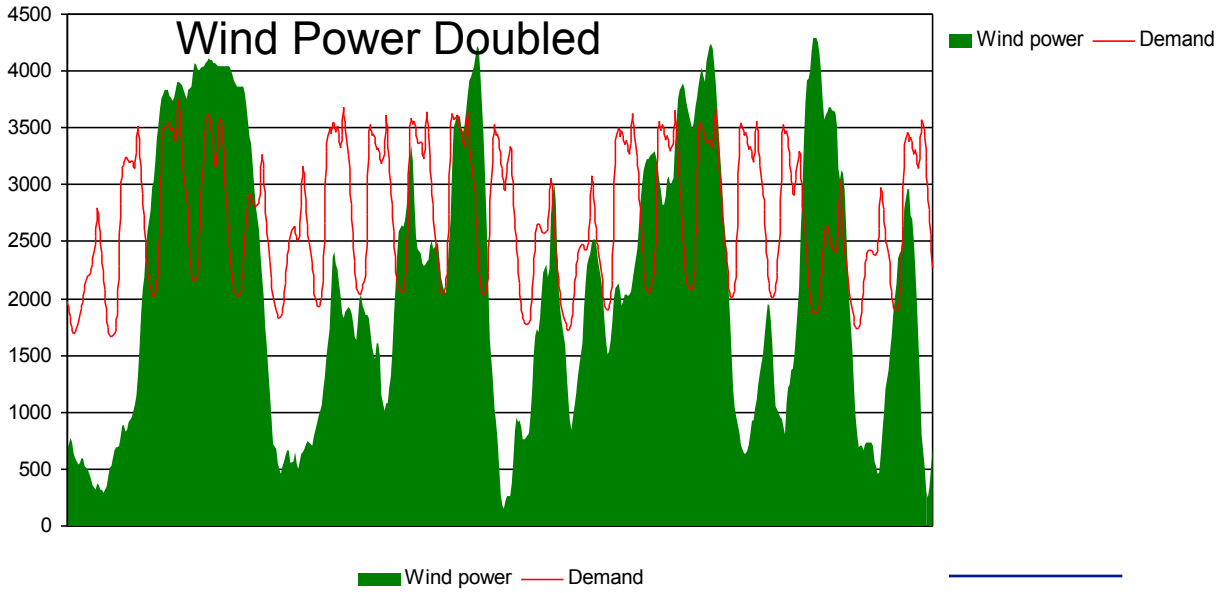


Strategic Research Agenda

Integration

- Wind power plants
- Grid codes
- Smart grids
- Super grids
- Forecasting
- Siting





