The EU's Energy Support Programmes

Promoting Sustainability or Pollution?

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Summary

The enlargement of the European Union and EU energy market liberalisation is expected to result in the largest liberalised energy market in the world, offering immense business opportunities. However, the EU has stated that besides market development, it is equally important to make the energy sector secure and sustainable. This will amongst other things require as a first step the creation of a level playing field in the economic treatment of generating sources. This report shows to what extent such fair practice is lacking at present.

The current electricity market favours traditional power sources and companies, which benefit from huge economic advantages because environmental costs, such as emissions and nuclear waste costs, are not taken into account. Despite claims of support for renewable energy by national and EU authorities, nuclear power continues to receive the majority of research and development funding.

Reliable energy supplies (in particular electricity) are vital to society. However, energy production and use can cause immense environmental damage and should not be left to the whims of the market. Energy production and use must be carefully regulated to enable the development of less environmentally damaging technologies while continuing to ensure the provision of necessary energy services. At the very least, action must first be taken at the EU and Member State level to eliminate subsidies to generating technologies that have significant and long-term detrimental impacts on the environment. Secondly, additional financial support must be given to renewable generators. To make informed decisions on fuel choices, the truth about public financial support must be clearly documented, and current and future environmental impacts fully considered.

As part of its response to the threat of climate change, the EU has made clear its priority to develop and deploy renewable energy systems, approving in 2001 a Directive establishing a legal framework for their future development. This included a target that 12% of the EU's energy – or 22.1% of its electricity - must be generated by renewable sources by 2010. This is an important first step, but without further measures this target will not be met. In addition, legally binding targets need to be set for 2020 and beyond. Achieving these targets will require reform of existing financial support mechanisms for energy technologies. Certain European institutions will require reform as part of this process, to remove the long-standing prejudice in favour of conventional, dirty technologies.

This report finds that:

- There is widespread public support in Europe for the research and development of renewable technologies. Over 50% of respondents in a recent Eurobarometer survey said that they would like renewable energy to receive greater R&D funding (it currently receives around 20% of EU energy R&D funds).

- Nuclear technologies still benefit from huge subsidies under the provisions of the Euratom Treaty. Over the last 30 years, around €60 billion in R&D funding has been awarded to nuclear technology – vastly more than for any other energy source. In addition, the nuclear industry is arguing for ongoing subsidies to finance nuclear waste liabilities.

- On top of R&D funding, Member States and the EU continue to grant huge tranches of public finance as state aid for fossil fuelled power stations, which is sanctioned by the European Union. From 1994 to 2001, over €60 billion went to the coal sector in Member States. In Germany alone, the coal industry received €120 billion between 1970 and 2003.

- Established fossil fuel and nuclear technologies also benefit from 'indirect' subsidies. Public financial support through structural funds for both the extension of the gas and electricity networks is expected to reach €4 billion between 1994 and 2006. Most such projects exacerbate the current unsustainable energy system by decreasing reliance on small-scale,

locally produced power. Renewable energy will receive €650 million from structural funds over the same period, or 16% of the total.

- Between 1990 and 2003, European Investment Bank (EIB) loans for energy projects totalled around €18 billion. Of this non-hydro renewable energy projects received funding worth €323 million.

- The true costs of conventional fossil fuel and nuclear power stations are not given due consideration when assessing energy sources. Fossil fuel and nuclear technologies are not required to internalise external costs, such as the impacts of human-induced climate change or the long-term management of nuclear waste. As a consequence renewable energies and energy efficiency measures, which will have no or localised environmental impact, are being penalised.

The table below gives an overview of the major funding issues discussed in the report. The reader should be aware that this is not exhaustive – there may well be other sources of funding not covered in this report. Similarly, it is not possible to draw direct links between the different levels of funding, given the variation in timescales for the data. However, it is possible to conclude from this evidence that fossil fuels – coal, and increasingly gas - and nuclear power continue to benefit from EU support to a much greater extent than renewables.

Infrastructure support mechanisms are also included in the table. Although this is not direct support for conventional fossil fuelled or nuclear generation, the construction of high voltage transmission lines tends to support large-scale conventional generation. It is safe to assume, then, that the funding of large-scale energy infrastructure tends not to benefit small-scale renewable generation to the same extent.

Table 1: Summary of Community Support for Energy Projects

Technology	Type of support	Programme	Dates	Amount (million Euros)	Comments
Coal	Grant	ECSC	1952 – 2002	13,000	European Commission 2003
Nuclear	Grant	Euratom safeguards	2003	20	The current annual expenditure is around €20 million
Nuclear	Loan	Euratom loans	1977-2003	3,200	European Commission 2003
Nuclear	Grant	PHARE/TACIS	1991-2006	2,000	This is an estimate taken from consultancy reports produced for the European Commission and EU budget proposals.
Renewables	Grant	PHARE/TACIS	1990-1998	14	Institute for Environmental Studies 2001 for European Parliament
Gas	Loan	EIB	1990-2003	5,771	EIB/Bankwatch
Oil	Loan	EIB	1990-2003	100	EIB/Bankwatch
Renewables	Loan	EIB	1990-2003	896	EIB/Bankwatch
Coal	Loan	EIB	1990-2003	1018	EIB/Bankwatch
Nuclear	R&D	Framework Programmes 4-6	1994-2006	5,361	Includes funding for both nuclear fission and nuclear fusion
All non-nuclear energy	R&D	Framework Programmes 4-6	1994-2006	1,393	Figures for R&D for specific non-nuclear technologies are only available for FP5 – see Figure 5
Gas	Grant	Structural fund	1994-1999	1124	European Parliament 2001
Renewables	Grant	Structural fund	1994-1997	300	European Parliament 2001
Electricity	Grant	Structural fund	1994-1997	325	European Parliament 2001

Table 1 continued:
Support for infrastructure

Energy networks	Loan	EIB	1990-2003	1983	EIB/Bankwatch
Electricity networks	Loan	EIB	1990-2003	6436	EIB/Bankwatch
Gas infrastructure	Grant	TENs	1995-2001	68	European Commission 2001
Electricity infrastructure	Grant	TENs	1995-2001	44	European Commission 2001

Although progress is being made towards a fully liberalised energy market, State funding is standard. To date, this has supported conventional fossil fuel and nuclear generating technologies and infrastructures. An alternative vision of the energy sector is necessary, which would allow smaller, renewable and localised power production and encourage energy efficiency and conservation. This would reflect both the environmental realities we face and the state of public opinion in the European Union. Making this alternative vision a reality would require at the very least:

- a change in the funding levels provided to electricity generators by the European Investment Bank to ensure that the Bank's activities reflect the policy importance attached to increased renewables generation and energy efficiency
- a shift in research and development priorities from nuclear to sustainable generation options
- the abolition of the Euratom Treaty, which institutionalises the EU's promotion of nuclear power
- the end to EU endorsed State aids to fossil fuel and nuclear generation
- changes in structural funding to remove the emphasis on large scale energy transfers and to encourage the integration of renewable energy projects in energy networks
- the internalisation of the external costs of electricity generation to reflect the environmental damage done by fossil fuel and nuclear generation in comparison with renewables

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1. INTRODUCTION

The production and use of electricity is a fundamental part of society. Until the last decade Member States owned most power companies, and there was little competition between generators. However, in the 1990s the process of privatising and liberalising Europe's energy market resulted in the first electricity and gas market Directives in 1996 and 1998 respectively. The 2000 EU Lisbon Summit called for the acceleration of this process. Under the terms of the latest electricity and gas Directives[1] due to be implemented by all Member States – including the current accession countries – by July 2004, full market liberalisation will be completed in 2007. However, as the electricity Directive notes "shortcomings and possibilities for improving the functioning of the market remain, notably concrete provisions are needed to ensure a level playing field in generation" (recital 2).

