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FORUM ÖKOLOGISCH-SOZIALE MARKTWIRTSCHAFT

AN INVESTIGATION INTO ALL FORMS OF STATE AID FOR ATOMIC ENERGY 1950 - 2008

Green Budget Germany research report commissioned by Greenpeace

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„If governments do not facilitate the investment,
I don't think nuclear will fly.“

Fatih Birol, Chief Economist,
OECD International Energy Agency,
in: The Economist, 9 November 2006

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SUMMARY/ABSTRACT

This short study, based on literary research, interviews, and our own methodical considerations, presents, for the first time, an extensive and complete timeline of both direct and indirect state fund-ing for atomic energy from 1950 to 2008. This funding amounts to about 60.8 billion Euros in fi-nancial aid, 64.8 billion Euros in tax benefits, and 39.1 billion Euros in assistance from state provi-sions independent of the budget (all values in terms of 2008 prices). In ad-dition, the external costs of atomic energy are factored in.

I. SUMMARY OF RESULTS AND THESES

This short study, based on literature research, interviews, and our own methodical considerations, for the first time presents an extensive and comprehensive timeline of both direct and indirect state funding of atomic energy from 1950 to 2008, as well as an outlook on areas currently expected to receive support from 2009 onwards.

All contributions from this particular time period are listed (nominal values). In order to translate them to present-day prices (2008 price levels), it was necessary to calculate inflation adjustment by consulting a timeline of the price index for the cost of living provided by the Federal Office for Statistics (Statistisches Bundesamt).

If new findings become available that suggest that the release of a second edition would be appropriate, we will prepare an updated version.

It is already apparent from the current qualitative compilation of incompletely documented or as yet undocumented subsidies that the actual total costs of nuclear energy borne by government and society have been far from exhaustively calculated in this study. This means that they are considerably higher than we have so far been able to substantiate.

The following first summarises the results of the investigation into public funding for the atomic sector in general, and then for individual areas of funding. Even a careful balancing of funding levels for all relevant state provisions to the nuclear sector since 1950 shows that nuclear energy has received special political attention in Germany.

1. Financial support from the public budget up to 2008 nominally amounts to 95.4 billion Euros or 125.6 billion Euros in terms of 2008 prices (see sum 1 in the table). This corresponds to an average amount of 2.3 cents/kWh (nominal) of nuclear energy[1], or 3.0 cents/kWh in (actual) in 2008 prices.

2. Including the benefits atomic energy receives through emissions trading, the amount of aid adds up to 101.3 billion Euros nominal, or 131.8 billion Euros in 2008 prices (see sum 2 in the table). Per kilowatt hour of electricity generated using nuclear energy, this corresponds to an average subsidy of 2.4 cents/kWh nominal, or 3.1 cents/kWh in real value (in 2008 prices).

3. The amount of state aid provisions from 1950 to 2008, when accounting for the benefits the nuclear industry receives through the inflation of electricity prices from incomplete competition in the electricity market – but without consideration of external costs – is 128.1 billion Euros nominal, or 164.7 billion Euros in 2008 prices. This corresponds to a nominal average funding amount of 3.0 cents/kWh of nuclear energy, 3.9 cents/kWh in real value.

4. Due to extreme differences in value estimates found in the available literature (from 0.1 to 270 cents/kWh), we did not adopt a ‘best guess’ approach to the value of external costs. Non-internalised external costs are indeed an incredibly relevant advantage for nuclear en-erg, but due to this uncertainty, we have not incorporated this benefit through omitted state internalisation in our calculations.

5. Future provisions which are already currently established, as well as other state provisions with funding for nuclear amount to 49.1 billion Euros (sum 1) energy in terms of budgetary

[1] The total gross electricity production from 1950 to 2008 added up to 4.241 TWh.

aid alone. Additional considerations, such as the funding value of emissions trading, bring this amount to 80.1 billion Euros (sum 2). Furthermore, when the advantage from inadequate competition in the electricity market is taken into account, the overall amount totals 92.5 billion Euros (sum 3).

Table 1) Overview of Findings Regarding State Funding For Nuclear Energy

	All Specifications in Billions of €	Funding 1950-2008 nominal	Funding 1950-2008 real (2008 prices)	Funding as of 2009
A.	**Financial Aid**	**40.6**	**> 60.8**	**> 7.1**
A.1.	Research (Germany)	22.8	41.2	1.4
A.2.	Federal State Contributions	5.0	5.2	n/ a
A.3.	Guaranteed Loans	0.14	> 0.14 *	n/ a
A.4.	Euratom + Phare (German Share)	1.9	2.5	0.5
A.5.	Closure of East German Nuclear Power	2.7	> 2.7 *	1.0
A.6.	Wismut Decontamination	5.1	6.1	1.1
A.7.	Morsleben	1.0	> 1.0 *	1.2
A.8.	Asse	0.3	> 0.3 *	2.0
A.9.	Repository Site Search	0	0	0
A.10.	Chernobyl	0.5	> 0.5 *	n./ a.
A.11.	Contributions from International Organisations	1.1	> 1.2 *	n./ a.
B.	**Tax Benefits**	**54.8**	**> 64.8**	**42.0**
B.1.	Accruals	20.0	24.4	27.4
B.2.	Net Energy Tax Benefits	34.8	40.5	14.6
C.	**Budget Independent State Provisions**	**32.7**	**> 39.1**	**43.4**
C.1.	Increase in Price of Electricity through Emissions Trading	6.0	6.2	31.0
C.2.	Incomplete Competition in the Electricity Market	26.8	33.0	12.4
A. +B.	**Sum 1: Budgetary Funding**	**95.4**	**> 125.6**	**> 49.1**
	Average in cents per kWh	*2.3*	*> 3.0*	*4.0*
A.+B.+ C.1.	**Sum 2: Budgetwirksame Förderungen + Vorteile Emissionshandel**	**101.3**	**> 131.8**	**> 80.1**
	Average in cents per kWh	*2.4*	*> 3.1*	*6.5*
A. - C.	**Sum 3: All Funding excluding External Costs**	**128.1**	**> 164.7**	**> 92.5**
	Average in cents per kWh	*3.0*	*> 3.9*	*> 7.5*

* Inflation adjustment not possible because the sources used only displayed cumulative values, not values for individual years

6. **In case of doubt, careful estimations were employed.** In particular, the following points were only quantifiable by means of assumptions and estimates:

A.3. Guaranteed Loans,
B.1. Accruals
B.2. Tax Benefits for Energy Taxes
C.1. Value of Electricity Price Increase through Emissions Trading
C.1. Value of Incomplete Competition in the Electricity Market, and
D. External Costs and Incomplete Liability.

7. **Some funding provisions could not be quantified or not completely quantified.**
This concerns:

- For A.2. (Federal State Contributions) we could not complete a full review of individual state budgets. Here, we included solely the information available from the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung) study of 2007.
- For A.4. (European Contributions to Nuclear Energy) no information was available to us regarding the EU nuclear programme before the year 1984.
- For A.8 (Decontamination and Closure of the Asse Nuclear Waste Storage Facility) it will only be possible to estimate the future costs reliably once a precise closure plan has been agreed upon.
- For A.10. (National and international contributions in the wake of the Chernobyl disaster,) only incomplete values were available with regard to the costs of the Integrated Measurement and Information System for the Surveillance of Environmental Radioactivity (IMIS), because the costs are shared across four different federal ministry budgets, and it is not always possible to identify the relationship to IMIS. The costs which accrue in the Federal Ministry form Environment, Natural Protection and Reactor Safety (BMU) budget are included completely. Furthermore, the amount Germany contributed between 1986 and 1997 for humanitarian and technical aid and the construction of the first protective covering (the co-called 'sarcophagus'), could only be calculated incompletely.
- For A.11. (International Organisation contributions) the Federal Ministry for Education and Research (BMBF) currently gives 130 million Euros annually to the European Organisation for Nuclear Research (CERN); information from previous years was not available to us.
- We have also not included the fact that the network expansion for nuclear power plant sites was financed by inflated energy prices from the monopoly period.

8. In part E, further state services to the nuclear energy sector are listed. Because it is disputed whether and/or to what extent these can be classified as an additional state subsidy, we have not included these facts in the figures in our calculation of total public funding to nuclear energy. This includes the following:

- E.1. Police protection of nuclear transports and police presence at large demonstrations against nuclear energy.
- E.2. The portion of the costs of national administration of nuclear energy not covered by administration charges.
- E.3. Public contributions to institutions for the development and maintenance of the nuclear industry that have evolved since 1950.
- E.4. Costs for emergency planning with regard to the risk of nuclear disaster.

9. **In summary, it can be observed that it is certainly the case that the total costs are higher than those substantiated here using official sources.**

10. In the **federal government's subsidy reports** only one single figure for nuclear energy was recorded, namely support for agriculture following the Chernobyl disaster. Subsidies for this purpose declared in the subsidy report amount to less than 200 million Euros for the entire period from 1950 to 2008. The difference between the official government figures for subsidies for nuclear energy and the actual value of state provisions calculated here is therefore very large.[2] Even if the external costs of nuclear energy are not incorporated into the calculation of total subsidy payments, the federal government undervalues nuclear funding for this time period by a factor of 800.

11. From today's point of view, most of the funding for nuclear energy are 'sunk costs' and do not appear to have any direct influence on the industry's competitive position. **However, had the nuclear energy operating companies been required to bear even a portion of all relevant costs during the building phase, these technologies would never have been implemented.** It has only been possible for nuclear energy to maintain its current market position as a result of high levels of funding in the past.

12. **Almost all subsidies are at the very least indirectly relevant for the commercial launch of and competitive advantages granted to nuclear energy.** Evolutionary economics demonstrates that an established and well-worn developmental path can hamper or even prevent innovation, instead 'locking in' existing technologies. The concept of path dependence outlines a series of requirements, under which innovations can establish themselves and proliferate. Path dependence is encouraged by a range of factors and leads to established technologies enjoying a series of advantages that hamper the breakthrough of innovations into the market. The developments of the last 50 years would have presented more and earlier opportunities for environmentally friendly energy if, for example, power grids were not oriented towards large, central power plants, or if research had not been one-sidedly directed towards nuclear energy.

13. Funding that still produces direct competitive advantages for nuclear energy today include:

- Compulsory provisions or funds for decommissioning that the nuclear industry must set aside to cover future costs such as decommissioning
- Advantages from the increase in the price of electricity due to emissions trading
- Inadequate internalisation of external costs, as well as a lack of complete liability.

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[2] This is attributable to the narrow definition of subsidies in the federal government's subsidy report. The federal government's subsidy report is published every other year and narrowly defines both tax benefits and financial aid. At the time this report was written, the most recent report was the 21st Subsidy Report from 21/8/2007 (BT-Drs 16/6275); for a complete list of all subsidy reports please see the bibliography (under Bundesregierung, Subventionsberichte). For an overview of which types of energy subsidies are covered in the federal government's subsidy report, see Meyer 2006, S. 21 f.

In the field of nuclear energy, almost all of the subsidy expenditures listed here are not listed in the subsidy report for various reasons. According to the definitions in the subsidy report, most of the expenditures would be classified as gen-eral state expenditures; research expenditures are listed in the research reports, and there is a separate report for loan guarantees from the Federal Ministry of Trade and Industry (Bundeswirtschaftsministerium). Both of the tax benefits included here are also not in the subsidy report, because they do not fall under its narrow definition of a tax benefit. Moreover, budget independent provisions are generally not collected in the state subsidy reports.

For the individual subsidies detailed below, the following general conclusions can be made:

A. Financial Aid

1. Federal Research Expenditure

The public expenditure for research reactors and pilot projects in the nuclear sector from 1950 to 2008 amounted to about 41.2 billion Euros (real). Whereas the focus during the early days of nuclear energy was predominantly on the development of research reactors, which included several technologies which never achieved commercial viability (e.g. breeder reactor technology), in recent times, the costs of decommissioning, dismantling, and permanent storage have increasingly accrued. Cost estimates for future amounts of necessary expenditure are hindered by continuing problems with dismantling contaminated facilities and storage of waste. As the examples of the nuclear re-search facilities in Karlsruhe and Jülich show, originally estimates of costs can multiply in a short time.

2. Federal State Expenditures (Bundesländer)

In 2007 the German Institute for Economic Research (DIW) stated that the expenditures by federal states for nuclear research from 1956 to 1975 were 4.97 billion Euros real (2006 prices); in 2008 prices this would amount to 5.2 billion Euros. These expenditures are considered here. Further expenditures by the federal states for nuclear energy could not be more closely researched within the framework of this study.

3. Loan Guarantees for Projects Abroad

Between 1969 and 1998 Hermes guarantees supported the export of nuclear technology to 20 countries in the form of loan guarantees worth 6 billion Euros. An interest rate approximately 2% lower than that available on the free market (ca. 5%) was charged on these export loan guarantees, meaning that 2% of this 6 billion Euros should be understood as a subsidy. This financial subsidy was thus worth approximately 120 million Euros - although in all probability, this estimate is too low. Furthermore, the Bayerische Landesbank's investment in the Financing Consortium for the construction of the Finnish Olkiluoto reactor led to a reduction of investment risk for private stakeholders in the consortium. Although the European Commission contests this on the basis of the nominally relatively small contribution from the Bayerische Landesbank, there are proceedings pending in this matter in the European Court of Justice. We have estimated the approximate amount of support at about 19.53 million Euros, which is derived from the difference in interest rates between the market rate and the guaranteed interest rate of under 2.6%, the officially documented financial contribution to the project, and the number of public actors involved. In total, this amounts to a support value of approximately 140 million Euros in loan guarantees.