Correlation in wind power

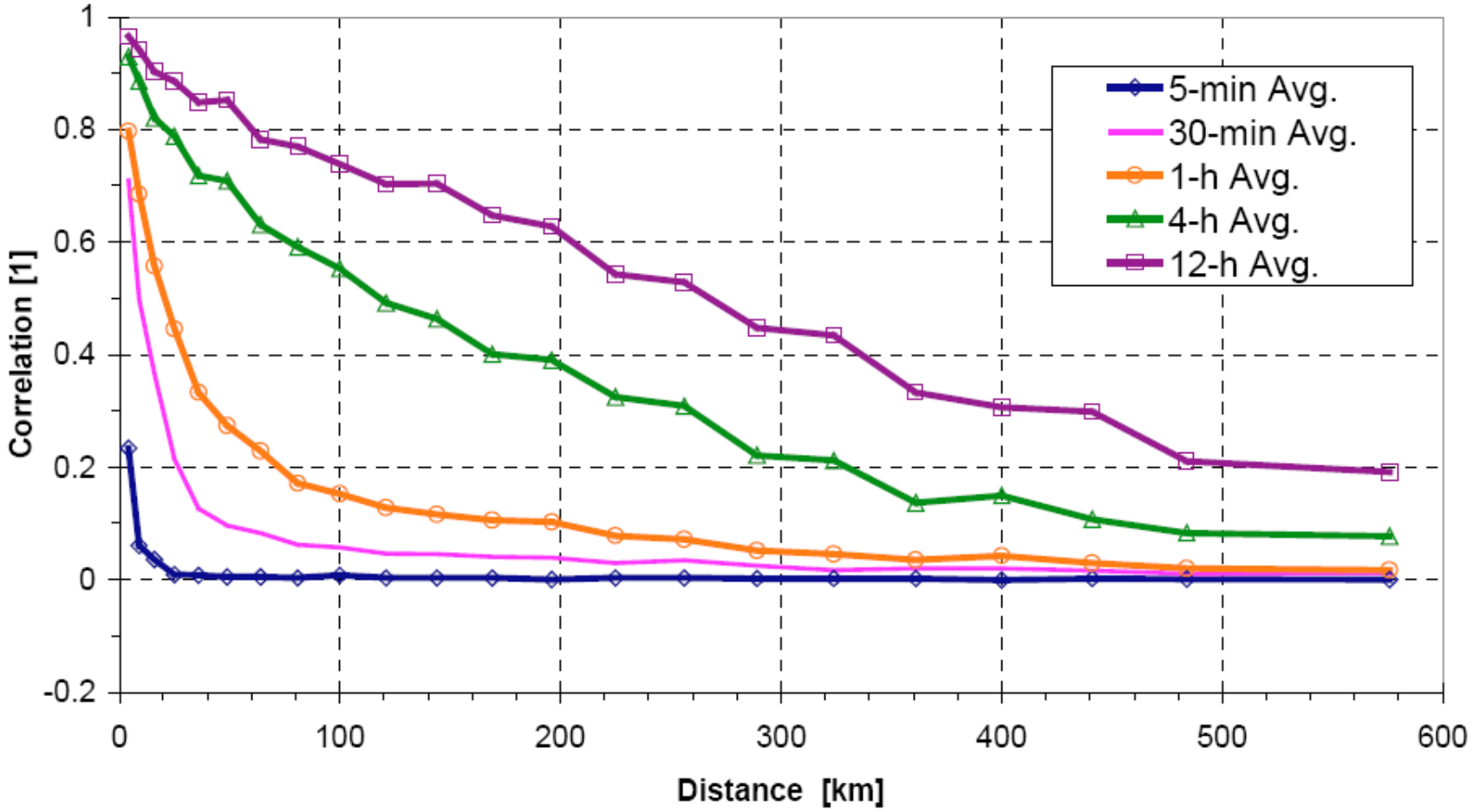


Figure 3: MEAN CORRELATION OF THE CHANGE OF WIND POWER (**ΔP**) VERSUS DISTANCE AT DIFFERENT AVERAGING TIME SPANS VERSUS DISTANCE DERIVED FROM MEASURED WMEP-DATA OF 176 TURBINES.