This report looks at one of the current barriers to a level playing field between generators: subsidies from the EU and Member States to the different types of generator. Energy subsidies in current and future Member States of the EU have been reviewed by a number of institutions and researchers - most recently in December 2002 by the European Commission[2]; by researchers for the European Parliament[3] in 2001; and for Greenpeace in 1997[4]. Furthermore, analysis has been undertaken on different countries in the EU, different regions of the world and the different technologies by numerous researchers and international institutions: of particular note is the extensive body of work undertaken by the International Energy Agency[5]. Another significant analysis is from the National Institute for Public Health and the Environment in the Netherlands. Their 2001 report concluded that each year at the end of the 1990s countries in the OECD were awarding $82 billion in subsidies to the energy sector, 70% of which went to fossil fuels[6]. This paper brings together these different strands to produce an overview of the state of energy subsidies at the EU level.

Most of the existing studies come to the same conclusions, namely that fossil fuels continue to receive vast subsidies, despite the known and real dangers posed by climate change and the pledges under the Kyoto Protocol to reduce emissions of greenhouse gases, in particular carbon dioxide. Within the European Union, some of these subsidies, in particular for the coal sector, are well known and documented; however, in other areas the extent of the financial support is less obvious. Similarly, nuclear power continues to receive the largest share of the EU's and Member States' research and development budgets, despite the fact that no nuclear reactors have been ordered and completed in a liberalized energy market anywhere in the world. In contrast, renewables energies, despite being proclaimed as a priority in policy terms usually rank well below conventional energies when it comes to financial support from public sources in the European Union. Finally, energy efficiency and energy saving measures often do not even register in comparisons between funding of energy technologies as in some cases they are not even considered.

There is also ongoing support for the renewable energy industry at both Member State and EU level. Under the terms of the 2001 Directive on electricity from renewable energy sources[7], collectively the EU is expected to produce 22% of its electricity from renewable sources by 2010. In order to meet this target Member States have put in place a number of mechanisms, the most widely adopted being feed-in tariffs. These guarantee a fixed price for electricity produced from renewable energy sources,

[1] Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 Concerning Common Rules For The Internal Market In Electricity And Repealing Directive 96/92/EC: Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 Concerning Common Rules For The Internal Market In Natural Gas And Repealing Directive 98/30/EC

[2] European Commission Staff Working Paper, December 2002, Inventory Of Public Aid Granted To Different Energy Sources. http://europa.eu.int/comm/dgs/energy_transport/state_aid/energy_en.htm

[3] Frans Oosterhuis, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, draft report for the European Parliament's DG for Research, July 2001. Energy Subsidies in the European Union.

[4] Elisabeth Ruijgrok and Frans Oosterhuis, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, for Greenpeace International, May 1997. Energy Subsidies in Europe, How Governments use taxpayers' money to promote Climate Change and Nuclear Risk.

[5] http://www.iea.org

[6] Van Deers and de Moor, National Institute for Public Health and the Environment. 2001. Public Subsidies and Policy Failure.

[7] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 On The Promotion Of Electricity Produced From Renewable Energy Sources In The Internal Electricity Market. Official Journal of the European Communities, 27th October 2001, L283/33.

which in turn creates more certainty and security for investors developing renewables projects. These and other schemes adopted by Member States are calculated to total around €3.3 billion in 2001[8]. This support has been used by the large electricity producers and consumers to call for a change in European energy policy[9]. They claim that renewable energy is more expensive than conventional electricity producers and thus increase use of renewables will result in higher energy prices. However, as is noted in this report, conventional energy sources continue to receive direct and indirect financial support which far exceeds that granted to renewable energy. Furthermore, the Commission views the state aid granted to renewables as fundamentally different to state aid for other forms of generation because of the environmental benefits that they entail[10]. This is not a blanket agreement to all state aid for renewable projects on the grounds of environmental protection, as any state aid granted is subject to a number of conditions outlined in the guidelines. However, the presumption is that state aid for investments in renewables generation is acceptable as long as it does not adversely affect trading conditions contrary to the common interest[11]. This is an important recognition of the need for environmental benefits to be taken into account in the implementation of competition policy, especially in the light of the EU's commitments to promote renewables as an environmental priority.

The Commission has acknowledged the importance of renewables generation, and has adopted a set of guidelines that on the surface should be helpful renewables generation. However, the Commission's approach should be viewed in the context of state aid and other subsidies to conventional forms of generation. As this report shows, state aid and other subsidies to fossil fuel and nuclear generation dwarf those given to renewables.

However, there are a number of areas that the reports mentioned above do not give adequate attention to, partly because there may be insufficient data. The main areas that will continue to impact on energy subsidies are:

- **Historical Subsidies**: Conventional power technologies, fossil and nuclear powered generators have received vast subsidies that have enabled them to mature. In the case of the coal sector between 1994-2001, Member States granted €60 billion in aid to their industry for both production subsidies and to help phase out the industry[12]. In Germany alone around €120 billion was given to the coal sector between 1970 and 2003 [13]. Furthermore, in liberalised and privatised energy markets many power stations built under public ownership and then transferred to the private sector have had construction costs written off.

- **Future Costs:** Conventional generators have environmentally polluting fuel cycles. Each stage, from the mining of the raw material, its transportation and processing through to the decommissioning of used facilities, creates waste and environmental pollutants. The problems that these cause will all have to be addressed. Furthermore, in the case of nuclear power, wastes will not begin to be dealt with until decades after the closure of facilities. The funds for these clean up costs have to be accrued during the operating lifetime of the facilities – meaning that the levels of mechanisms of funding should be treated as of equal importance as the economics of building new power stations. As yet, however, rules to ensure that adequate provision is made to clean up wastes after the closure of nuclear stations are yet to

[8] Eurelectric. January 2004. A Quantative Assessment of Direct Support Schemes for Renewables, 1st Edition Working Group Renewables and Distributed Generation: Ref: 2003-030-0741, table 4 page 22.

[9] IFIEC Europe and Eurelectric, 25 March 2004, European Industry Needs a Coherent, Stable and Realistic Energy Policy -IFIEC Europe is the federation of European industrial energy consumers ; Union of the Electricity Industry - EURELECTRIC is the sector association of the European electricity industry.

[10] Official Journal of the European Communities, Community Guidelines on State aid for environmental protection, OJ 2001/C 37/03, 3.2.2001, http://europa.eu.int/cgi-bin/eur-lex/udl.pl?REQUEST=Seek-Deliver&COLLECTION=oj&SERVICE=eurlex&LANGUAGE=en&DOCID=2001c037p00030015&ext=.pdf

[11] Official Journal of the European Communities, Community Guidelines on State aid for environmental protection, OJ 2001/C 37/03, 3.2.2001, paras 32 and 72

[12] European Commission. 2002. Report from the Commission on the application of the Community Rules from State Aid to the Coal industry in 2001. http://europa.eu.int/comm/energy/en/state-aid1.html

[13] Material provided by the Oko-Institute in Germany. (Personal communication between Martin Cames and BMWA (Bundesministerium für Wirtschaft und Arbeit (Ministry for Economic Affairs and Employment)), March 2004.

be developed at a European level. The impact of this has already been seen in the UK where British Energy, the privately owned nuclear generator, is proposing to rely on a Government subsidy of up to €17 billion to enable it to pay for its decommissioning and waste management costs over the coming years[14]. The European Commission, under its State aid rules, is currently reviewing this proposal. If it is acceptable to the European Commission it is probable that other State- and privately-owned nuclear companies will demand that their Governments assist with their nuclear waste management funds.

- **Environmental Costs**: Emissions from the energy sector are the major contributor to greenhouse gas emissions, contributing to human induced climate change. Despite the costs that climate change will incur, subsidies continue to flow towards the fossil fuel technologies that are responsible for the emissions. One reason is that the current and future environmental costs associated with the conventional technologies are not adequately assessed or included into existing economic analysis. In the case of nuclear power the cost of damage resulting from nuclear accidents is, for example, excluded from current insurance requirements. In both cases the economic advantages these market failures confer on conventional generators should be taken in to account in any assessment of the economics of energy options.

Energy policy in the European Union is changing in two key ways. Firstly, the enlargement of the EU will increase its membership by ten and add 76GW of new generating capacity and 350 TWh of demand to the 'European' market. Enlargement brings with it an energy sector whose history differs significantly from that of many current EU Member States, with much greater central planning, and a greater reliance on either nuclear power or coal generation. Simultaneously, the energy sector in Member States is becoming more closely integrated. The revised energy market Directives enter into national law in 2004. In addition, Brussels is proposing new legislation to increase energy trade infrastructure between Member States. Finally, on a policy level, the current draft of the EU constitution proposes an energy chapter – and therefore effectively a EU energy policy – for the first time. These parallel processes of integration and expansion both have a fundamental requirement for transparency.