4. Germany and the EU

Between 1984 and 2008, the German share of the EU total budget sank from about 30 to 20 per cent, not least due to the accession of new member states. This is reflected in the German share in Euratom expenditures for EU Research Framework Programmes (1984–2008), which amounted to 1.8 billion Euros. As yet, it has not been possible to determine the amount of Euratom funding between 1957 and 1984, i.e. before the introduction of the Framework Programmes.

Because of EU enlargement, safety and decommissioning projects in the nuclear sector were funded in addition to Euratom research to ensure safe plant decommissioning when, for example, eastern European countries such as Bulgaria did not have the necessary means to dismantle power stations safely. Germany’s contribution to nuclear projects in the PHARE Programme (2001-2005) amounted to 120 million Euros. Further expenditures for nuclear projects, for example, by means of the provision of cheap credits from the European Investment Bank (EIB) or the European Bank for Reconstruction and Development (EBRD), could not, thus far, be quantified.

5. Post-Operation and Closure of East German Nuclear Power Plants

The vast majority of facilities – the single exception being the Helmholtz reactor in Berlin – have been decommissioned since the beginning of the 1990s. Because of the particular historical situation, no provisions had been made for decommissioning. In general, although the closure of East German nuclear power plants involved state spending for nuclear energy, it does not appear to be relevant to the current competitive situation. Bearing the cost of decommissioning the now deactivated East German nuclear power plants was a competition-relevant state expenditure however, as much as the legal successors of the former GDR state energy providers and nuclear power plant operators took over the electricity customers in the region, while the taxpayer has had to pay for the decontamination of former sites. In this case, the old policy of ‘privatise the gains, nationalise the losses’ was applied. The costs to the state that arose from decommissioning have amounted to circa 2.7 billion Euros thus far.

6. Decontamination of the Soviet Uranium Mines in Saxony and Thuringia (Wismut)

In total, it is estimated that 6.2 billion Euros (13 billion DM) of federal funds in total will be spent on decontamination, secured through commitment appropriations in the 1992 federal budget. Originally, decontamination was expected to be completed by 2010 or 2012 at the latest. This target will only be achieved in Ronneburg in eastern Thuringia. Because a further five years of post-decontamination work will be required in all the Wismut regions, a completion date is not expected before 2020. Whether the total amount of 6.2 billion Euros estimated by the federal government will prove to be sufficient is questionable.

7. Purchase, Construction, Operation, Decontamination and Closure of the Morsleben Depository

The Morsleben nuclear waste storage facility, already operating in the time of the German Democratic Republic (GDR), was also used for collective German nuclear waste disposal after reunification. Although only approximately half of the inventory was covered by disposal obligations in the Reunification Treaty, the government nevertheless guaranteed that it would cover all further costs. Less the German nuclear energy operator’s fulfilled advanced payments of 138 million Euros, the costs up to 2008 added up to 0.96 billion Euros. The Federal Agency for Radiation Protection (BfS) estimates a further 1.2 billion Euros will be needed for closure and decommissioning. The total costs for the federal government add up to 2.3 billion Euros. The contribution from business of 138 million Euros barely covers 6% of this amount.

8. Decontamination and Closure of the Asse Nuclear Waste Storage Facility

The nuclear waste stored at Asse was initially sent to the fuel reprocessing plant in Karlsruhe (WAK) by nuclear power plant operators. The waste disposal charges at the time were marginal compared with the current estimates and ever increasing costs. Even though flawed management by the erstwhile operator of Asse, the Association of Radiation Research (GSF), increased the problem – and the costs of decontamination measures – the nuclear industry remains responsible. State expenditures for the investigation and operation of Asse amounted to about 290 million Euros up to 2008, and those for the closure and decommissioning are currently projected at about 2.0 billion Euros. In total, fees from those who delivered the nuclear waste to Asse amounted to 16.5 million DM.[3] In terms of the estimated decontamination costs of about 2.5 billion Euros, this figure does not even amount to 0.4% of the actual costs. Taxpayers are to pay the remainder.

9. Site Search for the Gorleben and Konrad Storage Facilities

The operation and maintenance costs for the Gorleben and Konrad depositories were and are borne by those producing nuclear waste within a framework of pre-payments for waste storage. Given that nuclear research facilities are responsible for the radioactive waste, these costs have already been accounted for under the expenditures of the Federal Ministry of Education and Research (BMBF) for nuclear research. Should the Gorleben site be rejected as a result of a reorientation of the search for a suitable site instigated by the Federal Environment Ministry (BMU), and the extended search incur high costs, these would continue to be apportioned to the waste producers. Not least for this reason, the nuclear industry has advocated a quick decision in favour of the Gorleben site, otherwise its investments in investigation and site development would be lost.

10. Expenditures Following the Chernobyl Disaster – National and International

Particularly in the first 10 years after the catastrophe, this area is characterised by a notable lack of transparency in relation to the funds provided by Germany. The costs shown in the subsidy reports are incomplete. It is barely possible to ascertain when and how much money was transferred to aid organisations, and how German funds were used for the original construction of the sarcophagus. The German investment in the building of a second protective casing around the sarcophagus is well-documented. Only very incomplete figures are available regarding the costs of the Integrated Measurement and Information System for the Surveillance of Environmental Radioactivity (IMIS), because these costs are distributed among the budgets of four different federal authorities and the references to IMIS there are not always recognisable. The costs that have accumulated in the Federal Environment Ministry budget are included completely. In total, costs of about 453 million Euros can be documented in this area.

11. Contributions to International Organisations

The German contributions – including German shares of EU-expenditures – to the International Atomic Energy Agency (IAEA) and to the European Organisation for Nuclear Research (CERN) are considered here. Euratom, as well as the associated international thermonuclear experimental reactor (ITER), are recorded under research expenditures. The German contributions to IAEA amounting to 660 million Euros were revealed by means of enquiry from the federal government. In the case of CERN, only fragmentary information on contributions to construction costs and actual annual costs was available. In spite of extensive inquiries, the Federal Ministry for Education and Research (BMBF) was not prepared to reveal the cumulative German expenditures for a protracted period of time. It is therefore reasonable to assume that the actual costs in this area lie far above the 1.14 billion Euros accounted for here. Predicted future contributions in this area also account for a significant sum, if current spending plans remain in place.

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[3] Federal Environment Ministry (BMU): origin from the Asse II pit of embedded radioactive waste and financing of the costs. As of: 5 March 2009.

B. Tax Concessions

1. Profit Tax Reduction Through Provisions for Waste Disposal and Decommissioning

Nuclear power plant operators are obliged to set aside **provisions** (funds for decommissioning, referred to as Rückstellungen in German) for decommissioning, dismantling, and waste disposal while the plant is operating. This is to ensure that future obligations to the general public to dispose of waste and decommission plants are reflected in the competitiveness of the plant during its operating phase. In principle, this is sensible, but in practice German provisioning practices lead to consider-able economic advantages for the nuclear industry:

Cash Flow Advantage: Because nuclear power plant operators administer the provisions within their corporations themselves, it is possible for the funds to be used for corporate activities in other business areas, unrelated to the original intended purpose. We estimate the resulting monetary benefit to be about 17.3 billion Euros.

In addition, the industry receives an **interest rate advantage from the adjustment of future tax payments.** The German Institute for Economic Research (DIW) (2007) estimates this value at a total of 5.6 billion Euros, although a portion of that will only accumulate in the future. We estimate the interest advantage up to 2008 at 2.8 billion Euros.

2. Non-Taxable Fuel Costs

A particularly pronounced selective advantage for nuclear energy can be observed throughout the entire time period up until 1 August 2006 (when the Energy Tax Law entered into force). While other energy sources were taxed as an input to electricity generation, the use of nuclear fuel was and remains tax free. The advantage of non-taxation of nuclear fuels is estimated by taking the gross nuclear power generation and valuing it using the CO_2/energy equivalent of the rate of tax on light fuel oil. The tax revenue of the coal penny, as well as electricity taxes levied since 1999, are offset. Calculated in this way, the cumulative net advantage nuclear energy enjoys through energy taxation amounts to 34.8 billion Euros nominal or 40.5 billion Euros real (2008 prices).

C. Budget Independent State Funding

1. Funding Value of the Rise in Electricity Price as a result of Emissions Trading

The EU-wide emissions trading scheme introduced in 2005 covers CO_2 emissions from the energy sector and from industry. Emissions trading resulted in a rise in the price of electricity, which increased profits, including and especially for power generation from nuclear energy. There are various studies concerning the assessment of the rise in electricity prices due to emissions trading. For example, an anticipated price for an emissions certificate of 22-26Euros per tonne of CO_2 for the second trading period starting in 2008 implies an electricity price rise of 1-4 cents per kWh. If one takes as a ‘best guess’ a rise in electricity price of 1.5 cents per kWh, one arrives at an advantage for nuclear energy of 2.2 billion Euros in 2008. In the first trading period, the rises in electricity price were smaller. We cautiously estimate the total advantage for nuclear energy from emissions trading during the time period of 2005-2008 to be circa 6 billion Euros. Because the advantages from emissions trading are highly relevant to competition advantages for nuclear energy in comparison to other power generation technologies, this issue merits particular attention.

2. Funding Value of Inadequate Competition in the Electricity Industry

In the literature regarding energy subsidies, regulations are generally not listed under subsidies. In cases where they are conceptionally included, they are not quantified. However, because there are a number of convincing arguments for doing so, profits resulting from the lack of competition in the electricity industry are included for consideration within the framework of this study. Building on comprehensive studies of this topic, we present a substantiated estimate of additional profits which are made possible by the oligopolisitic electricity market in Germany. In this sense, the government support is apparent in the lack of and inadequate regulations on competition within the electricity industry. However, because an omission has a different quality to an explicit state expenditure, we include the funding value of inadequate competition in the electricity industry only in Sum 3, as funding in the wider sense.

D. External Costs and Liability

External costs are costs that the beneficiary of the service does not pay for, but which are instead borne by a third party. External costs can arise at any level of the process chain of nuclear energy use: from uranium mining to processing, enrichment, transport, power plant operation, and interim and final storage of spent nuclear fuel elements and other contaminated substances.

A significant factor which influences external costs in nuclear energy are the expected costs and risks of a nuclear disaster. Liability insurance, as well as financial security, is attached directly to these costs and risks. If the external costs of energy supply were to be internalised (e.g. through e-missions-oriented energy taxation or full liability insurance), it would have serious implications for the competitiveness of the individual energy sources. In addition, renewable energies would benefit accordingly as the energy sources with the lowest external costs.

The identification and quantification of external costs is strongly determined by the assumptions and methodology applied. External cost estimates for nuclear range from 0.1 cents per kWh up to 270 cents per kWh – i.e. estimates can deviate from one another by a factor of 2,700! In our opinion, it is not possible to derive a methodically informed 'best guess' from such a wide range. The following table displays the funding values of the omitted internalisation of external costs dependent upon assumed values per kWh:

	Alle Angaben in Mrd. €	Förderungen 1950-2008		Förderwert ab 2009
		nominal	real (Preise 2008)	
D.	**Externe Kosten**			
	a) Bei Annahme: 0,1 Ct/kWh	3,3	4,2	1,2
	b) Bei Annahme: 1 Ct/kWh	33,3	42,3	12,4
	c) Bei Annahme: 2 Ct/kWh	66,7	84,5	24,8
	d) Bei Annahme: 7,5 Ct/kWh	250,0	317,0	93,1
	e) Bei Annahme: 20 Ct/kWh	666,6	845,4	248,3
	f) Bei Annahme: 270 Ct/kWh	8.999,4	11.413,4	3.351,9

Thus, every cent per kWh of external costs leads to a funding value from non-internalisation of 42.3 billion Euros (real) for 1950-2008 and to a funding value for the remaining lifespan of nuclear power plants of 12.4 billion Euros.

E. Other State Payments in Favour of the Nuclear Sector

The following issues are not taken into consideration in the calculation of total government assistance for nuclear energy. Instead, they are merely listed as an indicator of further public contributions. They pertain to the public cost of monitoring, inspection, and protection of nuclear assets and for precautionary measures for possible disasters. Any commercial enterprise, irrespective of its sector, is entitled to make use of this assistance.

In addition, specific subsidies for nuclear energy should be considered in the light of the fact that the exceptionally high risks and costs, and the corresponding controversy which surrounds nuclear energy, result in particularly high costs for public, parastatal, and state-funded institutions. Should nuclear power plant operators have to cover these costs, nuclear power would be accordingly more expensive.

1. Security for Nuclear Waste Transport

For informational purposes we have included Lower Saxony's expenditures for police security of nuclear waste transport to Gorleben. No values are available to us for the expenditures concerning the deployment of the federal police, for North Rhine-Westphalia's expenditures for transports to Ahaus, nor for expenditures of other federal states. In total, the public expenditures up to the present for police security of nuclear transports can be documented to an amount of circa 345 million Euros. But it is obvious that this amount does not cover all accumulated federal and state costs. Because policing costs are generally not charged to the waste producers, we have not considered this point in calculating total public funding to nuclear energy.

2. Costs for National Nuclear Administration

A verifiable deficit of 103 million Euros for 2008 was present in the Federal Agency for Radiation Protection's budget (BfS), meaning that the expenditures of the agency were not fully covered through fees. If one would try to consider only those expenditure and revenue items which are also related to the nuclear sector, one would arrive at a negative balance of a good 30 million Euros in 2008. However, in the end enforcement of nuclear law is the responsibility of the German lands. In the lands, whether fees in the nuclear sector cover the costs of nuclear administration cannot be estimated on the basis of a specific budget. There is, however, strong evidence to suggest that the fees are not cost-covering.

