

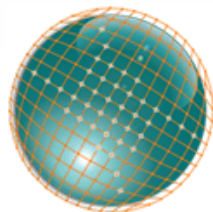
EU Electricity Grid Research Programme

Addressing DER Integration



Wiktor Raldow

European Commission, DG Research - Energy



4th International Conference on
**Integration of
Renewable and Distributed
Energy Resources**
December 6-10, 2010
Albuquerque, NM, USA

Conference Sponsors



Associate Sponsors



Presentation outline

- Policy perspective
- European electricity grids – the need to change
- The European Electricity Grids Initiative
- European Framework Programme for RTD
- International cooperation

Policy perspective

- Europe 2020 strategy:
smart, sustainable, inclusive growth
 - Innovation Union, Resource efficient Europe
- Energy policy
 - Sustainability, competitiveness, security of supply
 - Infrastructure to underpin energy choices
- Energy research and innovation
 - Strategic Energy Technologies Plan – SET Plan
 - Framework programme - excellence in research
- 3rd Internal Energy Market legislation
 - Unbundling of networks and generation
 - Deployment of smart meters, smart grids

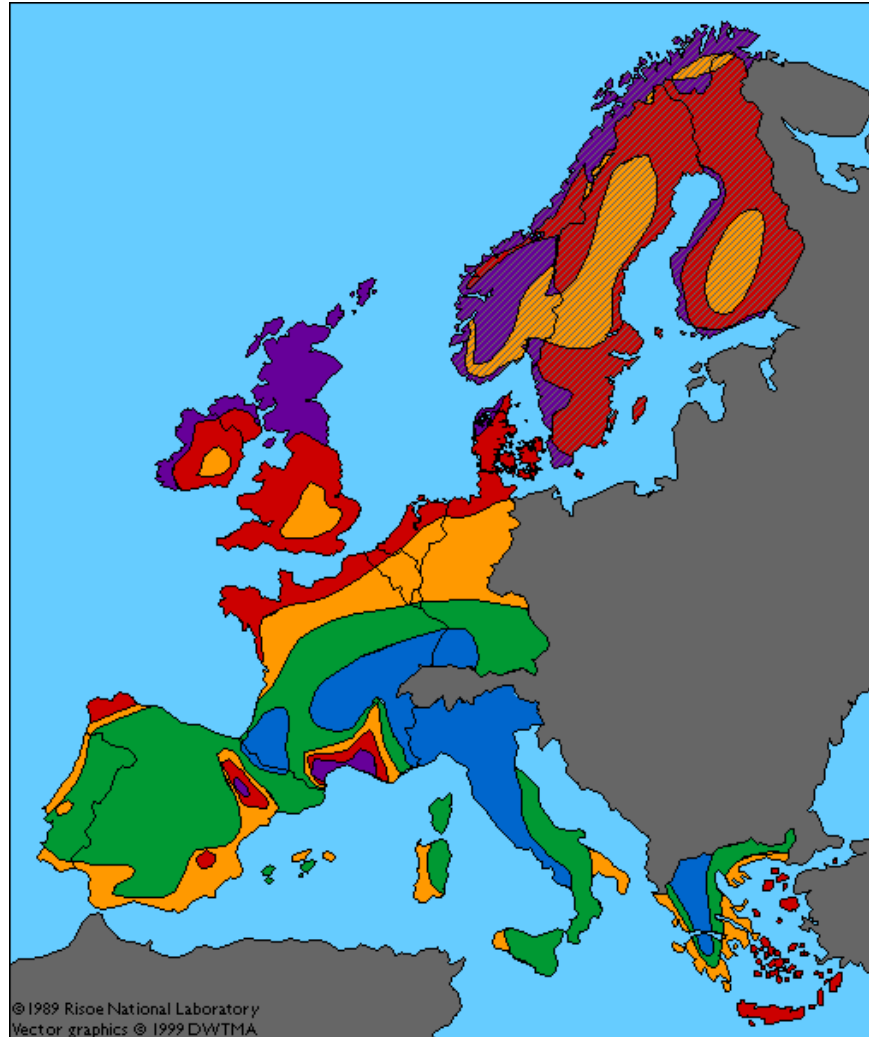
Electricity grids need to change

- 30-35% electricity from renewables in 2020
- Electric vehicles, heat pumps, Intelligent buildings, ..
- Active demand, prosumers
- Ageing infrastructure needs to be replaced, cost containment: capital & operational
- Grids need to be flexible