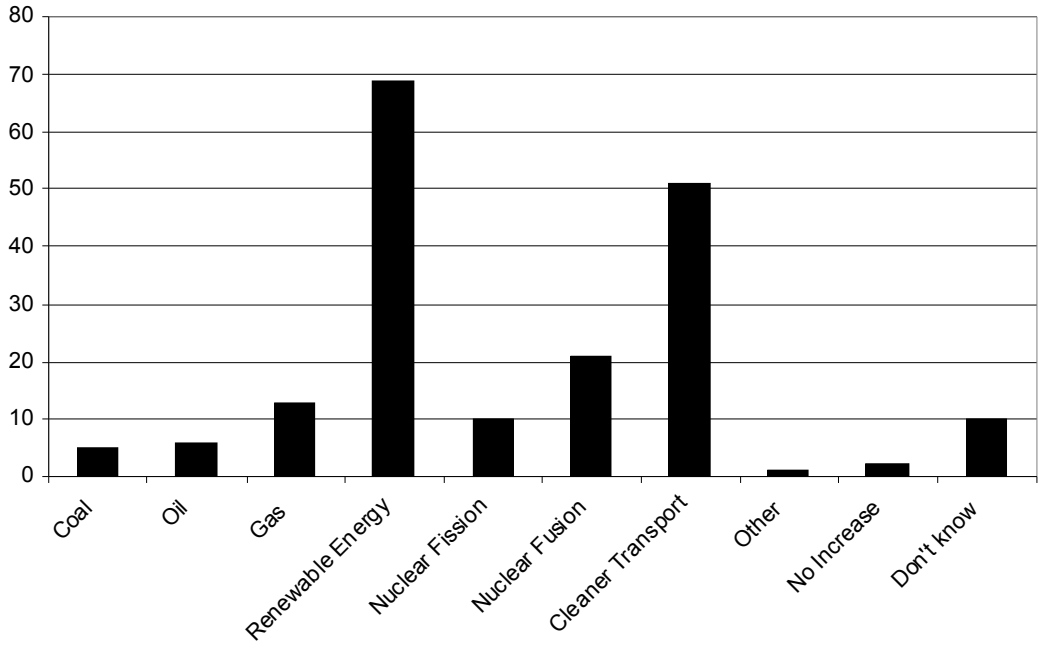
In December 2002 the European Commission released a public opinion poll on the future of EU energy[15]. One question asked the public in each Member State of the EU was what technology or technologies should be researched more by the EU? The responses showed that there was overwhelming backing for more support for renewables (37%) and cleaner transport (27%), with conventional energies scoring very badly. All fossil fuels together had 12% and nuclear fission power only 5%. This can be seen in Figure 1. Despite this, nuclear technologies, both fission and fission, receive twice the level of funding from the European Commission and Member States than would be awarded by EU citizens.

Figure 2 shows the levels of public support from the Eurobarometer poll and compares this to actual research and development funding in both Member States and in the EU's Framework Programmes. It can clearly be seen that the EU and Member States prioritise nuclear power, in contrast to the state of public opinion. Similarly, renewables would be granted much more funding than is currently allocated by Member States and the EU, if public opinion were used to determine funding levels.

[14] This is the total undiscounted value of part of the restructuring deal currently being assessed by the Competition Commission, and assumes a 'worst case scenario' where British Energy's economic performance continues to be weak. If the value is discounted to present day values, the measures being assessed to support British Energy total around €5.1 billion.

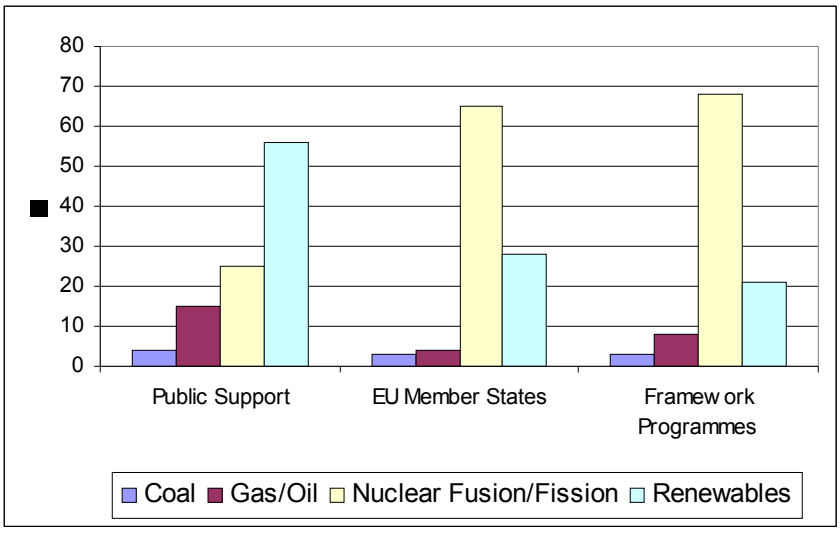
[15] European Commission, Directorate-General for Research Directorate-General for Research EUROBAROMETER, December 2002. Energy: Issues, Options and Technologies Science and Society EUR 20624

Figure 1:
Public Suggestions for Additional Energy Research and Development



Source: Eurobarometer 2002

Figure 2:
Support for R&D Budgets for Energy Technologies vs Actual allocations (%)



Source: Eurobarometer and European Commission Framework Programme

The European Union has stated that the development of renewable energy technologies should be a priority, although its institutions are yet to react to this call and continue to allow subsidies of more polluting sources. In June 2004 at the Bonn Renewable Energy Conference, Governments, industry and citizens from across the world will come together to plan the further development of the renewable energy sector. This gathering could be a key milestone in the development of a sustainable energy sector. The EU will play a key role in this, and must increase its support for renewable energy. As this report shows, European institutions are geared towards supporting

conventional technologies despite the environmental problems they entail, and in contradiction of public opinion.

The briefing considers the funding of the different energy sources used in the production of electricity from various EU institutions – largely the European Investment Bank and the European Commission. This gives some insight into the actual prioritisation and support that the EU is giving to different technologies. If the EU wants to ensure a sustainable energy market, it must address the past; current and probably future direct State financial support or policy measures that allow market distortions to continue. Only once this has been recognised and rectified can bold decisions be taken to reform the energy sector. At the very least, such reform would require:

- a change in the funding levels provided to electricity generators by the European Investment Bank to ensure that the Bank's activities reflect the policy importance attached to increased renewables generation and energy efficiency

- a shift in research and development priorities from nuclear to sustainable generation options

- the abolition of the Euratom Treaty, which institutionalises the EU's promotion of nuclear power (over other energy options??)

- the end to EU endorsed State aids to fossil fuel and nuclear generation

- changes in structural funding to remove the emphasis on large scale energy transfers and to encourage the integration of renewable energy projects in energy networks

- the internalisation of the external costs of electricity generation to reflect the environmental damage done by fossil fuel and nuclear generation in comparison with renewables

2 EU INSTITUTIONS

2.1 International Financial Institutions

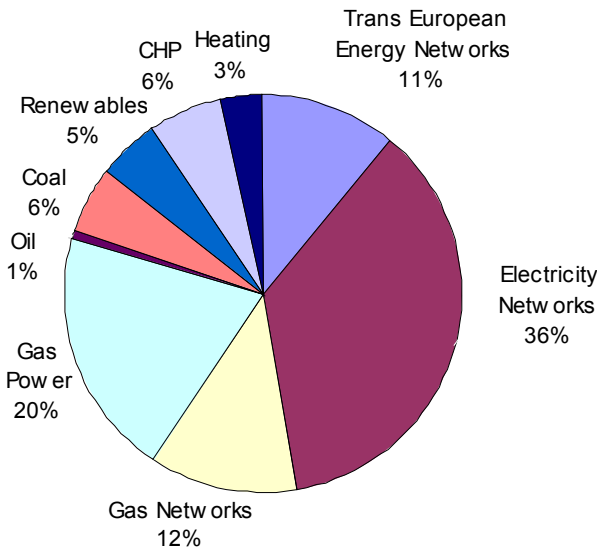
International Financial Institutions can be a key driver for change by promoting sustainable energy projects. There are three main financial institutions that lend for energy projects in the EU and accession countries: the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD) and the World Bank. The EIB is most closely linked to the EU, as it is an institution of the Union, and is required to 'continuously adapt its activity to developments in Community policies'. The EBRD and World Bank are influenced by the actions of its shareholders, which include the European Commission.