www.iset.uni-kassel.de/abt/w3-w/projekte/awea_2001_czisch_ernst.pdf

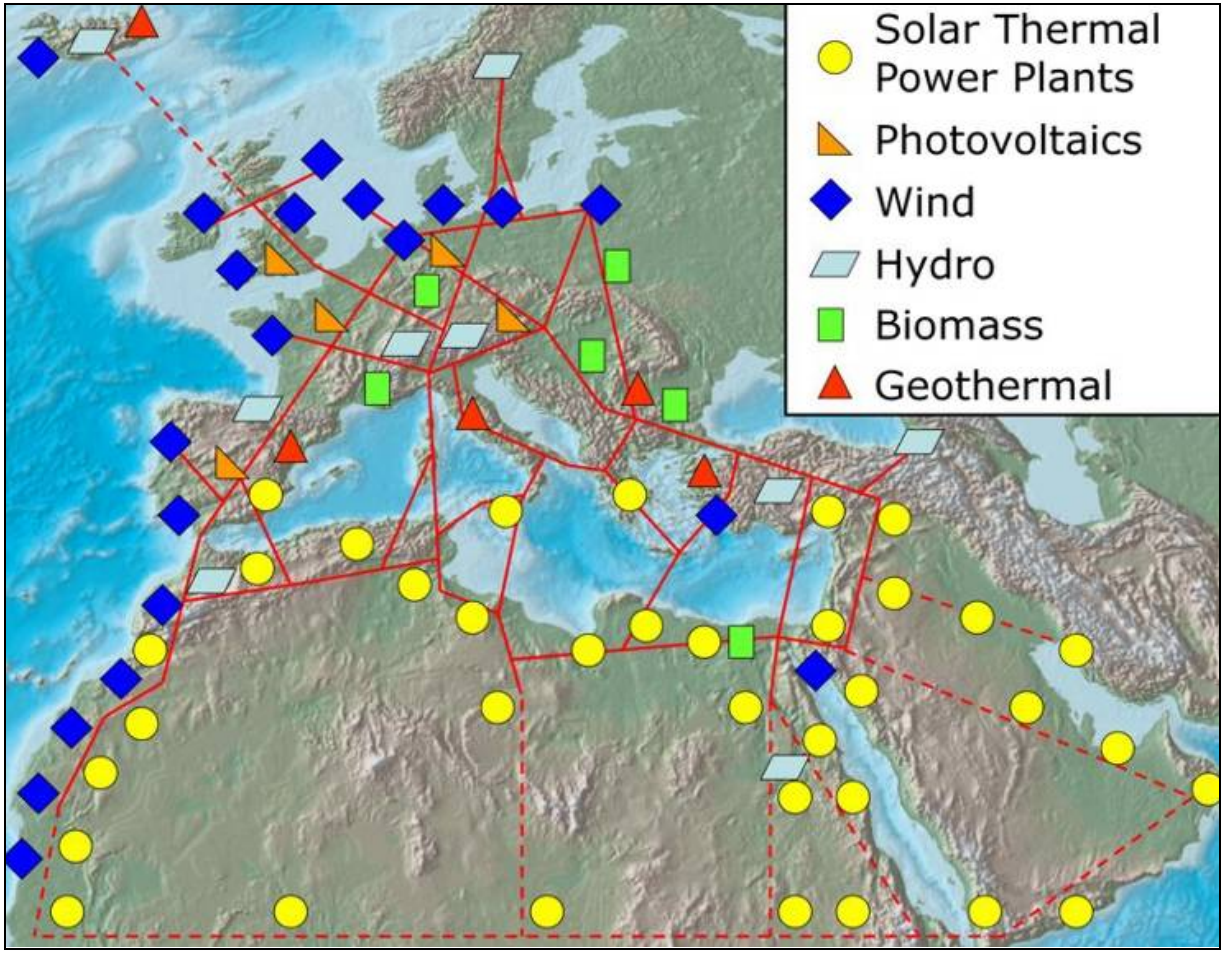
Integration and balancing

Long timescales

- **Super grids**
- Pump storage
- Bio-energy
- Synthetic gas & fuels

Short timescales

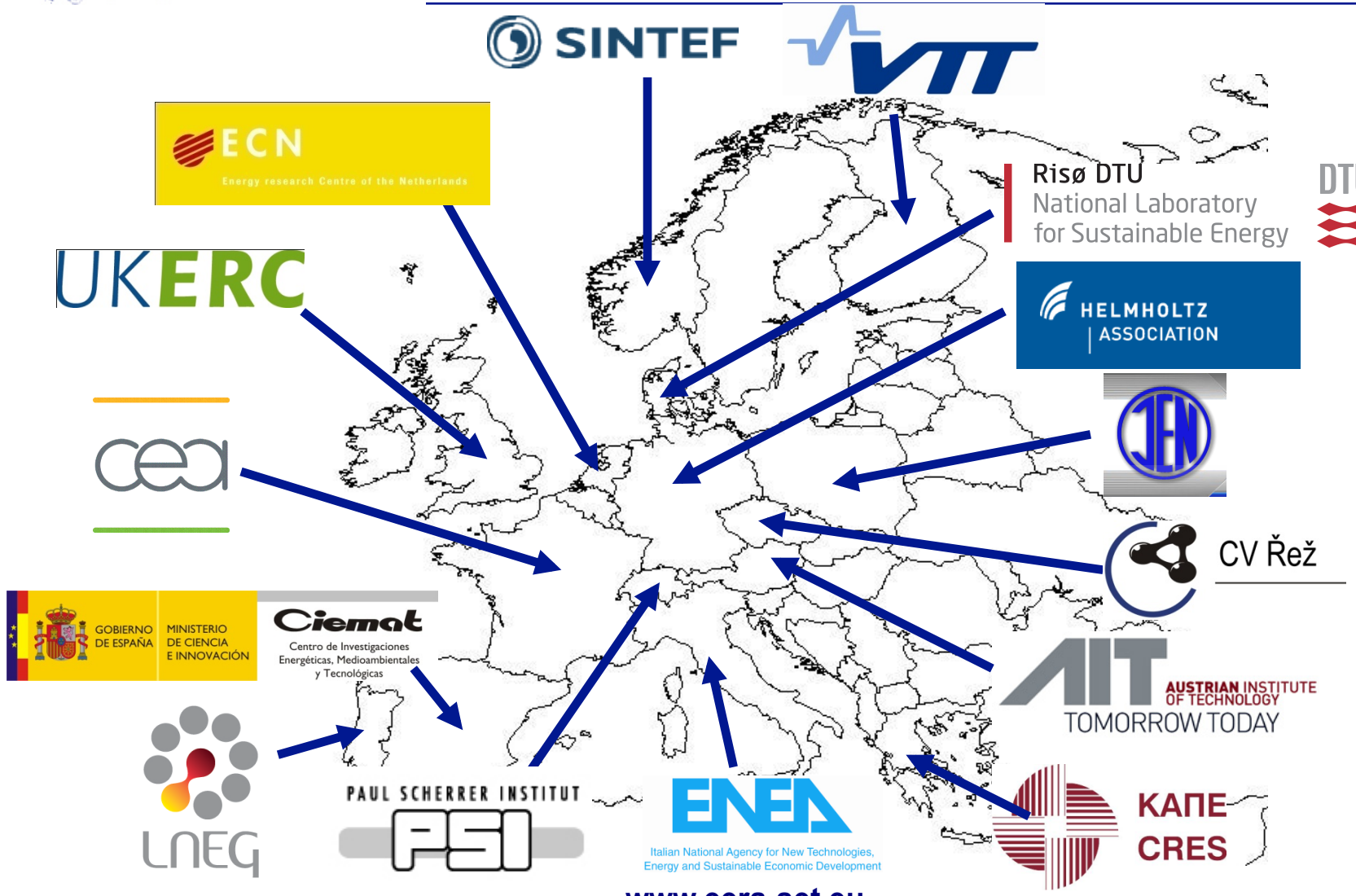
- Batteries
- Demand response
- Heat pumps
- Compressed air



What is EERA

- Cooperation of Energy Research Organisations
- 15 Partners
  - Responsible for EERA
  - Culture and Governance
  - Launch & review of EERA Joint Programmes
  - Partnership reviewed biannually, first time in 2012
- 100 Participating organisations
  - Responsible for EERA Joint Programmes
- 2000 professionals full time equivalent
  - Make it happen

