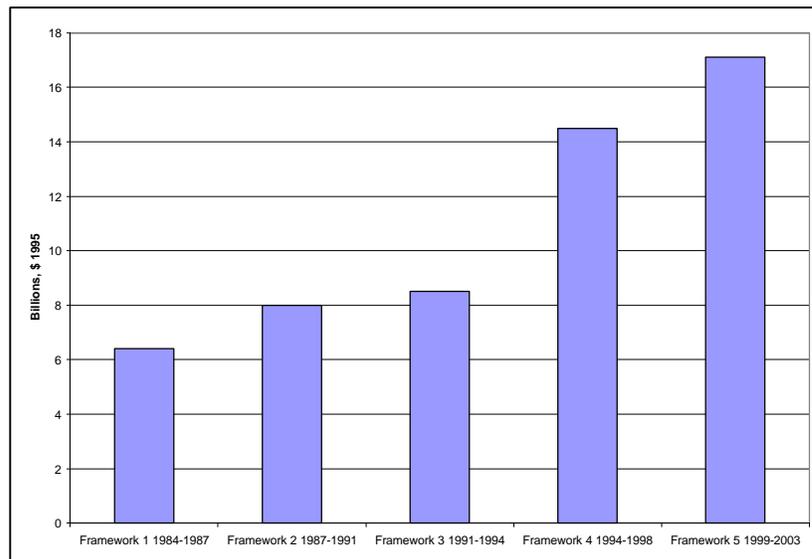


R&D In The European Union

The European Union is a major sponsor of research and development activities in many socio-economic areas. The EU sponsors research in support of Community policies and priorities and, through its research funding, aims to advance European integration through the development of scientific and professional networks. The main vehicle of European Union research is the Framework Programme for Research and Technological Development, a multi-year plan drafted by the European Commission, and approved by the Council of Ministers and the European Parliament with input from the Member States and the Economic and Social Committee. Framework Programmes provide legal and administrative structure, scientific and technical objectives, and financial resources for EU-sponsored research. The Fifth Framework Programme began in 1999 and will run through 2002.

Figure 1. Framework Programme Budgets 1984-2003



The Programmes are financed from the General Budget of the European Union, consisting of Member States' financial contributions. Projects that receive research funding under the Framework Programme must involve participants from industry, universities, or research laboratories from at least two EU Member States. Projects are selected competitively on the basis of scientific merit and therefore those countries that contribute a larger share of the budget cannot automatically expect their research institutions to receive funding in proportion to their contributions.