RES integration issues: examples today

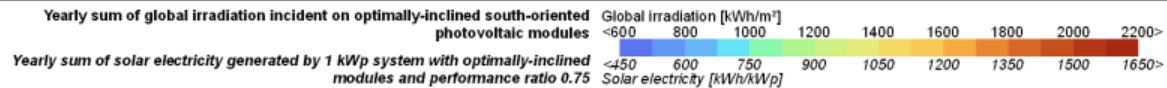
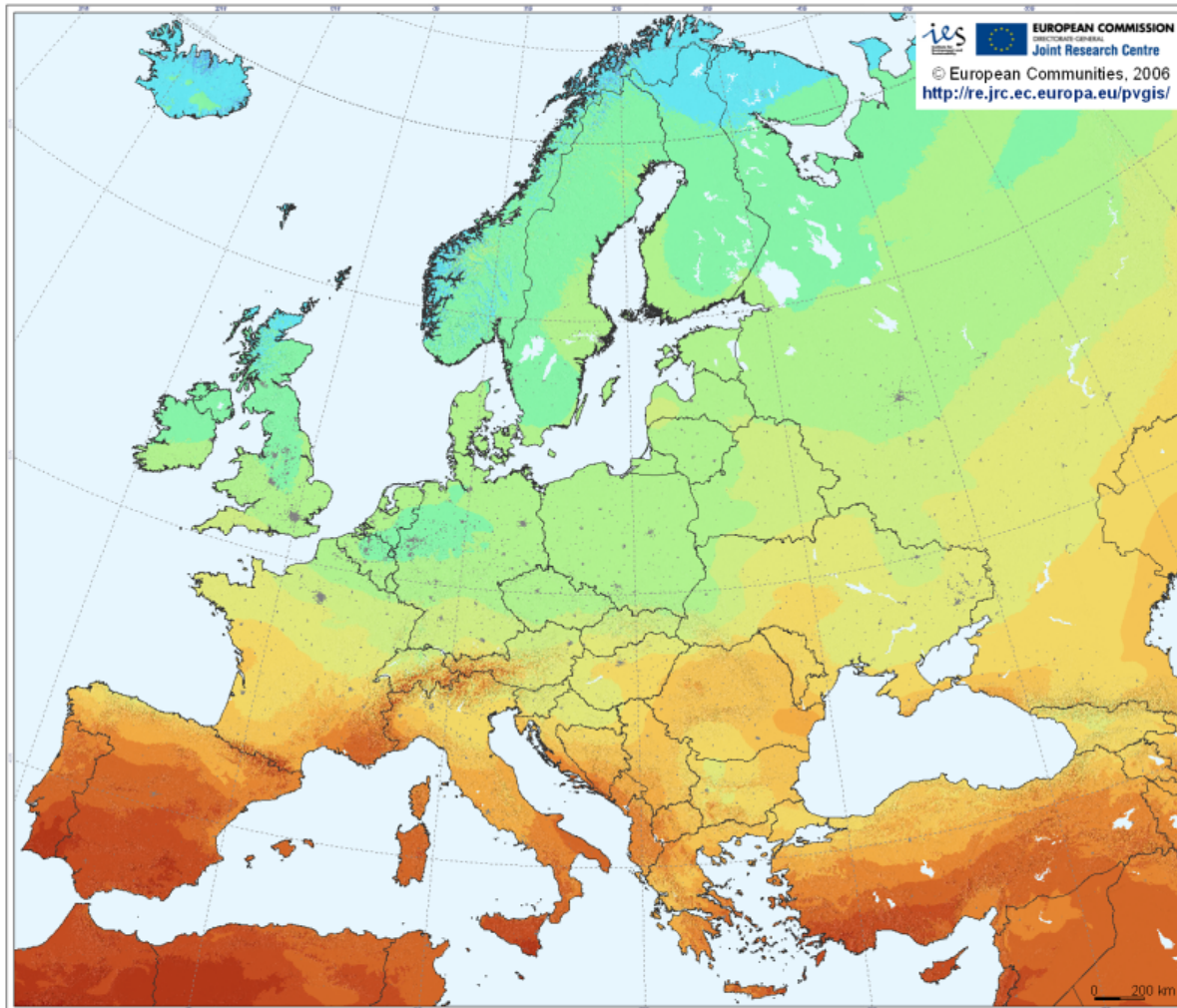
- Denmark: $\pm 20\%$ total electricity from wind
 - DK-West: wind $>$ load several times per year
 - Export to Germany, import from Norway (hydro)
- Germany: 27 GW Wind, concentration in North
 - North - South transmission congestion
 - Flows through adjacent countries – “loop flows”
- Spain: 19 GW Wind, 3 GW solar
 - Local congestions
 - Risk for curtailment