Current EERA Partners



EERA mission

Through Energy Research

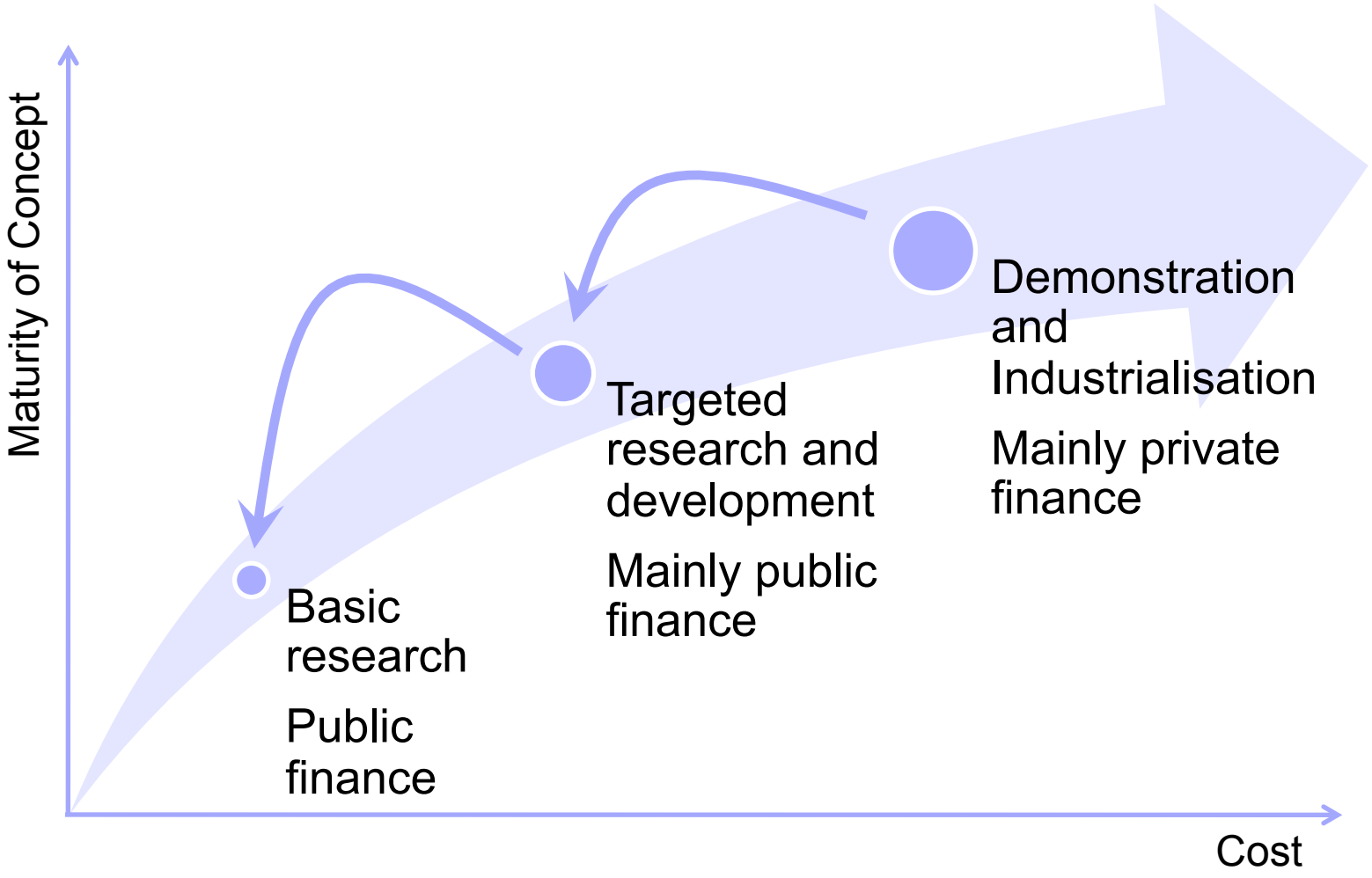
- Deliver on the objectives of the SET plan
- Accelerate development of new energy technologies