3. Costs for the Construction and Maintenance of Regulatory and/or Parastatal Infrastructure

From its inception, the nuclear industry has been surrounded by a dense institutional landscape, which was organised by the private sector, or as an association, or by the government. The costs and the public share of investment in establishing this infrastructure is difficult to quantify from today's standpoint. Authority has shifted several times, e.g. the predecessor of the BMBF, the Bundesministerium für Atomfragen (Federal Ministry for Nuclear Issues), which was renamed Bundesministerium für Atomkernenergie und Wasserwirtschaft (Federal Ministry for Nuclear Energy and Water Management) just two years after it was founded. A precise analysis of budgets up to 50 years old would be required in order to calculate the budget of this infrastructure, but for institutions from the private sector, a retrospective analysis is almost impossible.

It can, however, be stated that the well-trodden path toward power production through the nuclear industry has become very broad, and that a dense network of actors is involved in it. This requires financial investment and thus – whether intentionally or unintentionally – this situation also hinders the transition to alternative forms of energy, particularly because they ‘lock-in’ important resources in obsolete technologies.

4. Costs for Catastrophe Protection in Regard to the Risk of Nuclear Disasters

A further matter of expense, which is very difficult to quantify, but should nevertheless be noted, is the imperative for adequate catastrophe protection infrastructure which exists as a result of the extremely high risks associated with the operation of nuclear plants. The need to provide special equipment and qualified personnel for nuclear catastrophes is cost intensive. This applies, for example, to fire departments, hospitals, and the Technisches Hilfswerk (Federal Agency for Technical Relief).

II. INTRODUCTION AND METHODOLOGY

1. Aim and Approach

This short study, based on literary research, interviews, and our own methodical considerations, presents, for the first time, an extensive and complete timeline of both direct and indirect public funding of atomic energy from 1950 to 2008, as well as an outlook on currently known designations of public support from the year 2009 onwards.

Every issue of funding is accompanied by a standardised data sheet. The data sheets contain general information about each particular provision and its context. To quantify the effect of the subsidy values, data and text relevant to the calculation of the value of the subsidies is listed directly.

In this study, all the expenditures in the period under analysis (1950-2008) are compiled (nominal amounts). In order to convert them to present-day prices (2008 prices), we needed an inflation adjustment together with a timeline of the general price index for the cost of living provided by the Statistisches Bundesamt (Federal Statistical Office). Where the available sources provide cumulative information for several years, a price adjustment is not possible.

This study cannot yet provide complete findings. It is a first step towards revealing the actual costs of nuclear energy for the state, society, and every taxpayer. The available conclusion, calculated on the basis of careful assumptions and under non-inclusion of known, but in this framework non-researchable funding issues, clearly reveals high and manifold federal support mechanisms for nuclear energy. Green Budget Germany (FÖS e.V.) and Greenpeace gratefully welcome information which contributes to the further completion of this study.

If new findings become available to suggest that the release of a second edition would be expedient, we will prepare an updated version. The current qualitative compilation of the as yet incompletely gathered funding facts already shows that the actual total nuclear energy costs to the state and to society have been far from exhaustively quantified in this study; they are considerably higher than we have so far been able to verify.

At this point we would like to thank those people from public institutions, and those in the fields of science and economics, for their support in providing information, without which it would not have been possible to paint a reasonably complete picture of the subsidy situation in the German nuclear sector.

2. Subsidy Concepts – Definitions and Examples

In this study we deliberately speak of financial support or state funding because we incorporate, alongside subsidies in the narrower sense (financial aid and tax benefits), state provisions that advantage nuclear energy that are not recorded as a value in the public budget. Alternatively, one could speak of nuclear subsidies and use a correspondingly more broadly conceived definition of subsidies.

Because no unequivocal and generally accepted definition of subsidies exists, either in scientific literature or in practice[4], it is necessary at this stage to more closely define the notion of a subsidy applied here. Three general differentiation criteria should initially be specified, according to which various subsidy concepts can be differentiated.[5] Subsequently, a definition of subsidy will be established which is relevant for the purposes of this analysis. Meanwhile, it should be noted that the "various political and scientific concepts concerning the function of the state in economic events are reflected"[6] in the various definitions of subsidies.

According to Fritzsche, et al., the following three criteria play a large role in the differentiation of various subsidy definitions:[7]

1. The range of subsidy donors and subsidy recipients approved according to the definition,
2. The characteristics of the subsidy benefits, and
3. The forms of the subsidies.

In finance it is customary to use a broad definition of subsidy that can be summarised as follows: A subsidy is assistance that is characterised by specific features.[8] Subsidy providers are public, as well as intergovernmental and supranational organisations. Furthermore, organisations that only act as intermediaries in monetary allocation from public institutions and agencies, for example the KfW Bankengruppe (a government-owned development bank), are incorporated in the range of possible subsidy providers. Finally, the deciding factor is whether the granting of subsidies is fulfilled at the expense of the public purse.[9] According to financial theory, subsidy recipients are operations-oriented private and public corporations.[10] As for the characteristics of subsidy benefits, three points are of primarily importance: the first has to do with payments that are deliberately only granted to a certain subset of corporate actors, that is, they have a discriminating nature. Second, there are no direct services provided in return, and the conditions of the exchange differ from normal market conditions.[11] Third, the recipient of subsidies is bound to certain behaviours. With regard to this, it is not relevant whether an actor would have behaved in a manner appropriate for receiving the subsidy even without subsidisation.

There are various forms of subsidy that seem relevant from an ecological perspective: subsidies in the narrow sense are monetary payments from the state to corporations without a corresponding reciprocation, that are allocated for the attainment of a particular public interest. These can come in the form of financial aid or tax benefits. With tax benefits, the question arises as to what the 'ideal norm' of taxation is, that is, how appropriate differentiations inherent in tax norms can be distinguished from selective benefits.[12] Indirect or 'implicit' subsidies are included in this wider defini-

4 Rave 2005, p. 14.

5 Fritzsche 1988.

6 Rave 2005, p. 28.

7 Fritzsche 1988.

8 Rave 2005, p. 15.

9 Nieder-Eichholz 1995, p. 24.

10 The inclusion of private households is disputed and dependent upon the estimation of further criteria by various authors. Cf.: Hansmeyer 1977, p. 959-996, as well as Nieder-Eichholz 1995, p. 26.

11 Rave, 2005, p. 16.

12 See Rave 2005, p. 31, as well as Meyer 2006.

tion.[13] State provisions with subsidy characteristics as well as non-internalised external costs are also included.

The adequate definition and classification of subsidies (particularly compared with general public spending) depends on the intention of the analysis. For central questions which form the basis of this short study, all expenditures and provisions similar to subsidies from the state are factored in. This leads to a broadly composed definition of energy subsidies, in which non-internalised external costs and state provisions with subsidy characteristics are factored in alongside financial aid and tax benefits.

In the following diagram, the scope of subsidy elements are presented and are explained using the example of energy subsidies:[14]

Table 2) Types of Subsidies with Examples from the Energy Sector

Subsidies with Budgetary Effects			Subsidies without Budgetary Effects
(A) Expenditure Side: Financial Aid Real transactions (cash, purchasing, and price reduction subsidies) Interest rate reductions Loans, guarantees, warranties, investments	(B) Income Side: Tax Benefits	(D) Non-internalised external costs of energy use	(C) Provisions with subsidy character Preferential advantages occur through competition-influencing state provisions
Examples from the Energy Sector			
-Black coal subsidies -Aid programmes for regenerative energy sources and energy efficiency -Research and development (especially nuclear and regenerative energy sources) -Preparation measures and renaturation for ignite strip mining -Investment in financing and risks of nuclear waste disposal and transport	-Tax benefits in the course of energy taxation -Tax benefits in the context of income taxes (commuter tax allowance, homebuyer's allowance) -Tax benefits	-Greenhouse gases, air pollutants, non-material emissions -Space, ecosystems -Process chain (upstream and downstream processes relating to bu-	-Contract (*Jahrhundertvertrag*) in favour of black coal -Incomplete competition in the electricity market -Renewable Energy Law -Advantages for certain energy sources in the context of emissions trading

[13] Cf, OECD 1996, OECD 1997, OECD 1998, Meyer 2006, Lechtenböhmer 2004.

[14] Meyer 2006, p. 8.

-Loan guarantees/loans for power plants -Benefits/credits for financing of energy infrastructure	through restoration in the nuclear business sector	siness) -Limitation of liability for the nuclear energy sector	-Trade restriction
Subsidies in the narrower sense		**Expanded concept of subsidies.**	

In international discussions, one can draw on the GATT/WTO Agreement on Subsidies and Countervailing Measures, and studies within framework of the United Nations Environment Programme (UNEP), the International Energy Agency (IEA) and the OECD. In this context, a broad definition of energy subsidies has been established that is fully compatible with the subsidy definition used here:

Table 3) International Definitions of Energy Subsidies

UNEP/ OECD/ IEA[15]	**EU**[16]
Any government action that concerns primarily the energy sector that	All measures that offer direct or indirect advantages to energy sources, in particular:
• lowers the cost of energy production	• reduce costs for consumers and producers
• raises the price received by energy producers	• maintain producer prices higher than market prices
• lowers the price paid by energy consumers	• maintain consumer prices below market prices

3. Path Dependence of Innovations

The aid to nuclear energy over the past 50 years impacts the present and future. Evolutionary economics shows why the development path we are currently pursuing in the energy sector in relation to nuclear energy complicates and hinders innovation.

The goal of evolutionary economics is to identify drivers and legal measures that influence economic change.[17] The underlying assumption is that innovation occurs coincidentally and erratically, and then at some point will become established on the market, if framework conditions allow. Existing technologies that have proven themselves will stay in the market until they are replaced by a better innovation, while non-marketable innovations cannot emerge and be selected. Constant, open

15 UNEP/ OECD/ IEA, 2002, p. 9.

16 EU 2002, p. 4

17 Linscheidt 1999, p. 6.

competition must be allowed for the best possible functionality of this system, because innovations can be neither anticipated nor be planned or coordinated – this would amount to a “presumption of knowledge.”[18] Because market actors are influenced in their search for alternative and improved technologies in their field from technologies already established and available, technical advancement tends to take place along a particular development paradigm. For this reason, the term path-dependence is used.

Path dependence is enhanced by a number of factors and thus established technologies have an array of advantages which hamper an opening in the market for innovations:

- Errors can be eradicated through experience and production can be constantly improved, leading to price advantages, which are supported through higher output and a higher market shares, advantages not enjoyed by new, innovative technologies.

- Existing technologies enjoy the benefits of capital equipment and a labour force which have developed within a particular development paradigm.

- Neighbouring branches – for example suppliers – have adjusted themselves to the demand of the predominant technology.

Innovation competition can therefore result in an almost complete halt in the innovation process that can only be started up again with an external stimulus. The situation is especially problematic if an existing environmental or sustainability concern is not or is inadequately reflected because the paradigm was developed at a time when the concern did not exist, or knowledge of the concern was limited. This certainly applies to nuclear energy. According to evolutionary economics, the political level of intervention should, on the one hand, be minimised. However, in order to leave the path that was previously followed and later recognised as suboptimal, the theory shows, on the other hand, “that political steering impulses must be strong enough to introduce an irreversible path change in favour of environmentally friendlier technologies.”[19]

Previous subsidisation of the nuclear sector is still benefiting this technology today in relation to path dependence, and innovations in the renewable energy sector often experience difficulty entering the market. Economic development over the past 50 years would have had a better chance of preparing itself for environmentally friendlier energies if, for example, power lines had not been guided to central power stations, or research had not been influenced by significant expenditures on nuclear energy. For a long time, the power monopoly also impeded public innovation competition among power providers, as power operators simply passed on their costs to their customers. Only by means of large financial concessions on the part of the state were power corporations prepared to enter the sector at the beginning of nuclear energy use.[20]

Evolutionary economics requires only an “adequately strong political steering impulse” to lead us out of the current nuclear dead-end and make functioning competition for alternative innovations

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18 Von Hayek 1969, p. 225.

19 Linscheidt 1999, p. 14.

20 Trittin 2009, Baring 2009, Prüss 1974, Radkau 1983.

possible. However, current research funding for nuclear technology, such as fusion research, points in the wrong direction.

Between 1968 and 1973 the cash flow percentage (net assets) for power plant construction fell from approximately 75% to 50%, caused by the long construction period and high investments in nuclear power plants. Nuclear energy saw the cash flow percentage for the coming years and further construction of atomic energy sink further and hoped for state support like "[...] amortisation because of the construction time, special depreciation for atomic power plants, but also amortizations for recovery costs or special savings that fundamentally add to them, to effectively grow the cash flow percentage and to reduce the according external demand. Tax benefits of this kind are justified given the special role of the energy market and its key role for economic development in the Federal Republic, however the full consumption of tax benefits, in turn, depends on whether it will also succeed in the future in producing adequate power revenues".[21] These "adequate power revenues" were ensured through the monopoly position of the power supply industry, whose current nuclear power price is still made cheaper through tax-depreciated power plants.

[21] Atomwirtschaft 1975, p. 409 f.

III. DATA SHEETS

A. State Aid

1. Federal Research Funding

a) Current Regulations/Actual Aid

The following will list public aid dedicated to nuclear projects, especially research projects. This refers to costs for the erection and operation of research reactors, for example, as well as for funding provided for closure and dismantling of nuclear plants.