Figure 2. EU Research Expenditures in Selected Socioeconomic Areas, 1987-1998ⁱ

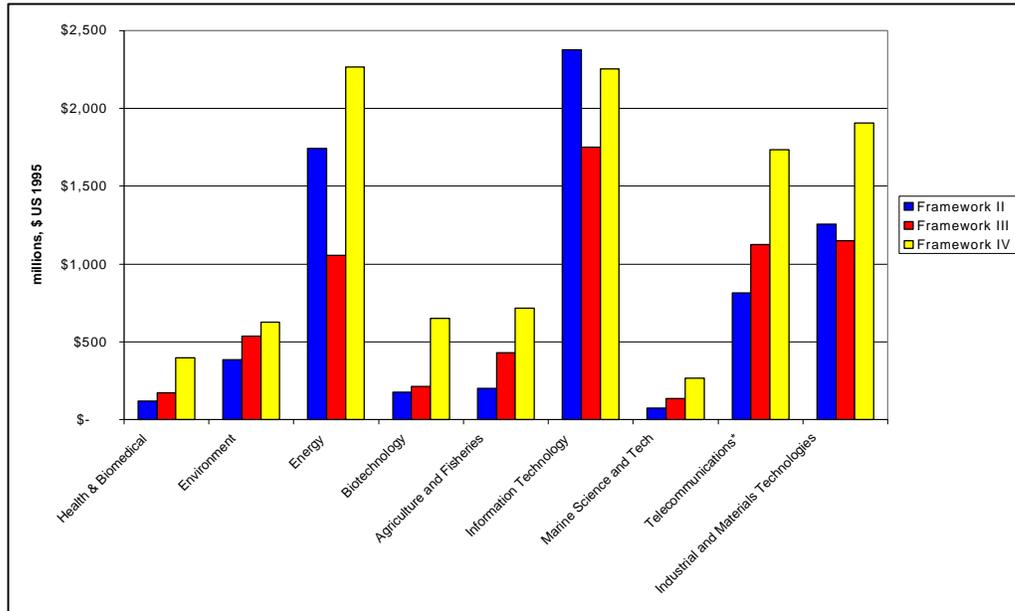


Figure 1 shows the EU's R&D expenditures in Framework Programmes I-V, covering the period 1987-1998. The EU Framework Programme budget has grown steadily since the Programme's inception in 1984. Between the first and fourth Framework Programmes, the total budget grew by more than 120% in real terms from \$6.4 billion to \$14.5 billion. The approved budget for the Fifth Framework Programme is \$17.1 billion.ⁱⁱ

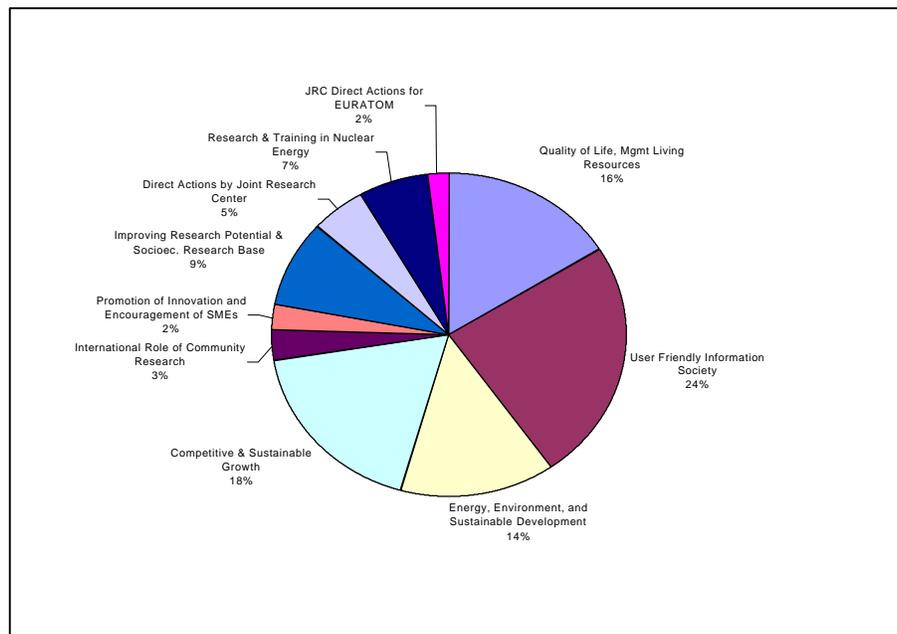
The EU's Framework Programmes cover a wide spectrum of research in the natural, engineering, and social sciences. Its major research areas (information and telecommunications, and materials research, biotechnology, energy, medical research, and the environment) have received consistent support for over a decade. At 87% of the budget, these areas constitute the lion's share of the Framework Programme's financial resources.ⁱⁱⁱ

That said, there have been significant shifts in emphasis among the priority areas over time, since their inception in 1984. In the First Framework Programme (1984-1987), for example, energy R&D accounted for close to 50% (\$3.0 billion) of the overall budget, although its share has subsequently declined to approximately 14% (\$2.1 billion) in the Fifth Framework. Note also, as Figure 2 shows, that the total Framework Programme expenditure on energy R&D appears to have grown sharply between the third and fourth Framework Programmes. The apparent jump in funding levels is actually due, in large part, to the incorporation of the \$400 million Thermie energy technology demonstration program in the Fourth Framework Programme. Until then, Thermie had operated independently of the Framework Programme and consequently was not reflected in its budget. With the incorporation of Thermie, more than half of the EU's Framework Programme expenditures in the non-nuclear energy technology areas were devoted to demonstration activities, while the remainder was spent on the Joule energy R&D

program. This development clearly underscores the rising importance of technology demonstration and commercialization in the EU's technology R&D effort.