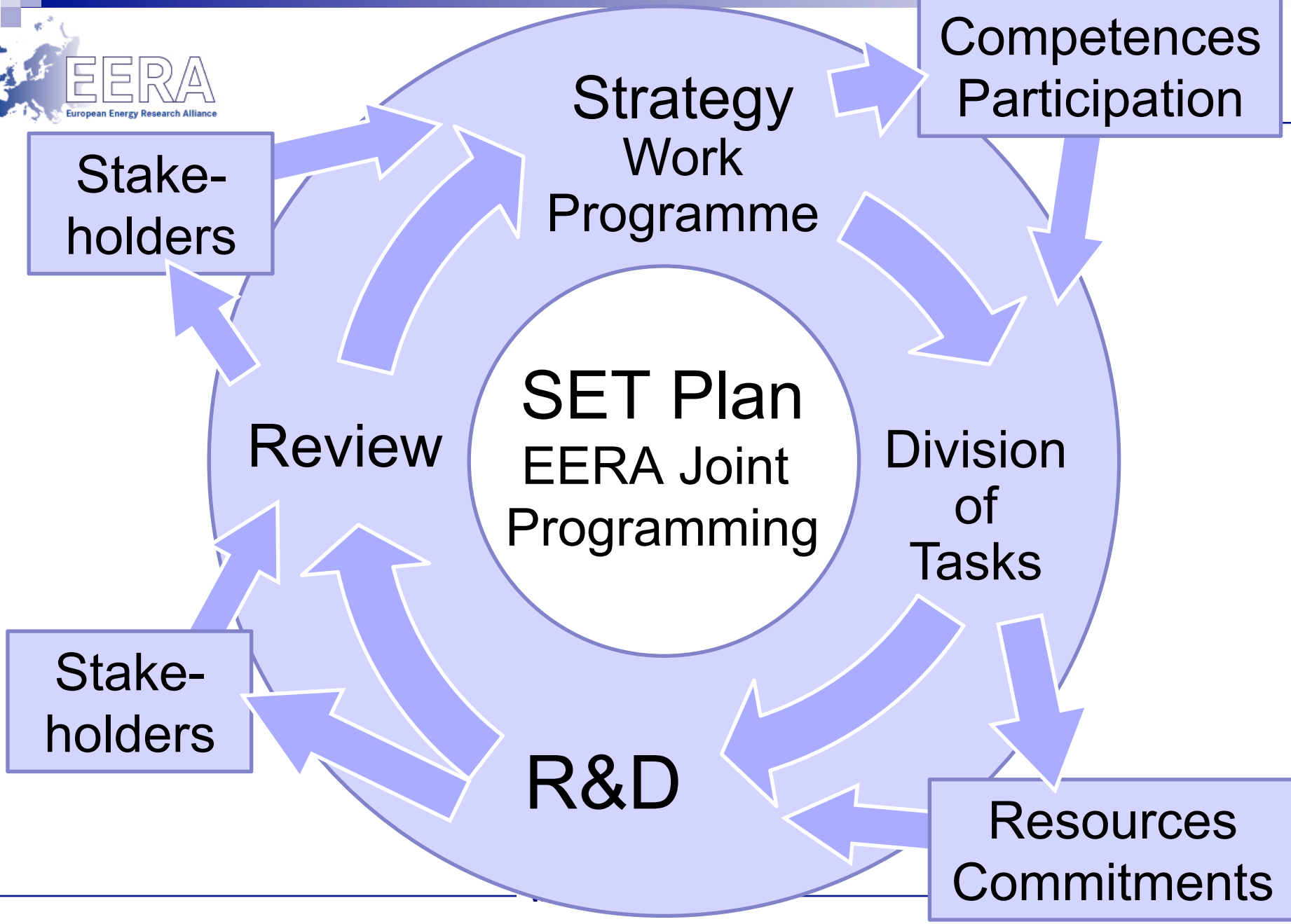
In Energy Research

- Improve coordination and cooperation
- Reduce duplication and fill gaps
- Increase efficiency and effectiveness


Review
Foresight
Grand
Challenge
SET plan
Joint
Programming
Strategic
Research
Agenda
Research
Innovation

Nonlinear innovation




EERA
European Energy Research Alliance
Stake-holders
Strategy Work Programme
Competences Participation
Review
SET Plan EERA Joint Programming
Division of Tasks
Stake-holders
R&D
Resources Commitments

EERA Joint Programmes

- Joint Programmes Launched June 2010
  - PV: ≈ 80 professionals*
  - Wind: ≈ 130 professionals*
  - Geothermal: ≈ 260 professionals*
  - Smart Grids: ≈ 100 professionals*

Participation increasing
New organisations joining

- Joint Programmes Launched November 2010
  - Bio Energy : ≈ 100 professionals*
  - CCS : ≈ 270 professionals*
  - Mat. Nucl. : ≈ 130 professionals*

Still start up phase !

* Full time Equivalent

EERA Joint Programmes

- Joint Programmes accepted for launch 2011
  - Concentrated Solar Power
  - Marine Energy
- Joint Programmes being developed
  - Energy Storage
  - Smart Cities
  - And more

Key players define programme at workshops organised by EERA and announced at www.eera-set.eu

EERA Joint Programmes

Clear and efficient coordination

Long term strategy and work plan

- Comprehensive coverage of research topic (minimise gaps)
- Agreed Objectives and Milestones
- Agreed Description of Work
- Agreed Division of Tasks and Responsibilities
  - Context supporting specialisation of Participants
  - Virtual centres working as one team on one topic

Added value of European cooperation

EERA Joint Programmes build on

- Vision and Trust
- Willingness and ability to give and take
- Concentrate on what you are best at and rely on EERA to provide comprehensive context
- Long term relationship
- Respect of National and Community objectives
- Efficiency and added value
- Clear governance and IPR policy

EERA Congress

- Review of Added Value
  - Progress and Results
  - Efficiency and Effectiveness
  - Quality and Relevance
- Review Strategy and Work plan
  - Challenges and Opportunities
  - Gap analysis
- Review Organisation
- Review Interaction with Stakeholders
- (S)election of Partners
- EERA chair reports to General Assembly of Participants