The Federal Ministry of Education and Research's (BMBF) funding in the area of basic energy research covers project funding in the following areas:

- Basic network research for renewable energy and rational energy use.
- Rational energy reorganisation
- Renewable energies
- Nuclear safety and disposal research
- Radiation research
- Fusion research (i.e. ITER)

In addition, funds are given for the Helmholtz Corporation in the fields of:

- Rational energy reorganisation
- Nuclear safety and disposal research (i.e. means for the GSF/investigation of the Asse II disposal site)
- Fusion research[22]

The focal point of support from the state has been adjusted again and again in the past decades. In this way, for example, the funding for renewable energy and rational energy research were decreased in the 1980s, but were later increased again.[23]

- Research in the energy sector should total 337.2 million Euros in 2010, of that 174.4 million Euros have been allotted to the nuclear sector, including radiation and fusion research.
- Funding for research with a nuclear background increased by 2 million Euros.
- For 2008 to 2010 the Federal Ministry for Education and Research has planned the greatest proportion of funding in the area of nuclear energy research to be for fusion research, project

[22] BMBF 2008

[23] DIW 2007

aid, and funds for the Helmholtz Corporation, which adds up to about 126 million Euros annually.

- Funding for nuclear safety and disposal research has grown from a total of 40 million Euros in 2008 to 43 million Euros in 2010.
- Radiation research (exclusively project funding) has a strong effect with 4 million Euros per year.[24]

Through national funding the state supports research in the energy sector through the general Research Programme of the EU (actually the 7th Framework Programme). In particular, fusion research will be more strongly supported at EU-level than through national focal points of support (see below).

b) Quantification of the Effect of Aid

In terms of federal energy research (FuE), between 1974 and 2007 nuclear projects were given 16.0 billion Euros (classification according to BMBF), adjusted for price (2006 value), this amounts to 24.1 billion Euros for this period of time.[25] This amount applies solely to the Federal Republic of Germany. Research aid given by the former GDR is not included. The amount from 1956 to 1975 also included funding amounts for fusion research, which was low. The federal funding for the above-named time period amounted to 16.1 billion Euros (2006 prices), in addition to an additional 4.4 billion Euros given by the federal states.[26]

The total federal nuclear research aid from 1956 to 2007, according to data from the DIW, amounts to 40.2 billion Euros (2006 prices). Updated to 2008 prices, as well as including research aid from 2008, the amount totals 41.2 billion Euros.

For the years 1973 to 2008, real aid is arranged accordingly: nuclear energy research was allotted 20.2 billion Euros, the disposal of nuclear facilities had a considerable effect with 0.6 billion Euros. Nuclear fusion research received 4.2 billion Euros. For the years 1950 to 1973 available data for this type of classification is unfortunately not available to us. Funding for site research has lessened since the beginning of the 1980s, but as of the end of the 1980s the aid for dismantling and closure of research facilities has risen. The federal costs for ongoing multi-year dismantling projects up until now amount to 1.3 billion Euros[27], for the year 2009 alone over 152 million Euros.

Single projects will continue long into the future. For example, the original fund for **decommissioning of the reprocessing plant Karlsruhe (WAK)** to run from 1991 to 2035 has already run out and has replaced by follow-up financing. In 2009, the federal government funded the project with 54 million Euros. So far, federal government funding for the WAK has amounted to a total of 524 million Euros. By 2035, a total funding value of almost 1.3 billion Euros is predicted. Also the dismantling of the HDB (Main Department of Decontamination Operators in the Research Centre Karlsruhe) is

24 BMBF 2008

25 DIW 2008

26 DIW 2007

27 BMBF 2009a (p. 95)

planned from 1998 to 2035: it made a significant impact of 16 million Euros in 2009 and will cost in total, according to today's plans, a total of 552 million Euros.

The costs for building further failed large projects are included in the total sum of 40 billion Euros discussed. Towards that count, among others:

- SNR 300, nuclear power plant (spawn reactor/faster spawn), Kalkar
- MOX burning element factory, Hanau
- THTR 300, high temperature nuclear power plant, Hamm-Uentrop
- WAA renovation/renewal site, Wackersdorf
- Urenco (Uranium accumulation site), Gronau
- Advance Nuclear Fuel, LLC (burning element finishing), Lingen

The federal government and the federal state North Rhine-Westfalia (NRW) shared (until 1987)[28] the cost of over 1.5 billion Euros for the erection of the Thorium High Temperature Reactor 300 (**THTR**) in **Hamm-Uentrop**, and in total the construction cost 2 billion Euros.[29] Since the closure of the power plant in 1989 and subsequent "safe enclosure" the costs had, up until 2005, amounted to around 394.8 million Euros for the company, of which the federal government covered 114 million Euros and the federal state NRW covered 133 million Euros. The 148 million Euros left over were taken over by the operating company HKG, a consortium of the five energy provider corporations (EVU) at the time, as well as further energy providers.[30] Expected costs for the closure from 2009 are not yet known. In the framework agreement from November 11, 1989 it states: "The federal state will take up negotiations with German industry, especially with the energy market, with the goal of readying the necessary financial means. The federal government and the corporations will take part in these talks."[31] It stands to reason that these dismantling costs – like closure and safe enclosure already – will be distributed in equal amounts between the federal state, the federal government, and operating companies. In terms of federal research, a further 35 million Euros is assumed for dismantling.[32]

A fundamental problem is made clear by the example of the **reprocessing facility Wackersdorf**: If a dismantling fund into which the federal state, the federal government, and the energy businesses have paid is not adequate to cover the actual costs, as a rule the state carries the additional costs. For Wackersdorf this meant that the Communal Fund (from 1991) amounting to 1.8 billion DM from the federal state, federal government, and energy sector had already been consumed by autumn 2005. According to the agreement at the time, the federal government took over 91.8 per cent of the further costs, and the federal state of Baden-Württemberg took over 8.2 per cent.[33] Dismantling costs were, however, included in the total aid package.

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28 Hochtemperatur-Kernkraftwerk GmbH 2009

29 Landtag NRW 2006

30 Landtag NRW 2006

31 Landtag NRW 2006

32 BMBF 2009a (p. 95)

33 Landtag Baden-Württemberg 2005

Future specified costs include the closure and dismantling of nuclear research facilities, as they are specified in the BMBF budget for 2009.[34] It is foreseeable that this number does not even come close to the future costs. These first experiences already show that decommissioning is markedly more difficult to implement than expected. For example, take the Research Centre Jülich: for the disposal of the reactor 34 million DM was originally suggested, but meanwhile 500 million Euros is now being discussed.[35] In addition, the costs for the disposal of contaminated reactor parts were not considered.

Table 4) Overview of the Results:

Nuclear Research Aid - Federal	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Total	**22.8**	**41.2**	**1.4**

c) Effects and Evaluation of the Provisions

Through public funding for research in what is ultimately a privately-owned technology, the power plant operators receive great advantages for the construction of their power plant facilities. From today’s point of view, most of the funding for nuclear energy is a “sunk cost” that seems to have no direct influence on competition position. Had the nuclear energy suppliers had to carry even a relevant portion of the costs that were taken over by the state in the construction phase, this technology would never have been implemented. High state funding in the past has made nuclear energy’s market position possible today.

To put these comments in context: it should be noted that in other energy sectors, state funded-background research has also been implemented. Thus, inasmuch as these research facilities are state institutions, the state is also legally responsible for their dismantling costs.

2. Aid from Federal States

The DIW claimed in 2007 the aid given by the federal states for nuclear energy from 1956 to 1975 had a real price of 4.97 billion Euros (2006 prices); in 2008 prices this is 5.2 billion Euros. These provisions are considered here. Further aid from federal states to nuclear energy could not be more closely researched within the framework of this study.

The DIW claims, for example, that the subsidy from the federal state Baden-Württemberg for the Research Centre Karlsruhe to be 41.3 million Euros in 2006

[34] BMBF 2009a (p. 95)

[35] Der Spiegel No. 30/20.07.09 (p. 25)

3. Loan Guarantees for Foreign Projects

a) Current Regulations/Actual Aid

Loan guarantees and shareholding are considered subsidies, or at least subsidy-similar payments with the same impact. The latter is also regarded in the same way by the EU Commission (in the context of aid control) and by economic research institutions (i.e. the Institute for World Economics). In its subsidy report, the federal government does not include loan guarantees for reasons of problems of quantification. However, it is noted on the financial report of the Federal Ministry of Finance (BFM) (19th Subsidy Report, p. 137).[36]

Over the course of the first half of 2008, the federal government took on guarantees for export companies with a contract volume of 9.8 billion Euros.[37]

Hermes provides for export guarantees and export credit guarantees, which are managed by Euler Hermes Credit Security AG and PricewaterhouseCooper's corporate accountancy firm as mandatory of the federal government. Through Hermes guarantees, exporters (producers as well as sellers) are protected from certain risks resulting from business with foreign debtors (purchasers). These risks include the inability of debtors to pay, political risks, and risk of take-over. Thus, export loan guarantees facilitate the opening-up of difficult markets and the maintenance of an economic relationship, even during difficult times. For Hermes guarantees, an exporter must pay a premium that reflects the risk of default in the receiving country, and a portion of the costs in case of default. In 2007, Hermes guarantees had made a total of more than 428 million Euros in favour of the federal budget, making for a total balance of 609 million Euros. In 2007, the Federal Republic of Germany took up new export guarantees worth 17 billion Euros.[38]

b) Quantification of the Effect of Aid

The federal government cannot calculate the amount of Hermit export credit guarantees actually paid out in support of the nuclear industry, because for the period before 1991, there is no data available which breaks down guarantees by industrial sector.[39]

In 2006 the Federal Government of Germany took on new guarantees for export companies worth 20.3 billion Euros.[40]

In 2005 the Federal Government of Germany took on new guarantees worth 20 billion Euros.[41]

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36 „Loan guarantees are an important instrument of economic funding through the federal government. With their help certain staate funding needs can be met without having to use the budget. The economic funding impact of federal loan guarantees, which make it easier for companies to take up credit in the capital market, is similar to that of a subsidy.

There would be a problem in including this in the subsidy report in quantifying the economic funding impact. This does not at all correspond to the total potential obligation capacity of federal loan guarantees, but rather only the eventual rate advantage and eventual eased taking up of credit.“ (19th Subsidy Report of the Federal Government, p. 137).

37 Federal Ministry for Business and Technology (BMWT) 2008.

38 BMWT 2007

39 Federal Government 2008b: BT-Drs. 16/10077

40 BMWT 2006

41 BMWT 2005

In 2004 the federal government took on new guarantees worth 21.1 billion Euros. From this, a surplus of 878 million Euros was paid to the federal budget.[42]

In 2003 the federal government took over export loan guarantees in the amount of 16 billion Euros. From this, a surplus of 669.4 million Euros was paid to the federal budget.

2002: Export loan guarantees: 16.4 billion Euros.

2001: 16.6 billion Euros.

2000: 19.5 billion Euros.

1999: 26.7 billion DM.

1998: 30.2 billion DM.

1997: 36.8 billion DM.

1996: 35.4 billion DM.

1995: 33.4 billion DM.

The portion relevant to nuclear projects is something that the federal government will not reveal. However, since 2001, the use of Hermes guarantees for nuclear exports has been banned. Siemens and AREVA tried in vain to get around this ban in 2003 by exporting a steam turbine for a nuclear power plant to Finland – in the end, guarantees were provided by the Bayerische Landesbank (BLB). This process will be discussed in detail below.

Between 1969 and 1998 nuclear exports to 20 countries received Hermes guarantees worth 6 billion Euros.[43] An interest rate approximately 2% lower than that available on the free market (ca. 5%) was charged on these export loan guarantees, meaning that 2% of this 6 billion Euros should be understood as a subsidy. This yields, **in all probability, an underestimated value of 120 million Euros**.

The European Commission described, in its report on the use of Articles 87 and 88 for the European Community Treaty on state aid in the form of liabilities and loan guarantees, how the aid value of a loan guarantee can be calculated.[44] In Section 3.2 of the report, the equivalent as a cash injection is given as a possibility for the calculation method of loan guarantees, exactly like the calculation of the subsidy equivalent of a rate benefit loan.

Here some examples of foreign projects. Please note that these descriptions do not provide a complete picture:

[42] BMWT 2004

[43] World Economy, Ecoology and Development 2002.

[44] European Commission 2000

- **Angra 2 (Brazil):** The 1975 nuclear treaty between the Federal Republic of Germany and Brazil led to the building of the Brazilian nuclear sector (8 nuclear power plants); Siemens began with the first nuclear project, Angra 2. At the end of 2000, Angra 2 became operational. Because the building costs reached about 10 billion Euros, Brazil experienced serious financial difficulties.[45]

- **Mochovce 1 and 2 (Slovakia):** Completion seemed improbable following the fall of the Eastern Bloc; the federal government gave a Hermes loan guarantee for these reactors in 1995, without insisting upon the implementation of safety requirements. The completed reactors would not have been operationally viable under German law.[46]

- **Krsko (Slovenia):** In July 1999 the federal government gave a 36 million DM Hermes loan guarantee for the retrofitting of the Slovenian nuclear power plant at Krsko.[47]

- **Nuclear Power Plant Lianyungang (China):** Originally approximately 300 million DM for control technology and emergency diesel power supply for both Chinese nuclear power plants Lyangyungang in 2000 were agreed upon.[48]

- **Nuclear Power Plant Ignalina (Lithuania):** Cementation facility for nuclear waste. Costs for the closure of the nuclear power plant amounted to a total of 7 million Euros for the Federal Republic of Germany. The decommissioning fund negotiated between the EU and Lithuania shows expenditures of 165 million Euros.[49]

- **Nuclear Power Plant Attucha I (Argentinia):** Retrofitting and repair measures for the nuclear power plant at Attucha I in Argentinia worth 20 million DM were agreed to in 2000.[50]

Nuclear Power Plant Olkiluoto 3 (Finland):

Since January 2001, the **funding of nuclear projects through Hermes loan guarantees is no longer allowed**. Siemens and AREVA have nevertheless tried to send a steam turbine to be built into the above-named Finnish reactor, using the argument that the turbine itself cannot necessarily be regarded as “nuclear technology”. This, however, was unsuccessful. In December 2003, the federal government deliberated about an export loan guarantee for the planned renovation of a nuclear power plant in Finland in which Siemens is involved. Under pressure from the political party Bündnis 90/the Greens, Siemens’ preliminary application for an export loan guarantee was rejected.