European Investment Bank:

This was one of the founding institutions of the EU (starting in 1958) and has a massive lending portfolio – larger than that of the World Bank. In 2002 it approved loans worth €53 billion, most of which were in Member States (80%) with 12% in Accession Countries and the remainder in so called 'partner countries'.

The EIB has introduced a target for its lending on renewable energy projects to ensure that within 5 years its lending will double to 14% of all energy projects[16]. However, within the EU and accession countries, lending for renewable energy projects fall well below this target. The graph below shows that renewables only accounted for 5% of lending between 1990 and 2003 (in 2003, however, it accounted for 10% of the total). Furthermore, over 60% of the renewable lending was for hydro power plants and only 5 out of approximately 200 energy loans in the regions were for wind and biomass projects.

Figure 3:
European Investment Bank Lending, EU and Accession Countries 1990-2003



Source: EIB[17] and Bankwatch Network[18]

[16] European Investment Bank, January 2003 Corporate Operational Plan 2003-2005, page 6
[17] EIB web site, list of projects approved: http://www.eib.org
[18] CEE Bankwatch Network, list of MDB records: http://www.bankwatch.org

World Bank:

The EIB is not the only international financial institute considering its role in supporting renewable energy. The World Bank is currently reviewing its lending in the energy sector and in particular those involving the extraction of raw materials, i.e. oil and coal sectors. This review and its implementation will have important ramifications for other financial institutions. To facilitate this process, the Bank appointed an independent panel of stakeholders, led by Professor Emil Salim, the former Indonesian Minister of Environment, to review the World Bank's energy lending. In January 2004 the results of the stakeholder review were formally presented to the Bank's President James Wolfensohn. It concluded that[19]:

> "The promotion of renewable energy that is needed in poverty alleviation efforts and in response to climate change should be done by setting up a specialized [World Bank Group] unit or team for renewables and energy conservation. It should support country teams by proactively identifying possible energy conservation and renewables projects or programs, assessing country capacity to produce and service renewables and energy conservation, and identifying ways to build up that capacity, as well as by assessing lending capacity for renewables and energy conservation and ways to strengthen that capacity. (Chapter 3)"

European Bank of Reconstruction and Development:

The EBRD has not adopted targets or undertaken a stakeholder review of its energy lending. The Bank is required by its founding charter to promote, in the full range of its activities, environmentally sound and sustainable development, and has developed a specific programme to facilitate lending to improve demand and supply side energy efficiency. The EBRD claim that it "has a healthy and growing portfolio of wind and hydro projects[20]" and has commissioned a comprehensive study on the investment potentials for these technologies in its countries of operation[21]. However, there is little evidence that renewable energy projects are to be funded at an accelerated rate and it is over a decade since they funded a renewable energy project. Since it was set up, the EBRD has committed 9% of its lending in Accession countries to renewable projects – although this was for two hydro power plants one in Latvia in 1992 and one in Slovenia in 1993 - and 22% for energy efficiency. Furthermore, unlike the World Bank, the EBRD does lend to nuclear power plants.

2.2 European Commission

Framework Programmes:

Joint development programmes have been part of the European Union virtually since its conception in the 1950s. The Joint Research Centre was established in 1957 to research nuclear issues under the Euratom Treaty. However, it was not until 1974 that a non-nuclear Community Research and Development policy was first introduced. Then in 1984 the Commission launched the 1st five-year Framework Programme; a second launched in 1987; a third in 1990; a fourth in 1994; and a fifth in 1998. The sixth Framework Programme began in 2002 and will conclude in 2006.

The EU's Framework programmes cover all non-nuclear energy R&D financing for research, development and demonstration projects across the whole energy sector. This includes funds for energy efficiency, renewable energy and cleaner fossil fuels. The total budgets allocated for energy in recent years can be seen in Figure 4. This shows that the nuclear technology receives approximately 50% more funding that all other energy combined.

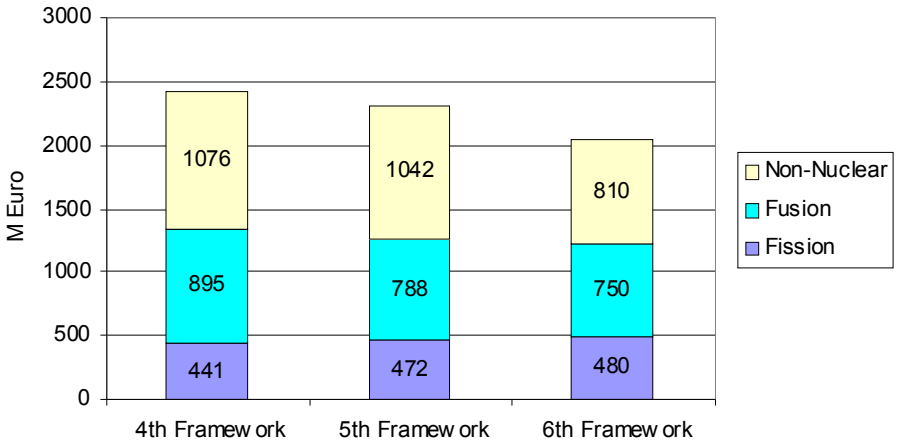
Nuclear technology continues to have its own Framework Programme under the Euratom Treaty that run in tandem with the EU's Framework Programmes. This has separate and different rules for adoption – not least that the Euratom Framework Programme is not subject to the same democratic scrutiny as the EU's Framework Programme as the European Parliament has only a consultative role.

[19] http://www.eireview.net/finalreport.htm

[20] Jean Lemierre, President of the EBRD, 23 October 2003, Renewable Energy and Energy Efficiency Partnership (REEP) Global Policy Network Launch Conference

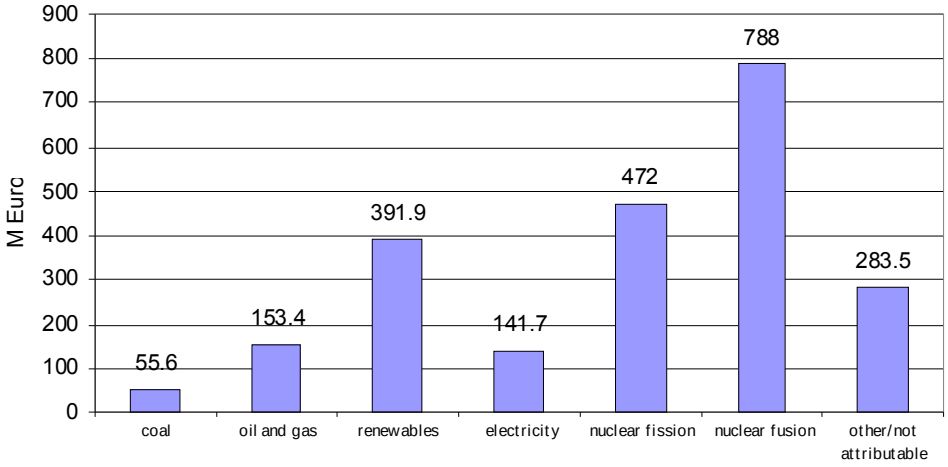
[21] http://projects.bv.com/ebrd/

Figure 4:
EU Framework Funding For Conventional and Nuclear Energy



It is currently not possible to assess the breakdown of energy funding in the 6th Framework programme. According to the European Commission, given the competitive nature of the FP6 programme there is no pre-defined budget for each of the sections. Therefore the final budget allocation for the different programmes is possible only after the end of each FP as the final allocations will depend on the applications received and funding awarded[22]. However, data is available for the 5th FP. This is shown in figure 5 below.

Figure 5:
Energy Research and Development in 5th Framework Programme



Source: Frans Oosterhuis[23]

[22] Personal Communication with European Commission, February 2004.