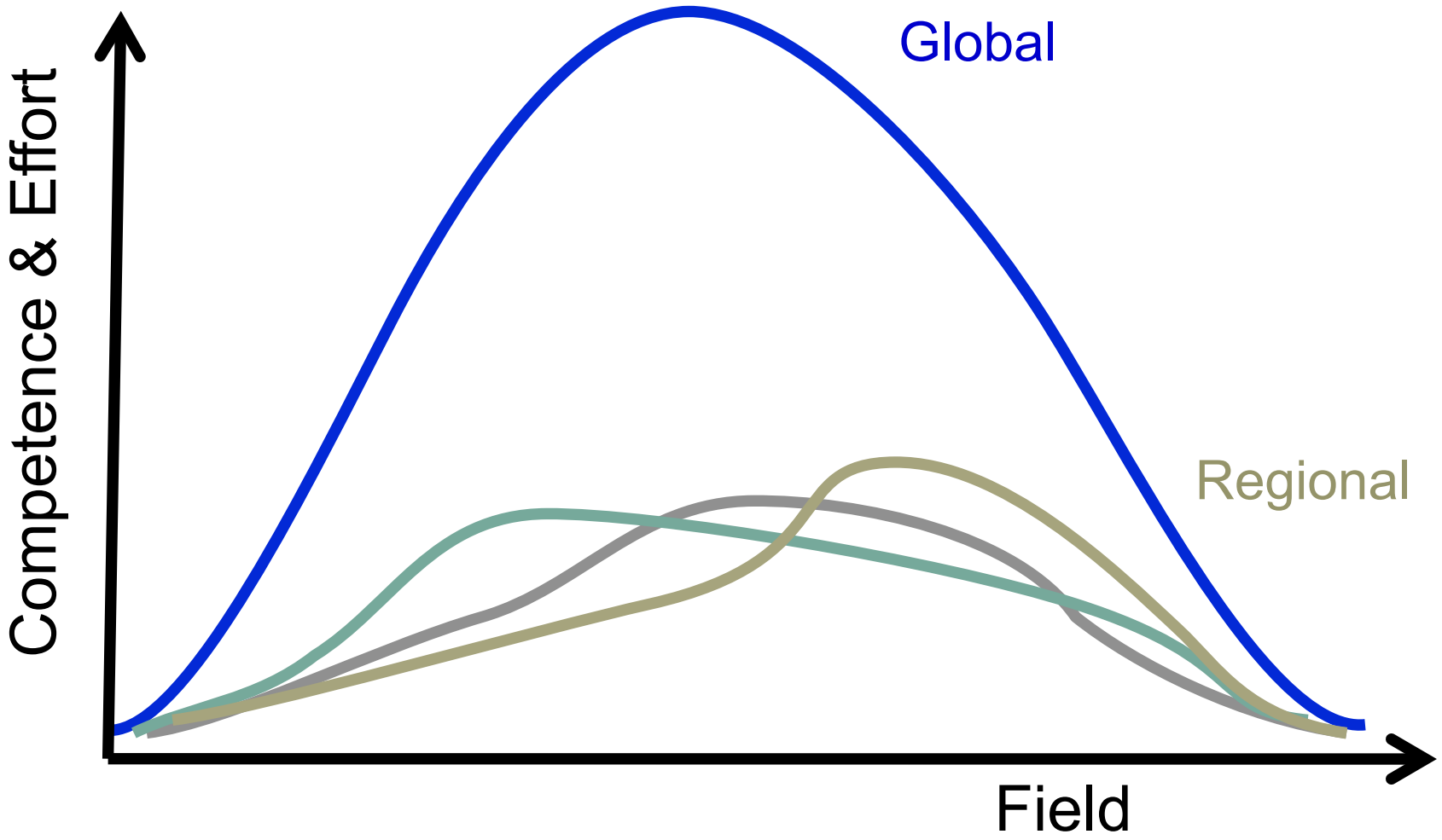
Valuable at both EU and MS level

Involve
- Industry
- Policy makers
- Funding organisations

EERA Joint Programming

- Creates Comprehensive Programme (its all there)
- Creates Cohesive Programme (and its connected)
- Fosters Specialisation
  - Do what you are best at
  - EERA provides comprehensive and cohesive context

Comprehensive regional programmes



Regional concentration