To finance the whole project, the “Teollsiuuden Voima“ (TVO) composed a consortium of financiers from the private and public sectors. The engagement of various public banks led to a clearly reduced risk for the private banks involved, which resulted in a considerably reduced interest rate for the necessary capital. Public banks from Germany, France and Sweden have taken over a large part of the risk. The original loan contract from 2003 was, however, changed in 2005 and the 2.6% in-

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45 World Economy, Ecology and Development 2002

46 World Economy, Ecology and Development 2002

47 IPPNW 2009

48 Urgewald 2009

49 BMF 2006

50 Urgewald 2009

terest rate agreed upon in 2003 then clearly fell short, according to the European Commission.[51] The financial share arranged in the 2005 financing contract can be divided as follows:[52]

- **1.6 billion Euros from the international banking consortium**
  Originally the consortium (according to the 2003 contract) should have made available 1.95 billion Euros. In the 2005 contract, the share of the consortium amounted to only 1.6 billion Euros. The burden is shared between the Bavarian State Bank (BLB), BNP Paribas, JP Morgan, Nordea and Svenska Commerical Banks, each share amounting to between 15-20%. The participation of the BLB as a public bank alleviated the risk for the other participants significantly, which was expressed in the guaranteed interest rate for the loan of considerably less than 2.6%.

- **0.57 billion Euros from COFACE**
  COFACE acts as an export guarantor of the French government and can be therefore characterised as a public actor. Its participation also alleviated the risk for the whole project considerably.

- In addition, TVO raised **further bilateral loans in unpublished amounts**, among others through the public AB Svensk Export Credit Bank (SEK). Their participation also reduced the risk for the total project considerably. According to Schneider, the Swedish share amounts to 110 million Euros.[53]

The European Renewable Energies Federation (EREF) decided to file a complaint to the European Commission regarding doubts on the compatibility of building, financing, and business modalities for TVO's new nuclear power plant with community law. EREF's complaint originally applied to three potential state grants: the credit facility under shareholding by the German Bayerische Landesbank (BLB), the Swedish SEK guaranteed loan, and the guarantee from the French export credit agency COFACE. Following this, representatives of the European Commission have taken part in countless meetings with the involved parties, and have received information from those states which have public actors involved in the consortium in order to evaluate the processes. In 2006 EREF urged the Commission to make a decision. Following this, the Commission decided to split the case into two separate proceedings, a move seriously criticised by EREF. The Commission had overruled the part of the complaint about the credit facility, fundamentally based on evidence regarding the shareholding of many private banks in the consortium and the Private Investor Test as unsubstantiated in the preliminary proceedings, and without opening main proceedings. The question of aid from COFACE was also conclusively overruled after the main assessment. The grounds for this were fundamentally that the project could also have attained a private export guarantee. The Commission overruled a connection between the provision of an export guarantee through COFACE from state funds and the credit facility.

In January of 2007 EREF was informed by the Commission that the complaint regarding the credit facility under the Bavarian State Bank's share would be dismissed,[54] and in September 2007 the Commission had dismissed the complaint concerning the COFACE participation.[55] EREF brought

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51 European Commission 2006b

52 Kuhbier Lawyers 2007a

53 Schneider et al 2009

54 EU Commission 2006b

55 EU Commission 2007h

cases against both decisions before the European Court of First Instance in Luxembourg.[56] The court ruled that the fragmentation of the cases into two separate proceedings was inadmissible and once again the state aid character of the financing of the Finnish corporation TVO's planned nuclear reactor Olkiluoto was meticulously examined. These cases are still pending.[57]

The Bavarian State Bank, owned 50% by the Free State of Bavaria and 50% by German Sparkassen (saving banks), is one of three main public actors involved in the financing of the whole project. For this reason, one can speak of a one-third reduction of risk for the whole project due to the involvement of the BLB. Because it is well known that the guaranteed interest rate is well under 2.6% for the whole loan, 2.2 % will be taken as a basis for the calculation. A commercially available interest for long-term loans would have amounted to 4.95% in 2004, according to the OECD's Commercial Interest Reference Rate (CIRR), which the European Commission uses as a reference.[58] According to the British Finance Ministry, this averaged out at 4.9%.[59] For the calculation of the difference, or the value of the subsidy through participation of public actors, an interest rate of 4.9% will be used as a basis, meaning that the difference amounts to 2.7%. Based on the total known sum of 2.17 billion Euros - although the actual figure is probably higher, as implied above – this yields a subsidy value of 58.9 million Euros. Because three public actors were involved and it is assumed that their significance for the reduction of risk amounts to one-third, we will set the subsidy value of the participation of the BLB as 1/3*58.59 million Euros, **making a conservative estimate of 19.53 million Euros for the BLB's share of the subsidy value**. Building costs were originally estimated at 3.2 billion Euros; at least three and a half years of delay and other newly incurred expenses led to an additional demand of 1.5 billion Euros at the time. According to internal information, one should estimate the total building costs at 6 billion Euros.[60] The German Tageszeitung speaks of at least 4.5 billion Euros.[61] There are serious conflicts about the additional costs among the project participants.[62]

Complementary to previous annual reports, the current World Nuclear Industry Status Report includes a profitability analysis of past, present, and planned nuclear energy projects:[63]

"Typically most industrial branches succeed in reducing their specific costs once they have travelled along a learning curve – but not so with the nuclear industry. Here, the costs of current building projects and cost estimates continue to increase. In May 2009, the Massachussetts Institute of Technology (MIT) doubled a previous cost estimate (without financing costs) from $2,000 to $4,000 per installed kilowatt. Reality has also already exceeded this estimate: the flagship of the world's biggest reactor producer AREVA NP, the so-called EPR reactor, which will be built in Olkiluoto in Finland, has generated a true financial disaster. The project is over three years behind schedule and is at least 55% over its planned costs, which in the meantime has driven the total cost estimate to 5 billion Euros or 3,100 Euros per installed kilowatt."

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56 Kuhbier 2007a and Kuhbier 2007b

57 See The Energy Turnaround 2007 (Energiewende) for this.

58 EU Commission 2007d

59 UK Government 2006

60 Network Rainbow (Netzwerk Regenbogen) 2008

61 Tageszeitung Berlin 2009

62 For a timeline of events concerning Olkiluoto see Schneider 2009, p. 116f

63 Schneider et al 2009

Table 5) Overview of the Results:

Actual Aid	Aid until 2008 in billions of Euros nominal	Aid until 2008 in billions of Euros real	Aid as of 2009 in billions of Euros
Subsidy Value of Hermes 1969-2002	0.12		
Loan from Bavarian LB 2003	0.01953		
Total	**0.14**	**[0.14]**[64]	**n/ a**

c) Effects and Evaluation of the Provisions

The allocation of loan guarantees to certain projects is relevant to competition. This applies especially to cases in which alternative energy providers have searched for funds for project realisation in the credit market during the same time period. Through the guarantees, low loan interest rates could have been demanded which other actors did not necessarily have at their disposal at that time. Guaranteed competition advantages in relation to other energy providers applied to the capital market, where funds for the realisation of projects had to be sourced, and in the electricity market, in which capital costs also play an indirect role. The same is true for the financial contributions of public banks in consortia that do not explicitly establish that no greater payment obligations may accrue for public banks than for private partners in the event of damage or loss. As well, capital contribution requirements of participants in the consortium and interest rates are not permitted to be influenced through the participation of a public actor, if its participation should not be viewed as public aid.

Suggestion for the Reform of Regulations for Federal and State Banks

- Exclusion criteria for nuclear power plant-relevant, armaments, and dangerous exports
- Involvement of external, independent consultants
- Obligatory test procedures on the basis of World Bank criteria.

64 A price adjustment could not be carried out because the available sources only aggregated the expenditures until 2008, and did not display single years.

4. Germany and the EU

4. 1. Research Support from the EU

The support through the EU was effected through the relevant Framework Programmes of the EURATOM budget. Research and development are supported in the following areas: nuclear fission, nuclear fusion, safety of nuclear technological equipment, radiation protection, handling of radioactive waste, closure and decommissioning of nuclear technological equipment. The relative funds are allocated differently to the various research programmes. Fusion research, however, always takes the largest portion. This is considered in the following calculations.

a) Current Regulations/Actual Aid

The allocation of support funding is regulated through the Framework Programmes. After accreditation and submission of the project proposal, the European Research Council decides on the approval. The guidelines, according to which the budget for the various support areas is available, have been constantly changed in the various programmes. They differ, for example, in support of background research, individual scientists, infrastructure, or in support of small or medium businesses. Contentious fusion research should continue to be supported in the future; in the current 7th Framework Programme (2007-2013) it will be supported with a planned 1.94 billion Euros.[65] Germany's portion of the EU budget fluctuated from 1984 to 2006 between 30 and 20 per cent,[66] so Germany supports European nuclear energy as the largest EU net payer – not only in terms of safety, decommissioning, and disposal research, but also further development, as well as entering into new technologies like nuclear fusion.

b) Quantification of the Effects of Support

From the first research Framework Programme (1984-1987) to the sixth (2002-2007) a total nominal value of 6.61 billion Euros has been spent on nuclear research.[67] The German portion of the EU budget varied during this time period from 30 per cent in 1984 (equal to a nominal 4.5 billion Euros) to 20 per cent in 2006 (18.6 billion Euros). Therefore, Germany supported EURATOM research from 1984 to 2006 with a total of 1.71 billion Euros. In 2007, the planned total expenditures for EURATOM research in the current seventh Framework Programme were divided into the seven years (2007-2013). Bearing in mind Germany's share of the total EU budget for 2007, 0.08 billion Euros of the German contribution was spent on EURATOM research.

In the entire period from 1984 to 2007, the German share of European nuclear research amounted to 1.79 billion Euros. For 2008, the German portion of the EU budget has not yet been confirmed, and for the years from 2008 onwards, 20 per cent has been assumed, in line with Germany's share in 2007. There assumptions lead us to conclude that this support would correspond to a further 0.08 billion Euros, as in 2007.

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[65] EU Commission 2006

[66] EU Commission 2007g

[67] EU Commission 2009

Table 6) Overview of the Results:

EURATOM aid through Germany	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Total	**1.8**	**2.3**	**0.5**

c) Effects and Evaluation of the Provisions

Research support should primarily limit itself to the safety aspect of current facilities, as well as to radiation protection. Decommissioning and dismantling of nuclear technological facilities should only be supported in the case of state facilities, or existing waste sites that have been taken on by the state. Research for disposal should be financed as much as possible according to the Polluter-Pays-Principle through nuclear energy providers. The increased budget for nuclear fusion research in the 7th Framework Programme should be called to a halt.

The budget for the EURATOM area in the European research Framework Programme should decrease in line with the corrections suggested above. Germany would, in contrast to the current situation as the biggest net payer in the EU, no longer support research for disassembly and further development of nuclear energy in other European countries. The search for disposal sites would be covered by polluters Europe-wide (or by single countries in line with their internal formalities).

3. 2. EURATOM and German Bilateral Activities in Europe

In addition to European research support, there are other activities that target the nuclear energy sector that Germany takes part in via the EU or bilateral agreements. The EU Eastern expansion re-raised the question of the safety of European nuclear sites, and the EU supports individual countries with the goal of dismantling or modernisation of their nuclear sites.

a) Current Regulations/Actual Aid

An example is the International Closure Fund for the nuclear power plant Kozloduy (KIDSF) in Bulgaria. This fund contains more than 170 million Euros and was started within the framework of the European PHARE Programme (from which it received 50 million Euros[68]), as well as 9 EU states and Switzerland (Germany was not among them). The PHARE Programme supported central and eastern European countries (including Bulgaria/Kozloduy) from 2001 to 2005 with a total of 0.54 billion Euros in the areas of “nuclear safety” and “closure”, whereas “the support through the PHARE Programme in general was carried out not in the form of credits, but rather through non-repayable grants.”[69]

The European Investment Bank (EIB) provided loans between 1967 and 2002 for nuclear sites worth 6.6 billion Euros. From this, a mere 30 million Euros is still owed.[70] Recipients benefit from the “EIB’s favourable loan specifications” that “do not pursue pecuniary rewards”.[71] Numerous fi-

68 PHARE 2009

69 PHARE 2009

70 EIB 2007

71 European Union 2009

xed interest rates apply to the loan maturation, and repayment-free years are available. The actual value of aid is thus hard to calculate. Here an exact comparison must be made, to analyse the increased costs that would be faced by the recipients of loans for nuclear projects if they were to find the capital in the free financial market.

Project titles under the energy project grants from the European Bank for Reconstruction and Development (EBRD) do not reveal aid to nuclear sites.[72] According to information from the EBRD, all projects of this sort are combined into a bundle in the Nuclear Safety Account (NSA). The NSA of the EBRD was founded in 1993 in order to finance projects for the increase of nuclear safety in central Europe. All projects concern closure and decommissioning, not construction and further operation of nuclear power plants. So far Kosloduy (Bulgaria), Ignalina (Lithuania), and Bohunice (Slovakia) have been assisted. “So far (2009) the NSA has received 320 million Euros from the EU and 14 states.”[73] Among the donor countries was Germany, whose share in the total could not be calculated.