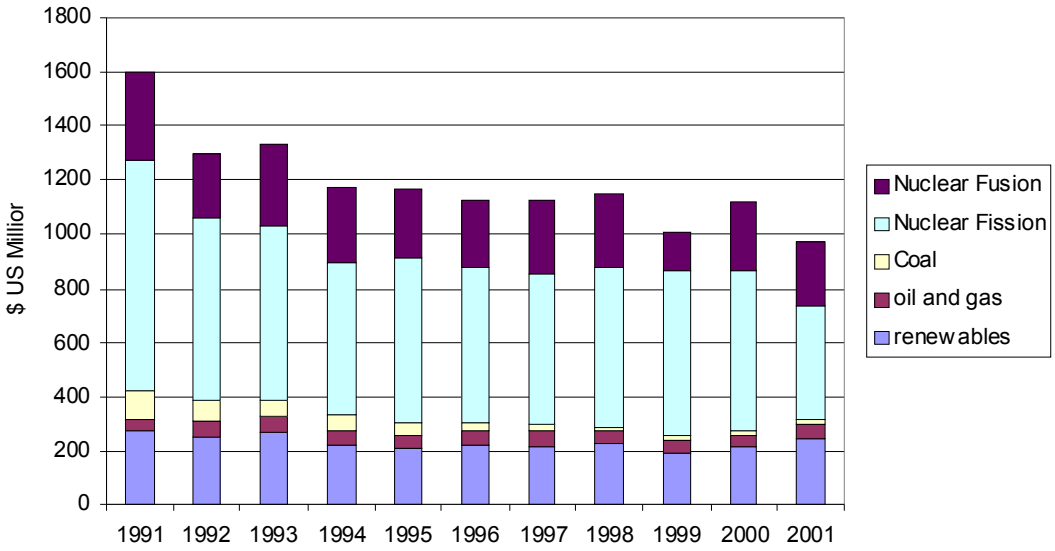
[23] Frans Oosterhuis, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, draft report for the European Parliament's DG for Research, July 2001. Energy Subsidies in the European Union. Page 14

Member States Research and Development:

Although research and development is done on a European level it is also carried out in Member States. In fact the level of funding undertaken in Member States is roughly double that allocated in the EU's budget. Furthermore, the funding programmes in Member States and the EU are often linked with joint funding occurring. The European Commission has estimated that between 1974 and 1998 Member States granted approximately $55 billion in research and development assistance for nuclear technology alone from their national budgets[24].

The expenditure by Member States is shown in the graph below. During the last decade the budget has decreased from €1.6 billion to around € 1 billion overall.

Figure 6:
Member States' Energy Research and Development Budgets 1991-2001

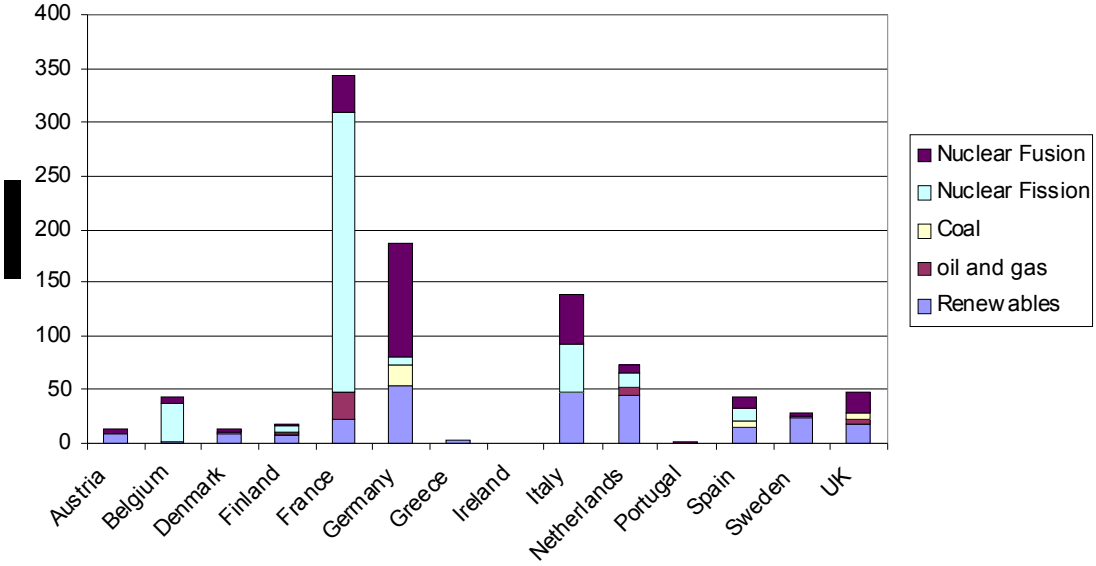


Source: IEA 2003
Note: the decrease in 2001 may be in part because data was not available from all countries.

The breakdown of expenditure by country and by technology in 2002 is shown in figure 7[25]. It can be seen that nuclear fission receives the highest funding at Member State level (40%), followed by renewables (27%) and then nuclear fusion (25%). France funds 35% of all research and development on the Member State level, largely on nuclear fission, followed by Germany, 20% and Italy, 15%.

[24] European Commission Staff Working Paper, December 2002, Inventory Of Public Aid Granted To Different Energy Sources. http://europa.eu.int/comm/dgs/energy_transport/state_aid/energy_en.htm, page 94
[25] International Energy Agency: December 2003. Review of Energy Policies in IEA Countries, (as not all data for 2002 was available some data used was based on 2001 figures).

Figure 7:
Energy Research and Development Expenditures in Member States (2002)



Source: IEA 2003

2.3 European Union Energy Support Programmes

The European Commission runs a series of programmes designed to support specific EU energy policies. Some of these programmes are for specific technologies, such as coal or nuclear power, while others support general energy infrastructure relating to the gas or electricity industries.

Coal:

Research and development of coal and steel continues to be funded under Articles 49 and 50 of the Treaty creating the European Coal and Steel Community (ECSC). The Commission has estimated that over the last 50 years around €13 billion was given in grants for the further development of the coal sector[26]. In 2002 the ECSC expired after 50 years of existence and a special fund was established, called 'Research Programme of the Research Fund for Coal and Steel'. The fund took the remaining financial resources of the ECSC – an estimated €1.3 billion – and will use the interest gathered for further developing the coal and steel industries. €60 million was allocated in both 2003 and 2004 for these activities, of which €17 million was allocated to Coal each year[27].

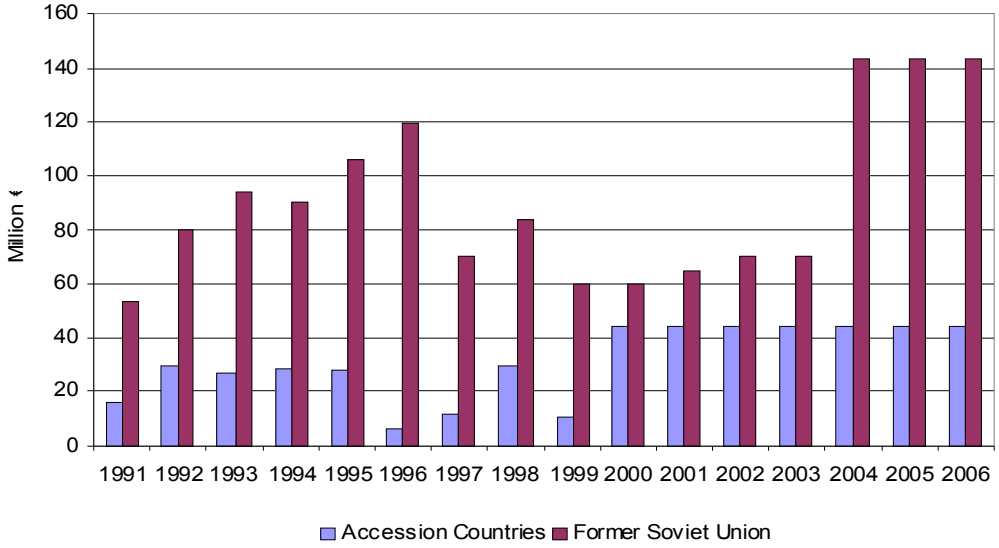
Nuclear Power:

International Support Programmes:
In 1991 the EU established initiatives under the PHARE and TACIS programmes[28] to try and improve nuclear safety in the region. By 2006 it is estimated that the EU will have allocated approximately €2 billion to address nuclear concerns in Accession countries and the former Soviet Union. Firms from Western Europe undertake most of this work[29].