(West-) European wind resources



European solar resources

Photovoltaic Solar Electricity Potential in European Countries



Natural resources are not equally distributed

- Wind in the North Seas and Mediterranean
- Solar energy in the South
- Hydropower in the Alps and Scandinavia
- Bio-energy important in forested areas

RES contribution to the grids

- Renewable generation will more often provide the majority of power on the network
- Better prediction of renewable generation is needed
- RES will need to contribute to the stability and operation of the network
 - Ancillary services for frequency and voltage control
- Changes needed in technology, regulation and market architectures

Grids need to link all producers and users

- Interconnection of national grids
- Active networks, especially at distribution level
- Deployment of suitable technology
- Appropriate allocation of costs and benefits
- Long-term coordinated planning and coordinated operation
- Electricity highways

Strategic Energy Technologies Plan

“The technology pillar of energy-climate policies”

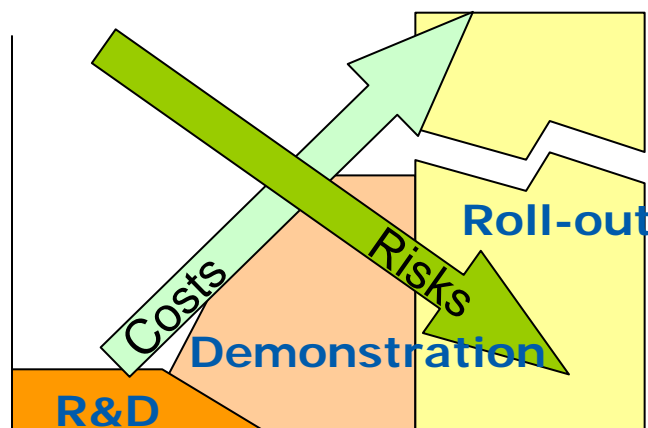
- Objective:
 - To accelerate the development of a portfolio of low-carbon technologies up to market take-off
- Joint Initiative EU – Member States
- Public-private partnerships

SET Plan implementation

- Industrial Initiatives: Wind, Solar, Grids, CCS, Bioenergy, Nuclear, Fuel cells and Hydrogen, (Smart Cities)
- European Energy Research Alliance: alignment of national energy research laboratories
- SET information system (SETIS): monitoring and reporting

Electricity Grids Initiative (EEGI)

- A SET Plan industrial initiative with 2020 horizon
- An integrated RTD programme
- Large-scale demonstrations to validate solutions
- Risk reduction for new technology deployment



- Analysis of technical performance & business cases
- Support to scaling up and replication