The trend in energy research reflects some important developments in Europe during the 1980s. First, prior to the adoption of the Framework Program organizational structure in 1984, energy R&D accounted for 50-70% of Community-sponsored R&D. Throughout the 1970s, energy occupied a central position in Community research because of the severe dislocations caused by the oil crises of 1973-74 and 1979-80. Following major reductions in energy intensity and the collapse of world oil prices by 1986, however, energy became a policy issue of relatively smaller significance than it had previously been. Second, the approval of the Single European Act in 1986 symbolized and cleared the way for accelerated European integration and the completion of a single European market. Consequently, European governments and industry began to place greater emphasis on the competitiveness of European industry and on the reduction of barriers within Europe that hindered industry's global economic competitiveness. More resources were to be devoted to the development of new industrial technologies and to common European codes and standards. Thus, in the budgets of the Second and Third Framework Programmes, fewer resources were devoted to energy R&D than had previously been the case, while industrial research accounted for more than 60% (\$4.8 billion) of the R&D budget. While energy R&D expenditures rose modestly in the Fourth Framework Programme, the amount of new resources devoted to energy research, development, and demonstration is far more modest than Figure 2 seems to suggest.

Figure 3. Breakdown by Major Area of Proposed Budget, Fifth Framework Programme, 1998-2002^{iv}
(Total: 14.9 billion Euro)



In recent years, two areas that have grown most significantly as a share of the total Framework Programme budget are those of life sciences/biotechnology and environmental research, which now account, respectively for some 12% (\$1.7 billion) and 8% (\$1.2 billion) of the Fourth Framework Programme budget.^v The increases in the life sciences and biotechnology areas reflect the significant scientific advances that have occurred in this area over the past two decades that have made it a high priority from both economic and human health perspectives. Similarly, the growth in environmental research (e.g., earth and marine sciences) highlights the growing extent to which environmental issues have become policy priorities across the European Union. The increases in EU funding in both of these socio-economic areas is also necessitated by the fact that addressing large, complex problems such as global climate change or the mapping of the human genome lie beyond the research capabilities and resources of any single country. However, in addition to “big science” projects in the life sciences, such as the Human Genome Project, the Framework Programme also sponsors research in several other commercially promising areas including bioremediation, molecular engineering, and biotechnological processes for agroindustry.^{vi}

The European Council formally adopted the Fifth Framework Programme in November 1998. Its specific or “thematic” research programmes are oriented to the achievement of the following four Community policy objectives: ensuring quality of life and living resources; creating a user-friendly information society; achieving competitive and sustainable growth; and preserving the regional and global ecosystems (see Figure 3).^{vii} The themes of the Fifth Framework Programme indicate a reorganization of European research that reflects the growing importance of research in the environmental and information technology areas. The new Programme will also place significant emphasis on the economic value-added of EU-sponsored research, by aiming to translate EU R&D investments into European products for the world market. The European Parliament and the Council recently agreed on a maximum overall budget limit of approximately \$17.1 billion¹ for the Fifth Framework Programme^{viii}

EU funding is oriented toward research projects that demand transnational cooperation and the development of broad research networks. EU Framework Programme activities observe the legal principal of subsidiarity in funding research projects, supporting mainly projects that would be unlikely to receive private support and those that lie beyond the capabilities of individual governments. At the same time, however, a key aspect of the Framework Programme is its role as a “multiplier” of the efforts of European industry and of individual Member States. Although EU-sponsored research leaves technology commercialization to the private sector for the most part, the bulk of the Framework Programme budget is devoted to technology development, deployment, and demonstration, and to the promotion of R&D cooperation involving governments and the private sector rather than to basic research activities. The Framework Programme’s stated

¹ Note: Purchasing power parity exchange rates are not yet available for the single European currency, the Euro, which was launched in January, 1999. The Euro/dollar exchange rate used here was calculated by averaging the daily Euro-dollar exchange rates for the first quarter (January 1-March 12) of calendar year 1999. Based on this calculation, the Euro/dollar rate is 0.8718. Daily rates can be found at <http://www.jeico.com/cnc57ecu.html>

goal of fostering a strong and integrated European economy helps to explain this orientation.^{ix}