Further support from Germany to other states is paid through method transfer, some through the project “Method transfers for the preparation for closure of the nuclear power plant for managing personnel of the nuclear power plant Ignalina and for representatives of Lithuanian administration,” from the Federal Ministry for the Environment, Natural Protection, and Reactor Safety (BMU).[74] The costs of this sort of aid are very hard to calculate.

b) Quantification of the Aid Effects

The German portion of the PHARE-Programme is worth a total of 122 million Euros (nominal) if calculated in relation to Germany’s contribution to the EU-Budget, as follows:[75]

- PHARE expenditures for nuclear safety/Kozloduy/closure (2001-2005): 545 million Euros
- Germany’s portion of the EU-Budget 2001-2005[76]: 22.38 per cent

Further direct aid for nuclear projects from Germany to other European countries could not be assessed.

As already stated, project costs for consulting and personnel training are very difficult to ascertain. Because the BMU trains personnel for international research projects, the corresponding personnel costs from the Federal Environment Ministry should also be taken into account.

Table 7) Overview of the Results:

EU-Project Aid through Germany	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Total	**0.12**	**0.13**	No data

72 EBRD 2009b

73 EBRD 2009a

74 EWN 2008

75 EU Commission 2007a

76 EU Commission 2007g

Aside from nuclear projects Germany finances through its portion of the EU budget, there are further bilateral tasks whose future costs are not yet appreciable. Similarly, it is unclear who will have to pay in the future. Just as the reprocessing facilities at Sellafield (UK) and La Hague (FR) will have to be redeveloped one day, so must the storage of German nuclear waste in Russia.

The French corporation AREVA took over the decontamination contract in October 2008 for Sellafield. An annual turnover of 1.5 billion Euros is at stake.[77] How high the German share of nuclear waste in Sellafield is could not be calculated, and even the operating companies do not know how many years it will take for Sellafield to be decontaminated.

An unofficial website speaks of a sum of 4 billion Euros for decontamination of La Hague.[78] The operating company itself has stated that the used-to-capacity UP3, predominantly supplied with German nuclear waste, is in production. Decontamination costs, therefore, cannot be specified. On 31 December 2008 the portion of German nuclear waste in La Hague amounted to 9.3 per cent (CSD-V, glazed fission product solution) of a castor and waste grade, as well as 30.7 per cent (CSD-C compacted decay) of another castor and waste grade.[79]

Since 1995, Urenco (Gronau) has stored German nuclear waste in Russia. At the end of 2009 the contract with the Russian firm Tenex expired. According to information from the weekly journal “Friday”, “storage in Gronau would cost an estimated 200 million Euros per year”.[80]

c) Effects and Evaluation of the Provisions

Germany also finances projects related to nuclear power plants in central and eastern Europe through the EU’s reconstruction programmes and structural funds. Both the means for decommissioning and dismantling of facilities, as well as the expenditures for nuclear safety – as provided for by the Nuclear Safety Account (NSA) of the EBRD – should be paid for by the polluter, in this case the operating company benefiting from these services.

[77] Financial 2008

[78] Brest ouvert 2009, see also: BfS 2009c

[79] AREVA 2009

[80] Friday 2008 (Freitag)

5. Post-operations and Closure of East German Nuclear Power Plants

a) Current Regulations/Actual Aid

The following **interim storage facilities** are relevant to East Germany: Ahaus, as well as Greifswald-Lubmin (KGR), and the interim storage facility North (Nord) (ZLN) operated through Energy Works North, LLC (EWN). Ahaus is actually located in North Rhine-Westfalia, but it was used as an interim storage facility for waste produced by the nuclear power plant Greifswald-Lubmin. The nuclear power plant itself was deactivated in 1990, but the affiliated interim storage facility was still used afterwards.[81]

The **dismantling of nuclear power plants in East Germany** concerns the above-named KGR, which has been closed since 1990 (Block 1 to 5), as well as the nuclear power plant Rheinsberg, also closed in 1990. Dismantling of the closed nuclear power plants Rheinsberg and Lubmin is still ongoing. According to information from the EWN, at the time this paper was written almost 75 per cent of the planned waste disposal lines had been completed. The work should be finished by 2012. The disposal of structural casing is not yet scheduled.[82] In Lubmin, current work is concentrated on the transportation of the reactor pressure vessels into the storage facility North (ZLN). Approval for demolition of the humidity-controlled storage for spent fuel rods is expected in mid 2009.

Former GDR research reactors are located in Berlin and Dresden: the experimental reactor at the Helmholtz Centre in Berlin, which has been in operation since 1973, and the Nuclear Research Centre Dresden-Rossendorf, which operated between 1957 and 1991. For the decommissioning of the still-operational Berlin Research Centre, costs of 28.12 million Euros for the public budget are expected as of 2009.[83] In Rossendorf, the dismantling and disposal costs had amounted to 95 million Euros for the public authorities up until 2007; in 2008 alone they amounted to 16.7 million Euros, and in the future, costs are expected to add up to 335 million Euros.[84]

The Saxon State Government has transferred the operation of the federal state collecting facility for radioactive waste to the Union for Nuclear Process Engineering and Analysis Rossendorf, Inc. (VKTA). The ongoing operation, administration, and maintenance costs of the collecting facility (interim storage facility for 40 years) are financed through fees collected from the original waste producers. If costs are not covered, the deficit is compensated for by the budget of the Saxon State Ministry for the Environment and Agriculture (SMUL). Lapses in payment due to insolvency of the waste producer are also covered by the SMUL.[85]

b) Quantification of the Effect of Aid

Because of particular historical developments, the EWN company has not set aside funds (provisions) to cover its nuclear legal obligations. To compensate for this financial deficit, EWN was

81 Federal Agency for Radiation Protection 2009

82 Ad-hoc-news 28.01.2009

83 Federal Government 2008b. BT-Drs. 16/10077

84 Federal Government 2008b. BT-Drs. 16/10077

85 Landtag Saxony 2005

given loan commitments subject to public law from a trust agency and the Federal Ministry of Finance. Up until 31 December 2007, EWN was provided circa 2.5 billion Euros within the framework of this loan commitment for the fulfilment of its nuclear legal obligations.

In 2008 111 million Euros was provided to the EWN for the fulfilment of its nuclear obligations. From 2009 on, according to current estimates, contributions from the federal budget will be necessary amounting to about 600 million Euros.[86]

In total, 2.7 billion Euros have so far been invested by the federal government and by the federal state of Saxony for the post-operation and decontamination of the East German nuclear power plant. Aside from this, future costs of about 1 billion Euros are estimated.[87]

Table 8) Overview of the Results:

Site	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
FZ Berlin	0		0.02812
Dresden-Rossendorf	0.1117		0.335
EWN	2.611		0.6
Total	**2.7227**	**[2.7]**[88]	**0.96312**

c) Effects and Evaluation of the Provisions

In general, the closure of the East German nuclear power plants does indeed constitute a state financial contribution to nuclear energy, but not one that seems relevant for the industry's competitive position today. Certainly, covering the costs of decommissioning the currently deactivated East German nuclear power plants is a state provision. It is relevant to competition insofar as the legal successors of the former state-owned GDR energy providers and nuclear power plant operators, with the former electricity providers, took over electricity customers in the catchment area, while the taxpayer has had to pay for the decontamination of these former providers' contaminated sites. Thus adhering to the old principle of "privatising the profits, nationalising the losses."

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86 Federal Government 2008b: BT-Drs. 16/10077

87 Federal Government 2008b: BT-Drs. 16/10077

88 A price adjustment could not be carried out because the available sources only aggregated the expenditures until 2008, and did not display single years.

6. Decontamination of the Soviet Uranium Ore Mines In Saxony and Thuringia (Wismut)

a) Current Regulations/Actual Aid

The Soviet Union's lack of its own raw supply of Uranium for production of nuclear weapons led to prospecting work in eastern Germany in 1945. The most sources were found in Ronneburg and Niederschlema-Alberoda. In 1945, the SDAG (Soviet-German Action Society) founded Wismut. Under its leadership the mines Smirchau, Lichtenberg, and Resut were developed in the 1950s, and in 1958 they began the exploration work for an open-cast uranium mine. In the mid-1960s, Ronneburg became SDAG Wismut's uranium mining centre, and the GDR became the third-largest uranium ore producer in the world.

In the almost four decades since, more than 231,000 tonnes of Uranium have been extracted.[89]

Through permanent radiation exposure and dust inhalation during excavation, many workers became sick with silicosis and pneumoconiosis. Until 1990 alone, over 7,000 miners had died from lung cancer, among whom circa 5,000 were recognised as radiation victims. There were also cases of death of people in the region caused by dangerous radiation.

In the 1970s the uranium supply ran short, exploration conditions deteriorated, and so strip mining was employed, starting in 1976. Until the beginning of the 1980s, underground mining was employed in the Paitzdor, Beerwalde, and Drosen mines.

The fall of the Berlin wall in 1990 led to the abrupt cessation of operations. According to an agreement between the FRG and the USSR from 16 May 1991, the operation of SDAG Wismut was officially suspended. The Soviet portion was transferred to the FRG and SDAG Wismut was converted into the federally owned Wismut GmbH, a limited company. Henceforth, the corporation had the duty of freeing contaminated areas from the legacy left by uranium mining in Eastern Germany. The challenge was to create a basis for a regional improvement and ecologically stable livelihoods in former open-cast mining regions.[90]

Decontamination measures should impede the dispersion of radioactive dust and reduce external radiation and radon emissions as much as possible. Furthermore, the dispersion of natural radionuclides through groundwater, seepage, and surface water should also be prevented.[91]

Originally it was decided that decontamination should be completed by 2010, or 2012 at the latest. This goal will only be reached in the Ronneburg and Eastern Thuringia regions. Because five years of post-decontamination work is still to follow in the Wismut regions, Wismut has plenty to do to complete decontamination by 2020, according to the CEO of the federally owned Wismut GmbH, Stefan Mann.[92]

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89 http://www.freiepresse.de/NACHRICHTEN/REGIONALES/1531361.html

90 http://forum.bauforum24.biz/forum/index.php?showtopic=10469

91 http://www.smul.sachsen.de/umwelt/strahlenschutz/2372.htm

92 http://www.freiepresse.de/NACHRICHTEN/REGIONALES/1531361.html

There are already indications that the Wismut decontamination will be much more expensive than previously assumed.[93] How the federal government and the federal states will share the expense remains open. In Saxony alone, according to the Wismut project leader Jochen Schreyer, between Vogtland and the Dresden area around 1,000 single objects in 33 municipalities have already been classified as requiring decontamination – many more than originally planned.

b) Quantification of the Effect of Aid

In total 6.2 billion Euros (13 billion DM) in federal funds is estimated for decontamination, which is secured in the 1992 federal budget through commitment authorisation.[94]

"Contrary to today's practices, no provisions (funds for decommissioning) were set up for future decontamination measures during Wismut's production phase until 1990. The uranium produced by Wismut from the former GDR is exclusively in the former Soviet Union, and according to local information, was predominantly supplied for the nuclear armament programme.

From 1990 to the end of 2007 Wismut GmbH has been given a total of circa 4.9 billion Euros from the federal budget for decontamination measures. 170 million Euros is earmarked for 2008. About 1.3 billion Euros more is required for outstanding decontamination work and the subsequent long-term tasks, according to the current state of knowledge."[95]

The **undervaluation** of decontamination is underlined by the following:

- Compensation for uranium mine victims can only be paid under very restrictive specifications. Around 500,000 people worked in Wismut, some even involuntarily in the first few years. Thereof, approximately 15,000 contracted silicosis, and some 7,000 developed lung cancer. It is estimated that a further 7,000 cases of cancer will develop in the coming years.[96]
- Partial payments from federal states continue to accrue for decontamination.
- In view of the greater amount of time required for decontamination, it can be reasonably anticipated that current planned federal funds of 6.2 billion Euros will not suffice.

Table 9) Overview of the Results:

Wismut Decontamination	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Total	**5.1**	**6.1**	**1.1**

93 Free Press (Freie Presse) 12.8.2009. http://www.ad-hoc-news.de/zeitung-wismut-sanierung-wird-teurer--/de-Regional/Sachsen/20426496

94 cf. BMWi 1996: Wismut – Progress in Closure and Decontamination (orig. Wismut – Fortschritte der Stilllegung und Sanierung, Dokumentation Nr. 370), Document Nr. 370, Scholz 1997, p. 29, 36 ff

95 Federal Government 2008b, BT-Drs. 16/10077

96 Pflugbeil 2007

c) Effects and Evaluation of the Provisions

Decontamination is necessary, thus it should be systematically continued and completed. The Wismut decontamination has no direct impacts on the current competitive capacity of nuclear energy in Germany. It can, however, exemplify what costs uranium ore mining is generated worldwide. According to the Polluter-Pays-Principle, which is valid under German law, the energy providers, as well as the German firms that process uranium, must pay for these costs as beneficiaries, even if this uranium mined abroad.

7. Construction, Operation, Decontamination, and Closure of the Morsleben Depository

a) Current Regulations/Actual Aid

In 1969 the GDR's State Centre for Radiation Protection designated the salt dome Morsleben as a repository for radioactive waste, and at the beginning of the 1970s storage had already begun. After the German-German reunification further radioactive waste was stored in the Repository for Radioactive Waste Morsleben (ERAM), until Greenpeace succeeded in stopping its operation through a lawsuit in 1998.

