

ASSESSMENT OF OPPORTUNITIES IN RELATION WITH SUSTAINABLE ENERGY FUTURE FOR E.U.



**REQUIRED MEANS AND
RESOURCES FOR LONG
TERM R&D IN ENERGY**

**A TECHNICAL AND
ECONOMIC
PERSPECTIVE**

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Towards the European Energy Research Area

Recommendations by the ERA Working Group
of the Advisory Group on Energy

Key Tasks for future European Energy R&D

A first set of recommendations
for research and development by the
Advisory Group on Energy

SOME KEY MESSAGES



- 🌀 The only route to a sustainable energy system is through new or improved energy technologies that will have to be found through research and development.
- 🌀 No single energy technology on its own will provide the solution, so research must be carried out across a wide range of technology options,
- 🌀 Targeted research should be performed in a range of energy technology areas, but on well-selected topics, tackling key tasks where a technical breakthrough would dramatically improve our chances of making our energy system sustainable.
- 🌀 Research across Europe is fragmented.
- 🌀 It is necessary a well-coordinated approach across Europe, and a pooling of the resources available at regional and national levels.



Some economic facts



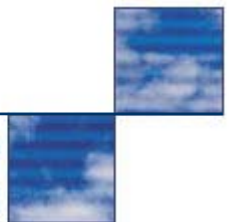
- 🌀 Commission-funded energy R&D expenditure has decreased dramatically over time, in real terms by almost a factor of four over the past 25 years.
- 🌀 Parallel declines have occurred in funding by EU Member States and by private industry, the latter accelerated during the last decade in the energy utilities by the liberalization of the energy market.
- 🌀 The new energy technologies which are needed will not be delivered quickly. The increased R&D effort should start now, and will have to continue over a long period of time.