[26] European Commission: 19th June 2003. Expiry of the European Coal and Steel Community (ECSC) Treaty: an Overview: Memo:
[27] European Commission: 19th June 2003. Expiry of the European Coal and Steel Community (ECSC) Treaty: an Overview: Memo:
[28] The PHARE programme gives transitional aid to accession countries, while the TACIS programme applies to countries in the former Soviet Union.

Due to the large spending commitment on nuclear assistance programmes the PHARE programme only allocated a relatively small amount to other energy sources. Between 1990 and 1998 the total energy budget for the whole PHARE programme was 220 MECU[30]. However, of this approximately 180 MECU[31] was spent on nuclear safety programmes – around 80% of the total. Of the funds not allocated for nuclear, a European Parliament report estimates that only MECU 14.3 million was allocated to renewable energy[32], just 6.5% of the total. The Parliamentary report also notes that during the period 1990-1997 the average expenditure for electricity projects was €4.1 million per year. The estimated development of these nuclear aid programmes from 1991 to 2006 is shown in Figure 8 below.

Figure 8:
International Nuclear Assistance Programmes Funded by the EU



Source: European Commission -various[33]

Euratom:
In 1957 the founding members of the current EU signed the Treaty establishing the European Atomic Energy Community (Euratom). Since then, the Euratom Treaty has not been subject to major reform and retains a mandate to both promote and regulate the activities of nuclear power within the European Union. Some of the activities that the Euratom Treaty enables the EU to oversee have budgetary implications for the EU. These include:

- European Safeguards Agency:

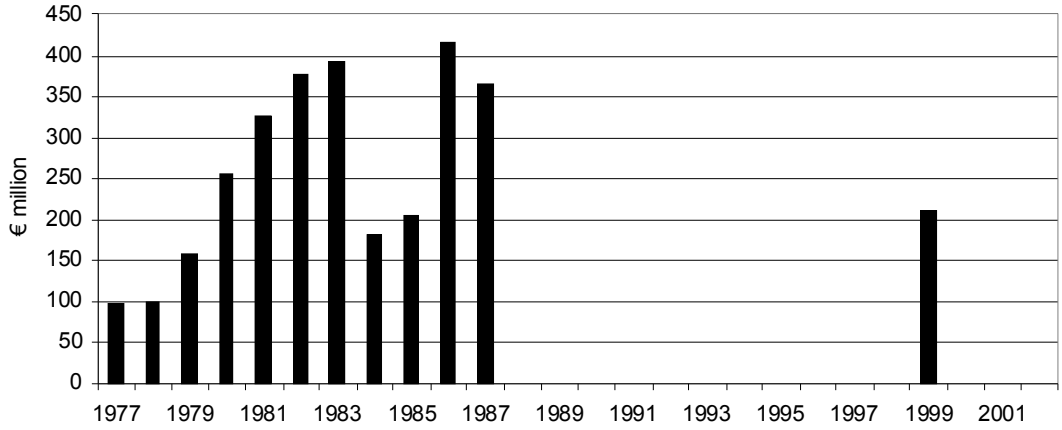
Due to threat of nuclear material proliferation Europe has established a division of Euratom to safeguard fissile material. In 2002 this agency cost approximately €20 million to operate[34].

[29] European Commission 17th January 2002 Nuclear Safety Strategy Paper, 2002-6 and Indicative Programme 2002-2003: Sorgem Organisation and Development, November 2000, Assessment of Phare and Tacis Nuclear Safety Activities.
[30] ERM, September 1999. An Evaluation of Phare-financed Energy and Environment Programmes Inventory Report, table 2, page 6. MECU stands for Million European Currency Units. 1 ECU is roughly equivalent to 1 Euro
[31] Sorgem Organisation and Development, November 2000. Assessment of Phare and Tacis Nuclear Safety Activities; Appendix A1, page 6
[32] Frans Oosterhuis, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, draft report for the European Parliament's DG for Research, July 2001. Energy Subsidies in the European Union.
[33] European Commission 17th January 2002 Nuclear Safety Strategy Paper, 2002-6 and Indicative Programme 2002-2003: Sorgem Organisation and Development, November 2000, Assessment of Phare and Tacis Nuclear Safety Activities.
[34] Report from the Commission to the European Parliament and the Council, December 2003, Operation of Euratom Safeguards in 2002. COM (2003) 764 final

- Euratom Loans:

Since 1977 around €3.2 billion worth of financial support for nuclear power has been awarded by the Euratom's nuclear loan facility. The loan facility enables nuclear companies to obtain financing for large projects, which given the uncertainty of nuclear construction, with its history of delays and cost overruns, they might not be able to obtain otherwise. The country recipients of these loans and their values are shown in Figure 9. As can be seen, the use of the loan facility has decreased significantly over the last decade or so. The only loan to have been signed in recent years was for work at the Kozloduy nuclear power plant in Bulgaria.

Figure 9:
History of Euratom Loans 1977-Present Day



Source: European Commission, 2003[35]

It is now more than fifteen years since a Member State has even applied for a Euratom loan. However, the Council is currently reviewing a Commission proposal to raise the Loan ceiling by a further €2 billion Euro. Simultaneously they are also proposing to change the scope for the type of projects that Euratom Loans can be used for, specifically relating to the enlargement of the EU. If adopted the ceiling increase will allow new nuclear construction to be supported by Euratom loans in both Member States and current accession countries. No date has yet been set for a final decision.

British Energy and nuclear liabilities:

The privately owned nuclear generator in the UK, British Energy, has been experiencing severe financial difficulties as a result of its poor performance in the UK's competitive electricity market. In September 2002, BE approached the UK Government claiming it needed aid in order to continue operating. The Government provided BE with a credit facility of £410m[36], which was allowed by the European Commission on the condition that the UK produced a restructuring plan for the company. The restructuring plan incorporates a range of measures that would transfer many of British Energy's nuclear waste liabilities to the UK taxpayer – in other words, the restructuring plan constitutes state aid to British Energy. However, the European Commission is reviewing the plan in the light of the Euratom Treaty as well as under competition rules. If the Euratom Treaty is found to take

[35] Information distributed by the European Commission to the EU's Finance Councillors Working Group February 2003.
[36] The credit facility was temporarily increased to £650 million. It currently stands at £200 million.

precedence, this could allow State aid for British Energy – worth over €5.1 billion in current values[37]– to go ahead despite the fact that they constitute State Aid.

The French nuclear operator, EdF, is reportedly also considering asking its Government for help with the long-term costs of dealing with nuclear waste. If the Commission allows the British Energy deal to go ahead under the Euratom Treaty, it may well open the door for other nuclear operators in Europe to follow the UK example of ongoing public subsidy for dealing with nuclear waste[38].

2.4 Energy Infrastructure Programme

One of the Commission's objectives for the next wave of liberalisation is to create a single EU energy market rather than fifteen liberalised but separate markets. To enable this to happen greater physical interconnections between national energy systems need to be constructed. Consequently, the construction of these Trans European Networks (TENs) are given priority status within EU institutions.

Trans-European Energy Networks:

TENs are an important part of the unification of Europe's energy systems. Specifically, the European Commission see them as a vital way of creating a single European energy market, as opposed to 15 or 25 liberalised but yet separate markets.

In June 2003 the European Union agreed to guidelines for the development of the TENs networks[39] - while the Commission launched a new consultation process on the TENs programme a month later in July[40]. Following this consultation, the Commission published draft legislation in December 2003[41]. This legislation will repeal the legislation adopted only six months earlier by the EU. Accompanying this legislation was further proposals for action in the field of security of supply and energy efficiency. The new Directive on Security of Supply[42], indicates that between 2005-9 a EU expenditure of €540 million is anticipated for the construction of TENs.