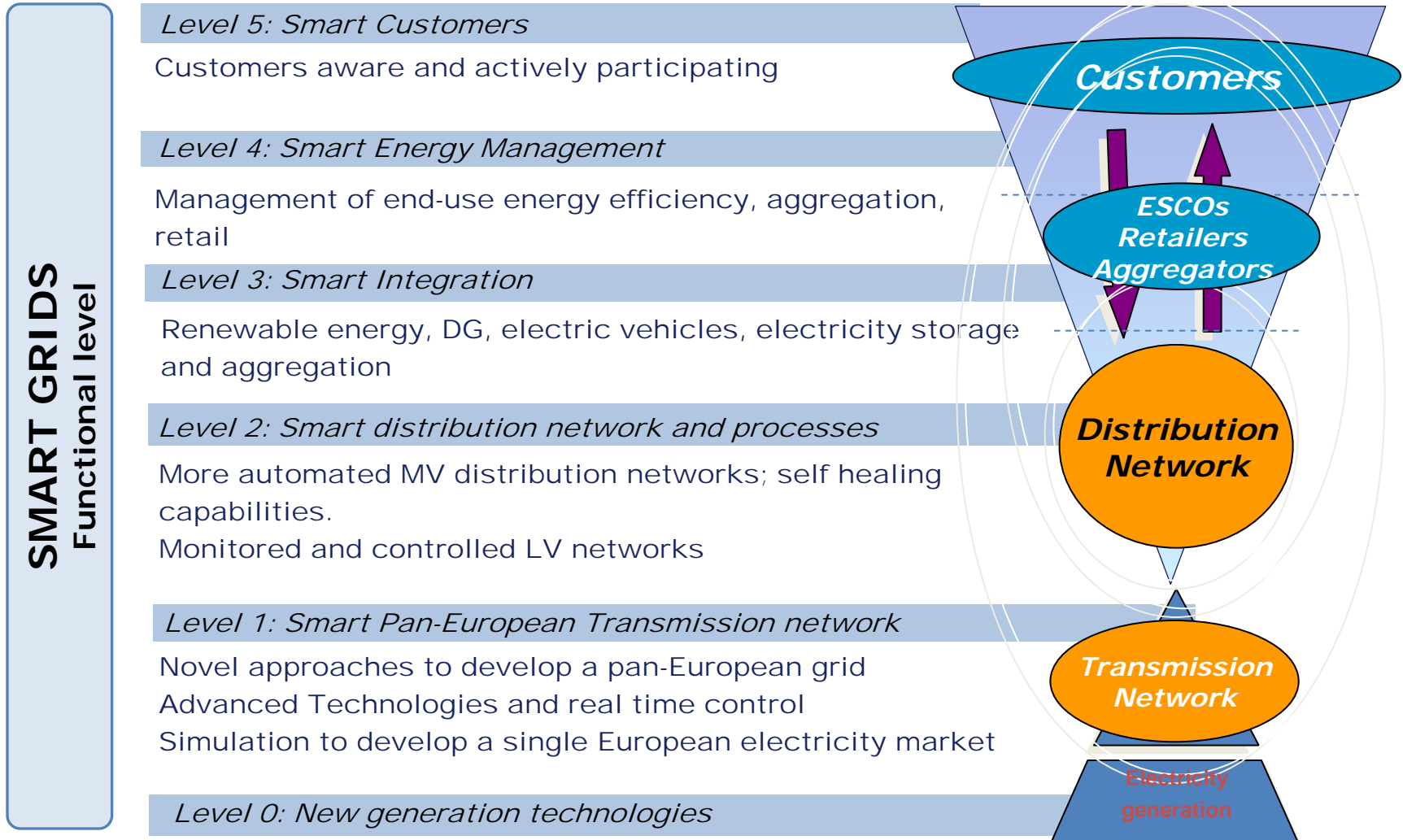
EEGI coverage

- Technology
 - to make networks smarter and stronger
- Market design
 - to allow integration of distributed resources, active demand and user engagement
- Information exchange
 - at European level to maintain reliability at affordable cost
- Interaction with regulators
 - to ensure a gain for the customer