Because it concerns inherited liability of former GDR businesses, for which the federal government took over responsibility in the course of reunification, it is not possible to bring the polluters to account. Indeed, Wolfram König of the BfS criticised on *Deutschlandradio* that over half of the nuclear waste stored in Morsleben was put into storage *after* reunification: "Here, too, [as in Asse II] only the taxpayers pay, even though more waste came into this GDR depository after reunification than during the time of the GDR."[97] In this case, it would be necessary to investigate the sources of the share of the nuclear waste stored after 1990 to find those responsible for producing it and charge them accordingly.

b) Quantification of the Effect of Aid

According to information from the federal government, the expenses incurred up until the end of 2007 for the depository total circa 648 million Euros. For 2008, 61.7 million Euros has been estimated, and a total cost of 2.2 billion Euros is expected by the completion of the project.[98] "The current costs of preservation until the approval of the plans, of the licensing procedure, and of closure are financed in full from federal budget funds."[99] The Federal Agency for Radiation Protection calculates the costs for individual project stages as follows, and currently expects higher total costs than the federal government as of 2008: "The costs for closure of ERAM are estimated at about 1.2 billion Euros. In total, the Morsleben project will entail some 2.3 billion Euros in costs. Because only about 138 million Euros in revenue from waste producers was obtained during the storage phase from 1994 to 1998, the total costs for this contaminated land, conditional upon agreement, are carried almost completely by state funds."[100]

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97 Germany Radio (Deutschlandfunk) 2009

98 Federal Government 2008b, BT-Drs. 16/10077

99 Federal Government 2008b, BT-Drs. 16/10077

100 BFS 2008c

The costs to be covered by the federal government consist of the total costs less revenue from waste producers, i.e. 2.3 billion Euros minus 138 million Euros, corresponding to 2.16 billion Euros. If half the waste is attributable to GDR polluters from post-reunification-times, then this amounts to public aid of about 1 billion Euros.

Table 10) Overview of the Results:

Operation and Closure of Morsleben	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Total	**0.96**	**[>0.96][101]**	**1.2**

c) Effects and Evaluation of the Provisions

In order to charge the polluters for the costs of Morsleben (and Asse II) as much as possible, two possibilities have been discussed on the parliamentary level: the implementation of a tax on nuclear fuel rods or the formation of a public fund with funds from the reserves held by nuclear corporate groups in accordance with the repository financing ordnance explained above.[102]

According to the Polluter-Pays-Principle, the legal successor of the power generation company to whom the nuclear waste in Morsleben can be attributed must bear the costs of decontamination for its share of the waste. So long as the state and therefore taxpayers pay the costs resulting from nuclear energy use, this should be regarded as a direct subsidy to companies that have produced the nuclear waste.

101 A price adjustment could not be carried out because the available sources only aggregated the expenditures until 2008, and did not display single years.

102 Cf. Schröder, Axel P.: Who Pays the Mine? (Wer zahlt die Zeche?) In: der Freitag 18.6.2009

8. Decontamination and Closure of the Asse Nuclear Waste Storage Facility

a) Current Regulations/Actual Aid

'Asse' was bought in 1965 from the former Society for Radiation Research (GSF) in a federal contract (as the majority shareholder of Asse) for 600,000 DM.[103] In 1992, the Federal Ministry for Research and Technology (BMFT) decided not to finance any further experiments by the GSF in Asse and agreed to cover the mine with residue salt. In 1995, the GSF Institute for Deep Storage was dissolved. At the end of 2008, the operating licence for the Asse site was revoked from the GSF's successor, the Helmholtz Centre Munich, and the BfS took over responsibility.

Around 80 per cent of the stored nuclear waste originated from nuclear power plants, experimental reactors, and the nuclear industry, and the remaining 20 per cent from research reactors and public facilities.[104] In the time between 1967 and 1975, no fees were charged for the storage of nuclear waste in the Asse II pit. For almost 50% of all waste stored at Asse, the waste producers have paid no fees at all. From December 1975, the "fee regulation for the storage of weak and medium radioactive waste in the Asse salt mine" has been applied. Between 600 DM and 3700 DM per storage unit was paid according to size and radioactivity. This raised 16.5 million DM in total.[105] With an estimated decontamination cost of circa 2.5 billion Euros, this amount does not even amount to 0.4% of the actual costs. The remainder will be paid by the taxpayer. A quote from the 10th Act to Change the Nuclear Law (AtGÄndG) from 17 March 2009: "The site is to be closed immediately. The federal government bears the costs of further operation and closure."[106]

b) Quantification of the Effect of Aid

In the 2007 federal budget plan, the following refers to the GSF:[107] "For the covering of the research mine 'ASSE', according to Article 55, Number 5 of the Federal Mine Law, the total costs for the years 1993-2013 have been calculated at 467,471 trillion Euros - as things stand at present. Therefore, 237,320 trillion Euros have thus far been designated as special financing." Even in 2008, the federal government placed about 57 million Euros for Asse in the budget, and, according to the SPD fraction Research Minister Schavan, it was already announced in mid-2008 that the costs would increase by about 100 million Euros annually.[108] According to information from the federal government (2008), the costs to the public authorities up until 31 December 2007 amounted to 257 million Euros, and the future costs were estimated at 536 million Euros.[109] However, this estimate is now obsolete, and the Federal Environment Ministry estimates the costs for the closure of Asse alone in the coming years to be about 2 billion Euros.[110]

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[103] Newsworthy hour in the Bundestag on 26 June 2008 based on a motion by the Greens – excerpt from the plenary transcript/quoted according to http://www.udo-leuschner.de/energie-chronik/080606d1.htm

[104] Greenpeace 2009a

[105] BMU 2009d: Origin of the radioactive waste stored in the Asse II pit and financing of costs (Herkunft der in der Schachtanlage Asse II eingelagerten radioaktiven Abfälle und Finanzierung der Kosten), 5 March 2009

[106] Federal Government 2008a

[107] BMF 2007: Federal budget plan 2007, individual plans 3007 Title 685 13 Tgr 13 Point 10

[108] http://www.spdfraktion.de/cnt/rs/rs_dok/0..44907.00.html

[109] Federal Government 2008b, BT-Drs. 16/10077

[110] BMU 2009a

The current search for a final decision on how to close Asse does not allow for a conclusive cost estimate. Criticism of the GSF, alleging that it had not analysed the situation openly, but rather set out to establish facts during the exploration phase, the search for those responsible for agreement, and the lack of a complete inventory, has lead to the establishment of a committee of investigation in mid-June in Lower-Saxony's Landtag (state parliament). Conversely, the Deutsche Atomforum (the German Nuclear Forum) partially financed public relations for the facility.[111] Three closure concepts should be available only as of autumn 2009, according to which, future costs can be better estimated.

Table 11) Overview of the Results:

Operation and Closure of Asse II	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Total	**0.29**	**[0.29]**[112]	**2.0**

c) Effects and Evaluation of the Provisions

See chapter 6.c) on Morsleben.

[111] Greenpeace 2009: Press release from 1 July 2009. 50 Years of the Nuclear Forum – 5700 Glitches in the Nuclear Facilities (50 Jahre Atomforum – 5700 Pannen in Atomanlagen).

[112] A price adjustment could not be carried out because the available sources only aggregated the expenditures until 2008, and did not display single years.

9. Search for the Gorleben and Konrad Final Disposal Sites

a) Current Regulations/Actual Aid

The Federal Environment Ministry presented a bill in June 2005 for a comparative search for nuclear waste final disposal sites. With snap elections in mind, in September 2005 the parliamentary debate on the topic was not further initiated.

In the coalition agreement between the CDU/CSU and the SPD, the question of disposal is formulated as follows: "CDU/CSU and SPD acknowledge the national responsibility for the safe final disposal of radioactive waste and will efficiently and deliberately search for a solution. We intend to find a solution during this legislative period."[113] The Grand Coalition could not meet this commitment due to ongoing disputes on the acceptability of the Gorleben salt dome as a repository for highly radioactive waste, and due to disagreement on the policy for the search for a site.

According to a moratorium that has been valid since 2000, the further investigation of the Gorleben salt dome has been deferred until 2010. Critics blame the government for not using the ongoing period of time to explore alternative, more suitable sites, and instead to wait until they can use the unsafe Gorleben site due to a lack of alternatives and delays to the selection process.[114]

The Federal Environment Ministry (BMU) made clear in 2006 that it was striving for an open search for an alternative to Gorleben and in accordance with the following criteria:

- Enforce primacy of safety: Safety takes precedence over all other aspects in disposal. Therefore, all radioactive waste is to be stored in deep geological formations. The decision on a repository site, in which highly radioactive waste is stored, must be based on a comparison of multiple alternatives for the best qualified site.
- Ensure transparency and traceability: The choice of and commitment to a repository site, in which spent nuclear fuel elements and highly radioactive waste are stored, requires a traceable, transparent process.[115] A range of arguments that, in 1979, spoke for the exploration of Gorleben, are no longer valid – among others the multitude and type of nuclear waste to be stored and the building of a nuclear disposal centre close to the repository. This is also the BMU's reasoning: "It is questionable that the past decision for Gorleben would be met in the same way today."[116]

The BMU wants to first establish an adequate selection process for a repository, and for 2010, no budget funds are planned for the investigation of Gorleben.[117] In a press release to announce new

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113 Together for Germany. With Courage and Humanity. Coalition Agreement between the CDU, CSU, and SPD for the 16th Election period of the German Bundestag, 18 November 2005. (Gemeinsam für Deutschland. Mit Mut und Menschlichkeit)

114 Cf. for example Sylvia Kotting-Uhl: Press release on 13.02.2009 on the Gorleben Moratorium

115 BMU 2006

116 BMU 2006

117 German Telegram Service (ddp): 22.07.2009: Gabriel wants to further extend the Gorleben Moratorium (Deutscher Depeschen Dienst: Gabriel will GOrleben Moratorium weiter verlängern.)

safety requirements for nuclear waste final disposal sites, the BMU has emphasised three new requirements:[118]

- It must be shown, for a million years if need be, that marginal, defined amounts of pollutant can be released from the depository.
- The safety of the repository must be subject to a continual optimisation process with periodical safety inspections from the planning stage until the closure of the repository.
- The recovery of nuclear waste must, at least until the closure of the repository, be still possible as a means to rectify errors.

b) Quantification of the Effect of Aid

The costs for both the repositories Konrad and Gorleben should be 100 per cent refinanced by the polluters, although a payment obligation will also exist for the federal government as a licensee of research facilities. "The financing of the planning in particular and the construction of repositories is effected through contributions by the waste producers according to Article 9a, Clause 3, Line 1 of the Nuclear Law (Article 21b, Clause 1 of the Nuclear Law)",[119] and a payment obligation likewise exists for the federal government as licensee of research facilities within this context. However, the costs are already covered and incorporated in other places (the BMBF budget for nuclear research facilities).

The costs for the site search are charged to the polluters through the repository financing ordnance and amounted to 54 million Euros in 2006[120] and are thus not a matter of state aid. The tax advantages from the regulations on obligatory provisions to pay for future costs of decommissioning (Rückstellungen) were covered in chapter B.1.

The federal government counted the costs for the **Gorleben** site as follows: "For the Gorleben project the accrued costs amount to about 1.51 billion Euros from 1977 to 2007. In the current budget year 2008, 27.6 million Euros are estimated for the Gorleben project. The future costs depend particularly on a political policy decision on further procedure for the disposal of highly active, heat-generating waste. The costs will be refinanced according to the Nuclear Law through the waste producers in the full amount. The portion to be paid by the arrangements of the public authorities for the Gorleben repository project according to the repository financing ordnance amounts to 11.52 per cent."[121]

11.52 per cent of 1.51 billion Euros amounts to 174 million Euros, to which the 27.6 million Euros from the budget for 2008 should be added. These expenditures do represent a public contribution to Gorleben, but they are already incorporated into the research expenditures and hence are not separately accounted for here.

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118 BMU 15.07.2009: PI Nr. 240/09, http://www.bmu.de/pressemitteilungen/aktuelle_pressemitteilungen/pm/44587.php

119 BMU 2009

120 DIW 2007

121 Federal Government 2008b, BT-Drs. 16/10077

For the **Konrad** site, costs for planning and exploration work had amounted to 945 million Euros as of the end of 2007.[122] The costs for refitting as a final waste disposal site are specified at 1 billion Euros (nominal), and the Federal Office for Radiation Protection estimates the total costs to be in the amount of between 1.8 to 2 billion Euros. So far, no radioactive waste has been deposited in Konrad. Compensation to the city of Salzgitter for the impact of the Konrad pit is still being negotiated.[123]

The determination of costs associated with plan approval procedures was difficult, because, among other things, personnel and court costs would have to be determined in order to establish a total sum. According to the BMU[124], no overview of the number of expert reports produced and paid at the expense of the state is available. Because the costs are not subsidies in a literal sense – everyone has the right to plan approval procedures if the correct paperwork for approval is submitted – we have investigated this matter further.

c) Effects and Evaluation of the Provisions

The procedure suggested by the BMU parallels the current international state of play in science and technology. Private-sector polluters have covered the majority of the costs arising in the form of advanced payments for final waste storage sites.