Data for expenditure from the TENs programme over seven years – between 1995-2001 -, shows the type of projects that are funded. In the gas sector, most funding has gone to gas storage (LNG and natural gas) and for electricity for connections to third countries. The total expenditure in period is only about €122 million.

[37] The net present value of the measures mainly being considered as relevant under the Euratom Treaty total €5.1 billion. However, if the total value of the relevant aid over time is used, the undiscounted value comes to over €17 billion. (European Commission, Restructuring Aid in Favour of British Energy Plc, Official Journal of the European Union, 2003/C 180/03, 31 July 2003.

[38] EDF seeks transfer of waste liability to French state, Nuclear Fuel, McGraw Hill, 1st March 2004

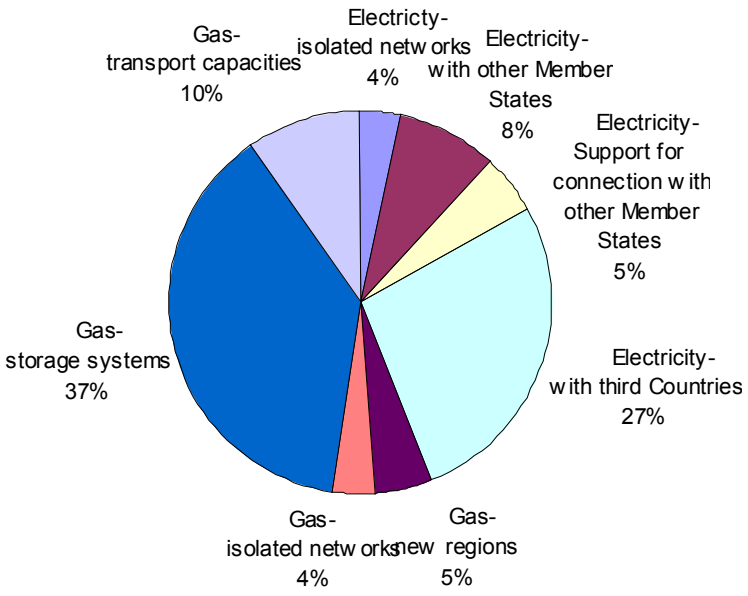
[39] European Commission, Decision No 1229/2003/EC of the European Parliament and of the Council of 26th June 2003 Laying Down A Series Of Guidelines For Tran-European Energy Networks And Repealing Decision No 1254/96/EC, Official Journal of the European Union, 15th July 2003.

[40] http://www.europa.eu.int/comm/energy/ten-e/en/index.html

[41] European Commission, Proposal for a Decision of the European Parliament and of the Council Laying Down Guidelines For Trans-European Energy Networks And Repealing Decisions No 96/391/EC And No 1229/2003/EC, COM (2003) 742 Final, 10th December 2003.

[42] European Commission, Proposal For A Directive Of The European Parliament And Of The Council Concerning Measures To Safeguard Security Of Electricity Supply And Infrastructure Investment (Presented By The Commission) {SEC(2003) 1368} Commission Of The European Communities Brussels, 10.12.2003 COM(2003) 740 Final 2003/0301 (COD)

Figure 10:
Type of TENS funded Projects, 1995-2001



Source: European Commission 2001[43]

However, structural funds are not the only sources for TENs developments. Others include:

- Co-operation programmes with third countries (PHARE, TACIS, MED etc)
- European Investment Bank Loans.
- European Coal and Steel Community Loans.
- European Investment Fund Loan Guarantees.

The extent of the contribution of each of these sources finance projects over the period 1995-1999 is shown in the table below.

Table 2:
Community Financing of Tens 1995-1999

Type of Assistance	Instrument	Total (€ m)
Loans	EIB	3507
Guarantees	EIF	291
Grants and Cofinancing of studies	Structural Funds TENs	1985 93

Source: European Commission 2004[44]

In total EU financing during this five year period was therefore €5.8 billion, with approximately, only 1.6% of the financing of TENs projects coming from the TENs budget.

[43] European Commission, Report from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, 14th December 2002, On The Implementation Of The Guidelines For The Trans-European Energy Networks In The Period 1996-2001.
[44] European Commission: Financing: http://europa.eu.int/comm/energy/ten-e/en/financing.html

Structural Funds:

Structural Funds are used widely in the EU to harmonise the economic and social conditions in different regions. These funds represent about one third of the Union's budget. Funding has been allocated for the development of energy infrastructure, often gas pipelines and electricity transmission systems, through[45]:

- The European Regional Development Funds (ERDF)
- Community Support Frameworks (CSF I and II)
- Community Initiatives (REGEN, INTERREG II)

A report for the European Parliament estimated expenditure by source from 1994 – 1999. Table 3 shows that natural gas receives about 65% of all energy funding, while renewables receive only 17%.

Table 3:
Allocation of Structural Funds to Energy Projects 1994-9

Peat production	Gas	Renewables	Electricity in General
€50 million	€1124.1 million	€300 million	€325 million

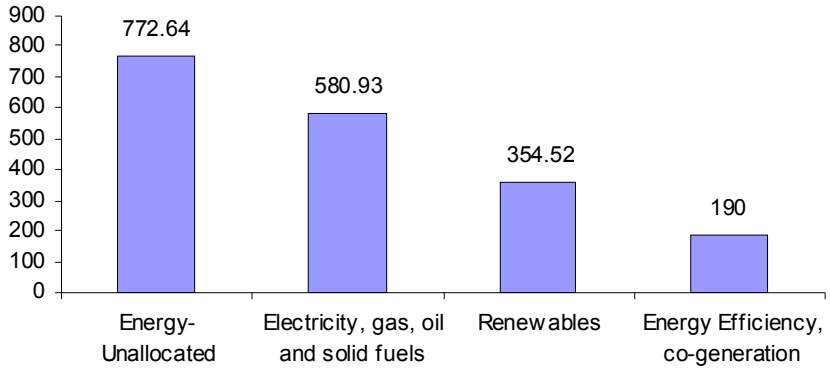
Source: European Parliament 2001[46]

However, others suggest that the total value of energy projects in the ERDF is considerably higher than that documented in the report for the European Parliament. The European Commission's Second rapport on Economic and Social Cohesion suggests that €2.9 billion was made available for energy projects, although it does not give further analysis of the type of project funded[47].

In the next period of the Structural Funds (2000-2006) a total of €213 billion has been allocated through structural funds. Of this approximately € 2 billion is currently earmarked for energy projects, although the final allocation to different energy projects cannot yet be determined. However, on the basis of commitments made in March 2002, it is possible to determine that renewable energy is currently scheduled receive the largest share of any particular group of technologies, as 22% of ERDF Funds have been earmarked for solar, wind, hydroelectric and biomass projects.[48] The current expenditures are outlined in Figure 11.

[45] European Commission: Financing: http://europa.eu.int/comm/energy/ten-e/en/financing.html
[46] Frans Oosterhuis, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, draft report for the European Parliament's DG for Research, July 2001. Energy Subsidies in the European Union. page 14.
[47] Javier de Quinto, Yolanda Garcia Mezquita, Antonio Navarro, Santos Ruesga, Richard Watt, Labour S.L. December 2000, Second Rapport on Economic and Social Cohesion: The Role of Energy, Chapter 5, page 90
[48] European Commission Staff Working Paper, December 2002, Inventory Of Public Aid Granted To Different Energy Sources. http://europa.eu.int/comm/dgs/energy_transport/state_aid/energy_en.htm, page 50

Figure 11:
Expected Expenditure on Energy Infrastructure 2000-6 in ERDF (€ million)



Source: European Commission 2002[49]

In addition to funding for Member States the ISPA, the Instrument for Structural Policies for Pre-Accession, was set up as part of the Agenda 2000 – the programme developed for the enlargement of the European Union - to provide assistance to the candidate countries in Central and Eastern Europe to prepare for EU membership**.** Over the period from 2000 to 2004, the Commission approved 324 projects amounting to a total ISPA contribution of EUR 7 billion. It is unclear how much of these funds have been allocated to energy projects.

[49] European Commission Staff Working Paper, December 2002, Inventory Of Public Aid Granted To Different Energy Sources. http://europa.eu.int/comm/dgs/energy_transport/state_aid/energy_en.htm, page 121. It must be noted that the figure used for renewables is less than that quoted in the same report on page 50, which estimates the renewables expenditure during this period to be €487 million.