EEGI implementation

- Focus on system-level innovation
- Led by transmission and distribution network operators
- Implementation plan agreed by industry, European Commission, Member States
- Projects identified, starting 2010-2014
- Smart Grids Strategic Research Agenda of the Technology Platform will cover 2050 horizon

A model for the EEGI



EEGI activities for distribution networks

- Integration of DER and new uses
 - Distributed generation, storage, electric vehicles
- Smart Customers
 - Active demand, integration with smart buildings
- Smart Metering
 - Metering Infrastructure, meter data processing
- Smart Distribution Networks
 - Network Automation
 - ICT Infrastructure
 - New business processes for network operators

EEGI activities for transmission networks

- Pan-European grid architecture (R&D)
- EU-level coordination of operations (R&D)
- Demonstration of new technologies
- Pan-European market mechanisms (R&D)
 - Integration of renewables, active demand
 - Balancing markets, congestion management

EEGI joint activities distribution and transmission

- Making distributed resources visible for the System Operator
 - Distribution-connected generation, active demand
- Frequency and Voltage control services provided by DSO
- Coordinated defense against disturbances and restoration plans after black-out
- IT system protocols and data exchange standards

EEGI support

- European Commission investment through the Framework Programme for RTD
- Member States national RTD programmes
- Projects supported through regulatory incentives
- Industry (co-)financing
- Funding under different schemes require
 - Coordinated planning
 - Reporting and knowledge sharing

Framework Programme for RTD

- European RTD:
5% European Commission, 95% Member States
- FP7: more than 50,000 M€ over 2007-2013 covering priority areas at EU level
 - Energy Theme: 2,350 M€
- Support of FP7 to SET PLAN
- Grids: 160 M€ committed so far 2007-2010
 - 2011-1 Call: 20M€ for transmission R&D
 - 2011-2 Call: 30 M€ for storage demonstration

FP7 RTD support to electricity grids

- Pan-European transmission networks
 - RTD on tools for coordination of operations, markets
 - Technology demonstrations e.g. TWENTIES
- Smart distribution networks
 - RTD on active demand e.g. ADDRESS
 - Demonstrations of active distribution networks
- Other activities
 - storage, superconductivity, impact of electric vehicles
 - Standardisation, DER integration e.g. DER-LAB
- ICT activities
 - ICT infrastructure, smart houses to smart grids

Example: TWENTIES (transmission)

Demonstration of critical technologies to improve pan-European transmission with

–increase of RES (wind)

–high reliability

–efficient contribution of RES to electricity market

26 partners

11 countries

Total budget 57 M€

Frequency & voltage support from wind generation and flexible load

2 demonstrations

Technology blocks for offshore wind development

2 demonstrations

Flexibility, security and hosting capacity

2 demonstrations

Cost/benefit impacts of demonstrations, scaling up

EU-wide replication potential of the demonstrations

Removing barriers for offshore deployment

Example: ADDRESS (distribution)