European Commission expenditure on energy R&D

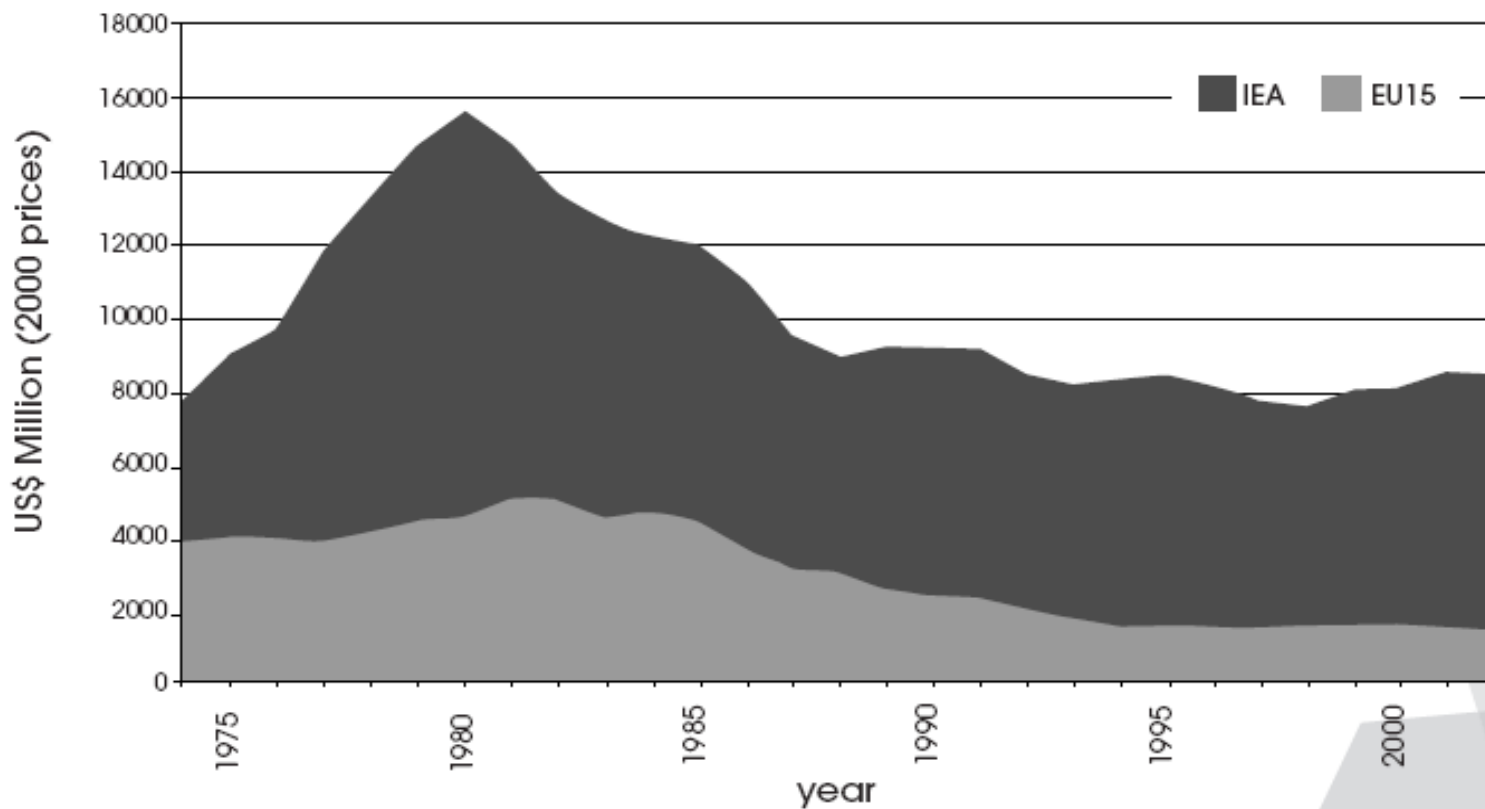


Framework Programme number	Total R&D (G€)	Energy R&D (G€)	Energy R&D (% of total R&D)
Before Framework Programmes			66
1 - 1983 to 1986	3.8	2.508	66
2 - 1987 to 1990	5.4	2.700	50
3 - 1991 to 1994	6.6	1.506	23
4 - 1995 to 1998	13.2	2.904	22
5 - 1999 to 2002	14.9	2.700	18
6 - 2003 to 2006	17.5	2.040	11.6





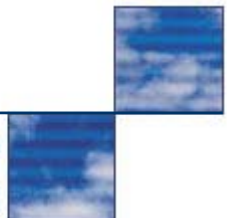
Government energy R&D Expenditures 1974 - 2002



Energy public subsidies (EEA)



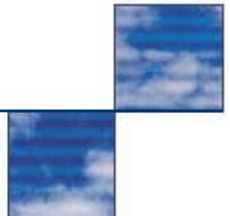
Energy Source	EU 15 Subsidy in 2001: G€
Coal	13.0
Oil and Gas	8.7
Nuclear Fission	2.2
Renewables	5.3
TOTAL	29.2



Energy technology options



- ⌘ Biomass energy (heat, electricity, transport)
- ⌘ Fuel cells (heat, electricity, transport)
- ⌘ Geothermal (heat, electricity)
- ⌘ Hydrogen-related technologies (heat, electricity, transport)
- ⌘ Near-zero emission power generation based on fossil fuel, including pre- and post-combustion CO2 separation and storage (Electricity)
- ⌘ Nuclear fission (electricity)
- ⌘ Nuclear fusion (electricity)
- ⌘ Ocean energy: wave; sea current (electricity)
- ⌘ Solar photovoltaic (electricity)
- ⌘ Solar thermal (heat)
- ⌘ Solar thermoelectric (electricity)
- ⌘ Wind energy (electricity)





BIOMASS

- Development of processes for production of bioethanol from lignocellulosic material
- New energy crops for solid and liquid biofuels
- Gasification of biomass





CLEANER USE OF COAL

- Improve the efficiency of the current methods of using fossil fuels, high-temperature materials, super-critical and ultra-super-critical steam generation

- Pressurised-fluidised-bed combustion (PFBC), integrated gasification combined cycle (IGCC) systems, coal gasification, including hot-gas-clean-up techniques,

- New processes which can separate and capture CO₂

- Long-term CO₂ storage





FUEL CELLS

- R&D on improved PEFC fuel cell stacks,
- Demonstration in vehicles
- SOFCs and MCFCs for stationary applications



HYDROGEN AS ENERGY CARRIER

- improve cost-effective production: water or high-temperature steam electrolysis. explore schemes to generate H₂ biologically, photo-biologically and via high temperature thermal splitting of water (Nuclear or Solar Thermal HT)

- Development of lightweight, compact hydrogen storage systems





NUCLEAR FISSION

- Safety and security in nuclear power facilities
- Safe final disposal of the radioactive waste
- R&D on innovative reactor design and advanced fuel cycles

NUCLEAR FUSION

- Built the International Thermonuclear Experimental Reactor (ITER)
- Built the International Fusion Materials Irradiation Facility (IFMIF)





PHOTOVOLTAIC

- Development of new processes for solar grade silicon feedstock
- Novel thin-film modules and production techniques.
- Exploration of novel PV materials, including organics, and new production technologies.





WIND

- Better understanding of wind resources, particularly in complex terrain and offshore, and power output forecasts

- 'Fourth-generation' wind turbine technology. New concepts and materials

- Offshore installations

- Grid integration.



Technology platforms. A new instrument.



🌀 **STAGE 1:** Emergence and setting-up of technology platforms: Stakeholders getting together. Elaboration of a **“Vision Document”**

🌀 **STAGE 2:** Technology platform activities and deliverables: Stakeholders define a **Strategic Research Agenda** and a **Deployment Strategy**. Define mechanisms to **mobilise the private and public investments**. Identify challenges and actions related to **education and training** and Establish an ongoing **communication** process,

Technology platforms: Stakeholders



- 🌀 Industry
- 🌀 Public authorities. Member states “Mirror Group”
- 🌀 Research Institutes and the academic community
- 🌀 Financial community
- 🌀 Civil society, including users and consumers



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