3 ENVIRONMENTAL EXTERNALITIES

Electricity production by conventional generators - fossil fuels and nuclear power - has a negative impact on the environment, because of the creation and emissions of pollutants. Utilities do not pay for their pollution, despite the negative cost that this entails for society. As the costs of these pollutants are not included in the price of electricity they are called environmental external costs – or externalities. They amount in effect to unseen subsidies for the industries producing the pollution. In 1991 between the EU and United States launched ExternE[50], a joint project to assess the economic costs of different environmental pollutants resulting from the production and use of energy. The project is still ongoing and has produced results that compare the costs of the different fuels in different Member States.

In July 2001 the European Commission issued a press release on the findings of the study. This concluded the "cost of producing electricity from coal or oil would double and the cost of electricity production from gas would increase by 30% if external costs such as damage to the environment and to health were taken into account. It is estimated that these costs amount up to 1-2 % of the EU's Gross Domestic Product (GDP), …They have to be covered by society at large, since they are not included in the bills which electricity consumers pay"[51].

Within the ExternE research to date a range of environmental costs have been allocated to different energy sources. This can be seen in the table below.

Table 4:
External Environmental Costs Associated with Energy Production

Technology	External Cost Range (€cents/kWh)
Coal/Lignite	2-15.0
Oil	3-11
Gas	1-4
Nuclear	0.2-0.7
Biomass	0.2-3.0
Hydro	0-1
Wind	0-0.25

The report has been criticised for failing to consider the full environmental impact of global warming and the impact of nuclear power. On nuclear power the report states that it "involves relatively low external costs due to its low influence on global warming and its low probability of accidents in the EU power plants". However there are a number of statements in the report that qualify – to some extent – the conclusion of the report regarding nuclear power. These include: "Reliable values of accident, high level wastes impacts, nuclear proliferation and impacts of terrorism have not been developed in ExternE. These omissions may well be significant and therefore should be clearly noted in any assessment[52]".

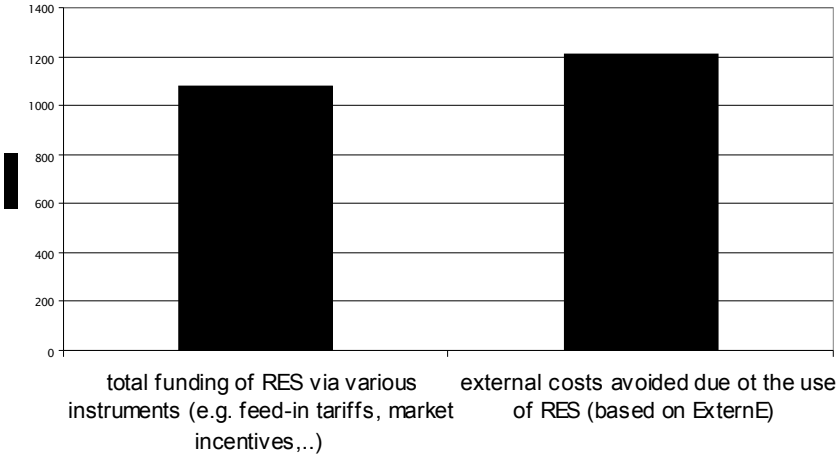
Despite these claims the ExternE report can be used to assess the environmental externalities associated with the energy sector. Analysis in Germany has suggested that the environmental costs of energy are greater than the more obvious direct support given to renewable energy. Therefore, renewable energy direct support is cheaper than paying the external costs of conventional generation. This can be seen in the graph below.

Figure 12:
External Costs Avoided due to RES in Germany in 2003

[50] http://externe.jrc.es/overview.html

[51] European Commission: 20th July 2001, New Research Reveals The Real Costs Of Electricity In Europe. http://europa.eu.int/comm/research/press/2001/pr2007en.html

[52] ExternE: 1998 update; Aggregation of Externalities, page 497, Volume 7.



Source: DLR 2004[53] (in Euro)

3.1 Nuclear Liability

An example of the significance of the insulation from environmental externalities enjoyed by the nuclear industry is the nuclear liabilities regime. Current nuclear insurance has a three tiered system, whereby part is covered by the operator, part by the State in which the facility is located and part by international convention. However, even these three tiers do not cover the full cost of a severe accident and there is a fixed ceiling for nuclear damage. In February 2004 it was agreed that the current ceiling should be increased from $350 million to $1.5 billion[54]. A nuclear operator will be required to have $700 minimal liability cover, the nation State will cover a minimum of $500 million and the public funds from the international tier will cover $300 million[55]. However, even this increase in costs both allows restrictions on the level of insurance that a utility is required to take out in the event of an accident and the total compensation that can be claimed following a nuclear accident. Were a nuclear generator required to fully cover the potential cost of a nuclear accident would significantly increase the cost of generating nuclear electricity. How much it would increase depends on a number of variables, including the probabilistic risk of an off-site release of radiation, the location of a plant and its vicinity to urban populations and the local meteorological conditions. A number of studies have been undertaken to assess the extent of this additional cost and these conclude:

> **France**: If EdF were required to fully insure their power plants with private insurance but using the current internationally agreed limit on liabilities of approximately €420 million, it would increase EdF's insurance premiums from 0.0017c€/kWh, to 0.019 c€/kWh, thus adding around 8% to the cost of generation. However, if there was no ceiling in place and a operator had to cover the full cost of a worst cost scenario accident it would increase the insurance premiums to 5 c€/kWh, thus increasing the cost of generation by around 300%[56].
>
> **Germany:** Ewers and Rennings estimated in 1992 the total damage of a reactor meltdown in Germany at €5,469 billion. Given a probability of 1 meltdown per 33,000 reactor years and 0% discount rate, this leads to external costs of 0.022 EUR/kWh. [57] Furthermore, the report for

[53] Wolfram Krewitt, Joachim Nitsch German Aerospace Center (DLR) Institute of Technical Thermodynamics, System Analysis and Technology Assessment Stuttgart, Germany Workshop on Long Term Energy Prospects and the Role of Renewable Energies Brussels, European Parliament 18th March 2004, Forecast Scenarios for the Potential Role of Renewable Energies

[54] International Atomic Energy Agency, 12th February 2004, Nuclear Liability Rules Revised to Increase Compensation.

[55] Nuclear Energy Agency, Press Communiqué, 10th February 2004, Revised Nuclear Third Party Liability Conventions Improve Victims' Rights To Compensation.

[56] CE, Solutions for Environment, Economy and Technology, Report for DG Environment January 2003 Environmentally harmful support measures in EU Member States, page 132

the European Parliament in 2001 on energy subsidies has calculated that this means an annual subsidy of €20 billion a year for the EU-15[58].

3.2 Cost of Climate Change

The ExternE takes insufficient account of the costs of global warming. Across the world climate related extreme weather events are occurring at an accelerated rate. A report by the insurers group for the UNEP Financial Services Initiative estimates that the cost of climate change may reach $300 billion per year if current trends continue unabated[59], while in 2003 the cost of natural catastrophes was $60 billion. The most expensive of these, both in terms of lives lost and economic impact was the heat wave in Europe in July and August, which caused upwards of 20 000 premature deaths and caused economic losses or around $13 billion. Wind storms and severe weather accounted for 75% of all insured loses caused by natural catastrophes[60]. However, the summer 2003 heat wave was not the largest climate related economic event of recent years. In August 2002, the flooding resulting from heavy rains in Central and Eastern Europe were thought to have resulted in economic losses of €30 billion, while the gales of December 1999 were estimated to have caused insured losses of around €11 billion.

[57] Ewers H-J and K Rennings 1995. Economics of Nuclear Risk – A German study, in O Homeyer and R Ottinger (eds), Social Cost of Energy, Present Status and Future Trends, Springer-Verlag, Berlin 150-166

[58] Frans Oosterhuis, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, draft report for the European Parliament's DG for Research, July 2001. Energy Subsidies in the European Union.

[59] UNEP February 2001.

[60] Munich Re. 29th December 2003, Analysis of Natural Catastrophes in 2003. http://www.munichre.com