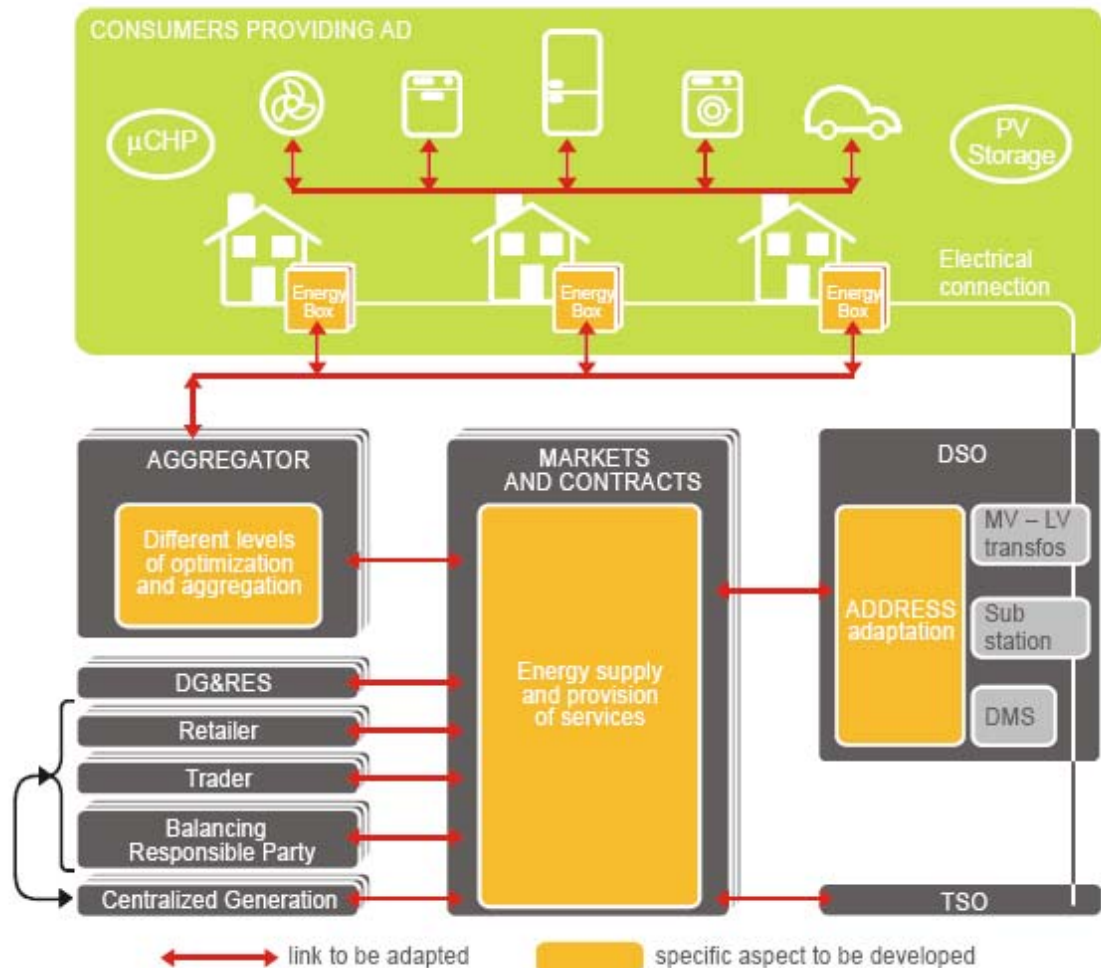
Demonstration of integration of active demand and distributed RES through active distribution networks

Technical and commercial demonstration and validation

25 partners

11 countries

Total budget 16M€



Example: DER-LAB (RES integration)

Network of European laboratories for DER integration:

- joint research,
- pre-standardisation,
- staff exchange,
- training, education

11 partners

11 countries

Total budget 16M€

Behaviour under fault conditions:
"fault ride-through, restoration

Local energy management:
local generation, load, storage

DER Communication and control:
protocols, virtual power plant

Ancillary services from DER:
balancing power, voltage support

International Cooperation

- Smart Grids: common issues across the world
 - Integration of RES, energy efficiency, security of supply
- FP7 open for participation of international partners
 - Mutual interest, with/without financial support
- EU-US Cooperation under Technology RTD Working Group of EU-US Energy Council
 - Workshops on storage, electric vehicles, assessment methodologies, ...
- Multilateral cooperation under ISGAN
 - Forum to discuss standards, best practice, etc.

In short

- Electricity grids are crucial for the energy future
- Overall objectives are the same across the world; RTD programs focus on the same issues
- Europe is active and open for cooperation

Thank you

- EEGI implementation plan:
<http://www.smartgrids.eu/?q=node/170>
- Energy RTD
http://ec.europa.eu/research/energy/eu/index_en.cfm
- Energy policy
http://ec.europa.eu/energy/index_en.htm
- Framework programme for RTD
http://cordis.europa.eu/home_en.html
- SET Plan information system
<http://setis.ec.europa.eu/>