An important rationale behind the EU's activities in the field of researcher training and mobility, in addition to augmenting Europe's overall scientific capabilities, is to build research networks specifically among European researchers. In 1995, for example, the European Commission found that European researchers more often formed stronger links with researchers and laboratories across the Atlantic than with those in neighboring countries. Thus, a major aim of EU support for basic research and researcher training is to consolidate and increase intra-European scientific capacity.^x

In addition to the research infrastructures of the individual Member States, the EU has its own research complex, the Joint Research Centre (JRC). It includes eight specialized research facilities at five sites throughout Europe that receive research support directly from the General Budget of the European Union under the Framework Programme. Funding for the JRC accounts for 8% of the Fourth Framework Programme Budget; in 1996, the JRC's total budget was \$286 million.² Although the JRC was created to share, at the European level, the large investments needed to carry out research on nuclear energy, over time its tasks have developed into other areas in which a common European approach is necessary. JRC conducts research in the following areas: industrial materials (e.g., ceramics and composites), measurement and testing, environmental and earth science (e.g., remote sensing and atmospheric science), non-nuclear energy; targeted socio-economic research, nuclear fission safety (e.g., reactor safety, safety of fissile materials), and controlled thermonuclear fusion (participation in ITER activities).

In addition, the JRC plays an important policy support role. It conducts research that informs the development and implementation of European Union policies in the following areas: information and communications technologies (e.g., security and reliability of information systems); environment (e.g., control of chemicals, foodstuffs, and drugs); life sciences and technologies (e.g., remote sensing to monitor the common agricultural policy); targeted socio-economic research, and nuclear fission safety (accident prevention).^{xi}

²This figure includes direct appropriations to the JRC from the Commission as well as resources provided by European Economic Area Countries (Iceland, Liechtenstein, and Norway), work for third parties, and other sources. See: European Commission, Directorate General for the Joint Research Center, *Annual Report 1996* EUR 17339 EN (Luxembourg: Office for Official Publications of the European Communities, 1997), p. 26.

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- ⁱ Commission of the European Communities, *EC Research Funding*, 3rd Fully Revised Edition (Luxembourg: Office for Official Publications of the European Communities, 1992); European Commission, *EC Research Funding* (Luxembourg: Office for Official Publications of the European Communities, 1996).
- ⁱⁱ European Commission, Fifth Framework Programme 1998-2002, <http://www.cordis.lu/fp5/src/over.htm>
- ⁱⁱⁱ European Commission, *EC Research Funding* (Luxembourg: Office for Official Publications of the European Union, 1996), p. 27.
- ^{iv} OJ L 64/5 12.3.1999; OJ L 64/24 12.3.1999; OJ L 64/62 12.3.1999; OJ L 64/44 12.3.1999; OJ L 64/82 12.3.1999; OJ L 64/95 12.3.1999; OJ L 64/109 12.3.1999; OJ L 64/130 12.3.1999; OJ L 64/145 12.3.1999; OJ L 64/157 12.3.1999.
- ^v European Commission, *EC Research Funding*, p. 28.
- ^{vi} OJ L 64/1 12.3.99.
- ^{vii} European Commission, "Toward the Fifth Framework Programme: Scientific and Technological Objectives" EUR-17531 (Luxembourg: Office for Official Publications of the European Communities, 1997); European Commission, "Inventing Tomorrow: Europe's Research at the Service of Its People," EUR-16961 (Luxembourg: Office for Official Publications of the European Communities, 1996); <http://www.cordis.lu/fifth/src/sp1.htm>.
- ^{viii} European Commission, "Setting Course for the XXIst Century: Main Thrust of the Fifth Framework Programme," *RTD Info* April-May 1997, pp 5-7; <http://www.cordis.lu/fifth/src/cc-4.htm>
- ^{ix} <http://www.cordis.lu/fp5/src/budget7.htm>
- ^x European Commission, *Research and Technological Development Activities of the European Union Annual Report 1995* (Luxembourg: Office for Official Publications of the European Communities, 1996), p. 17.
- ^{xi} European Commission, Directorate General XII (Science, Research, and Technology), *The Fourth Framework Programme (1994-1998)*, Luxembourg: Office for Official Publications of the European Communities, 1994, pp. 35-36.