10. Expenditures following the Chernobyl Disaster: National and International

a) Current Regulations/Actual Aid

Brief Information on Resulting Costs:

"The total damage for Belarus due to the Chernobyl catastrophe (calculated for 30 years adjustment of the aftermath) amounts to $235 billion U.S., which constitutes 32 budget years of the Republic (in 1985). This includes the following losses: Losses associated with a deterioration in public health; damages to industry and society, to agriculture, to the building industry, the transport industry, communications, and housing stock; contamination of raw minerals, soil, water, forests, and other resources; additional expenditures for the adjustment and minimisation of the aftermath of the catastrophe and for the establishment of safe living conditions for the population."[125]

The largest portion of the expenditures (81.6%) for the damage have supported the functioning of production operations and the implementation of protection measures ($191.7 billion U.S.). Direct and indirect losses amount to approximately $30.0 billion U.S. (12.6%). Profit setbacks are estimated at $13.7 billion U.S. (5.8%). Direct losses comprise the value of the national wealth lost to the Republic: static and current assets of production operations, objects of social infrastructure, living conditions, and natural resources.

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122 BFS 2008a

123 Federal Government 2008b, BT-Drs. 16/10077

124 Personal disclosure by Jutta Kremer-Heye, Press Representative of the BMU

125 Chernobyl Committee 2002

Comparable damage has appeared in the catastrophe's country of origin, the Ukraine, as well as in other surrounding states, Russia in particular. The radioactive substances have led to appreciable contamination in other parts of Europe, which has had direct and indirect negative effects on peoples' health.[126] The largest amount of radioactive Caesium-137 landed in Russia, Belarus, and the Ukraine. Yugoslavia, Finland, Sweden, Bulgaria, Norway, Romania, Germany, Austria, and Poland, however, each sustained more than a petabecquerel (10^{15} Bq or one million billion Becquerels) of Caesium-137, an enormous amount of radioactivity.[127] Because the decontamination of the sarcophagus has proceeded very sluggishly, further consequences of the aftermath have not been ruled out, such as the collapse of the hull and the associated release of a large amount of radioactive dust, or even a reignition of the chain reaction through water penetration.[128] The costs are split between many countries and various sectors – in particular, health and agriculture.

National:

After the Chernobyl disaster the monitoring network for **inspection of environmental radioactivity** was expanded. Today the Integrated Measurement and Information System for the Surveillance of Environmental Radioactivity (IMIS) is financed annually with 9 million Euros and operates continually. It combines all data and information provided by federal governments and countries.[129]

National and European Community-wide measures for the protection of the population were encountered in connection with the reactor disaster in Chernobyl on 26 April 1986. The basis for the fulfilment of compensation claims following the Chernobyl reactor disaster is Article 38, Clause 2 of the Nuclear Law and the compensation guidelines enacted by the Federal Ministry of the Interior (BMI) from 21 May 1986.[130] The funds were used almost exclusively for compensation petitions due to radioactively polluted game, according to the Game Recommendation, valid until 1999.

International:

In 1991, 1993, and 1997 project lists were developed in the three affected countries **Belarus, Russia, and the Ukraine**. From this originated Joint Plans I and II, as well as the Inter-Agency Programme of International Assistance to Areas Affected by the Chernobyl Disaster, or Blue Book for short. However, these plans did not succeed in raising the funds necessary between the UN member states: in 1998, projects costing $90 million U.S. were submitted, but only $1.5 million U.S. was available. Exactly how much money has flowed into the three affected countries cannot be determined. But an estimate of the magnitude can be based on the following estimation: The Belarussian government extrapolated that between 1999 and 2001 alone $35.3 million U.S. in humanitarian aid was sent to Belarus from abroad.[131] This also included work from state and non-governmental organisations.[132]

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126 Greenpeace 2006b

127 Green Fraction in the European Parliament 2006

128 Greenpeace 2006a, p. 29ff

129 Federal Office for Radiation Protection 2006

130 15th Subsidy Report, Attachment 1, Nr. 124, 16th Subsidy Report, Attachment 1, Nr. 98

131 The following international projects are included in this calculation:
-MAGATE BYE/9/006 Project "Rehabilitation of the territories polluted by the Chernobyl catastrophe" (Gomel area);
-MAGATE BYE/5/004 Project "Production of oil through canola seeds, which is cultivated in the polluted territories" (Gomel area);

b) Quantification of the Effect of Aid

National:

It has emerged from an SPD scoping paper about the costs of nuclear energy that the **aid for domestic agriculture** totals 238 million Euros attributable to the direct aftermath.[133] Because the timeline for compensation to agriculture extracted from the federal government's subsidy report is incomplete,[134] the value stated in this paper will be used here. In the 2010 federal budget around 130,000 Euros annually for 2009 and 2010 is budgeted for compensation claims due to the Chernobyl reactor disaster in line with Article 38, Clause 2 of the Nuclear Law.

Currently **IMIS** costs 9 million Euros annually.[135] According to the Federal Office for Radiation Protection the construction costs for IMIS amounted to 53.8 million DM until December 1994.[136] The costs for the operation, installation of a new prototype, and consulting services that accumulated in the Federal Environment Ministry and Federal Office for Radiation Protection budgets between 1995 and 2008 could be determined – a **sum of 453 million Euros** can be accounted for.[137] The costs contained in the budget plans of other ministries and federal offices could not be determined, because the amount paid to IMIS is generally not apparent based on the entries.

International:

In November 1997, the FRG agreed to give the European Bank for Reconstruction and Development in London $23.6 million U.S. for the Sarcophagus Fund of the Chernobyl disaster reactor. In doing so Germany fulfilled an economic summit obligation (1997 in Denver). There, the state and government heads of the G7 and the EU in June 1997 declared they would supply $300 million U.S.

-Project of the Swiss Confederation "Provisions of the central area hospital in Bragin with modern medicinal technologies" (Bragin area);

-TACIS TAREG 7.03.97 Project "Sustainable development in the affected territories" (Gomel area);

-TACIS ENVREG 9602 Project: "Solution to the question of rehabilitation of the territories and the secondary medical consequences of the Chernobyl catastrophe" (Gomel area);

-TACIS NUCREG 9309 "Elaboration on the level of information of the population affected by the Chernobyl catastrophe" (Gomel and Minsk areas);

-TACIS CHE 93.I.3 "Designation and implementation of measures for the improvement of production, packaging, storage, and sale of iodised salt" (Gomel area);

-UN Project "Establishment of a model center for social-psychological rehabilitation of parents, whose children were affected by the Chernobyl catastrophe" (Pinsk and Brest areas);

-European Commission Project "Restoration of normal living conditions in territories polluted by the Chernobyl catastrophe, ETOS-2" (Stolin and Brest areas);

-Project with the Italian humanitarian organisation "Humus" (Gomel area).

132 Chernobyl Committee 2002

133 SPD Bundestag Fraction 2009

134 As of the 20th Subsidy Report the "Chernobyl Subsidy" is no longer listed as a subsidy. In the 20th Subsidy Report a new classification of subsidies was undertaken (p. 9). Attachment 4 lists newly added and removed financial aid and tax benefits. Also in Attachment 4 the Chernobyl Subsidy is no longer mentioned.

135 Federal Office for Radiation Proection 2006

136 Written answer from the Federal Office for Radiation Protection from 7.7.2009 to a survey from Green Budget Germany from 25.6.2009

137 Written answer from the Federal Office for Radiation Protection from 7.7.2009 to a survey from Green Budget Germany from 25.6.2009

for the decontamination of the hull (sarcophagus) of the destroyed block 4 of Chernobyl. The agreed-upon contribution of national funds yielded a total German contribution of over US$52 million. The total costs for the sarcophagus project amounted to circa US$760 million.[138]

The following states took part in the financing the realisation of the Shelter Implementation Plan (SIP) for the stabilisation of the existing sarcophagus and for the construction of a new hull around the sarcophagus:[139]

Belgium	3,094,944 Euros	The Netherlands	8,507,337 Euros
Denmark	4,967,917 Euros	Norway	6,977,254 Euros
Germany	62,500,000 Euros	Austria	7,500,000 Euros
European Union	239,506,000 Euros	Poland	2,500,000 Euros
Finland	4,500,000 Euros	Portugal	169,205 Euros
France	52,470,000 Euros	Russian Fed.	9,004,053 Euros
Greece	6,000,000 Euros	Sweden	6,595,809 Euros
Ireland	8,020,925 Euros	Spain	4,729,791 Euros
Iceland	9,107 Euros	Switzerland	9,305,043 Euros
Israel	280,710 Euros	Slovakia	2,000,000 Euros
Italy	41,466,330 Euros	Slovenia	320,555 Euros
Japan	46,182,296 Euros	The Ukraine	62,338,764 Euros
Canada	35,225,344 Euros	USA	136,211,938 Euros
Korea	226,705 Euros	UK	62,206,992 Euros
Kuwait	3,601,981 Euros		
Luxembourg	2,500,000 Euros	**Total**	**829,919,000 Euros**

According to the Federal Environment Ministry, the German portion of SIP is 60.5 million Euros and the portion of the EU budget amounts to 28% of 240 million.[140] These specifications were used for the calculation. So we can assume that the total German contribution to SIP is 127.7 Euros. **Combined with national expenditures this amounts to at least 453 million Euros up until the end of 2008**.

Table 12) Overview of the Results:

What was paid	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
Domestic agriculture	0.238		
IMIS	0.087		
SIP	0.128		
Total	**0.453**	**[0.465]**	No data possible

[138] BMU 1997

[139] Federal Government 2006: BT-Drs. 16/1205

[140] BMU 2006, p. 5

c) Effects and Evaluation of the Provisions

These state expenditures do not result in direct competition advantages for the operation of German nuclear power plants.

11. Contributions to International Organisations

a) Current Regulations/Actual Aid

For EURATOM/ITER see Chapter A.3.2.

Germany's contributions to the **International Atomic Energy Agency (IAEA)** amounted to 29.593 million Euros in the 2009 federal budget. This amount is composed of contributions to the regular agency budget, to the Technical Cooperation Fund (TCF), as well as – as of 1978 – to the Safeguard Support Programme. The IAEA's regular budget expenditures particularly finance the areas of verification of non-proliferation (so-called safeguards), reactor and repository safety, physical protection of nuclear technological facilities and nuclear materials, and administrative tasks. About 5 per cent of the IAEO's regular budget goes to aid for development of the peaceful use of nuclear energy. Regional projects (in particular in emerging markets and developing countries) are financed by the TCF funds within the framework of (technological) development aid, as well as research aid. The main focus lies in the areas of agriculture, nutrition, and medicine.[141]

The European Organisation for Nuclear Research (CERN) was founded in 1954.[142] According to information from the Federal Ministry of Education and Research (BMBF) Germany currently contributes 130 million Euros[143] annually to the total budget. The BMBF does not specify which time period this figure is valid for. In the federal budget plans, the expenditures are not separately listed for various international research institutions, but rather only shown cumulatively. Although Germany is only one of 20 member states, Germany contributes 22% of the total budget according to the BMBF. The construction in 1954 and operation costs of CERN are shared in agreed and differing proportions by its member states (Germany, Belgium, Denmark, France, Spain, Great Britain, The Netherlands, Norway, Austria, Sweden, Switzerland, Italy, Greece). Germany's share amounts to circa 23.5% of a total amount of 158 million DM for 1966 and 227 million DM for 1967.[144] This information – incomplete in any case – concerning German contributions prior to 1973 was only available as a cumulative figure, and it is possible that contributions to CERN are already included in the accounting of earlier expenditures.

As one of the 20 operating member states of the European Laboratory for Particle Physics (CERN in Geneva), the Federal Republic of Germany currently contributes 130 million Euros annually, amounting to more than a fifth of the research centre's basic funding. In addition, funding worth 90 million Euros has been allocated by the Federal Ministry of Education and Research (BMBF) for the development of the Large Hadron Collider experiments[145] within the framework of project aid since the end of the 1990s.[146]

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141 Federal Government 2008b: BT-Drs. 16/10077

142 European Organisation for Nuclear Research 2008

143 Federal Ministry for Education and Research 2008

144 Ministries for Economy, Middle Class, and Commerce 1967

145 The Large Hadron Collider LHC is a gigantic particle accelerator with a perimeter of 27 kilometers, which is located approximately 100 meters underground in the border area of Switzerland and France, near Genf. Physicists use the LHC in order to examine the building blocks of the world and their interactions.

146 Federal Ministry for Education and Research 2009b

b) Quantification of the Effect of Aid

Germany's member contributions to the **IAEA** between 1957 and 2008 amount to a sum of 664.658 million Euros.[147] Because the EU is not a member of the IAEO, no public German funds flow through the EU to the IAEA.[148]

Table 13) Overview of the Results:

Organisation	**Expenditures until 2008 in billions of Euros nominal**	**Expenditures until 2008 in billions of Euros real**	Expenditures as of 2009 in billions of Euros nominal
IAEA (German part)	0.66		
CERN	0.39 billion Euros in 2006-08 0.09 billion Euros in 1990's		
Total	**1.14**	**[>1.15]**	No data

c) Effects and Evaluation of the Provisions

These state expenditures at least indirectly constitute a competition advantage for the nuclear industry. First of all, funds for international co-ordination are provided by IAEA financing, which brings nuclear energy many advantages. In this way Germany aids international networking and the flow of information within this branch.

CERN funds are also relevant to competition. Research is a prerequisite for the development of modern technologies. In turn, the development of modern technologies is a prerequisite for the generation of prosperity in the future. It should however also be noted that all industrial sectors profit from research aid. CERN also constitutes a European organisation aided by the state, which creates opportunities and advantages to actors within the industry.

147 Federal Government 2008b, BT-Drs. 16/10077. See also DIW 2007: Exact Costs 2003: 24.607 million €, 2004: 27.563 million €, 2005: 26.500 million €, 2006: 27.459 million €

148 European Commission Berlin, Mail from Hep Krekel 1.7.2009

B. Tax Advantages

1. Reduced Tax on Profits through Provisions for Disposal and Decommissioning

a) Current Regulations/Actual Aid

In the Federal Republic of Germany the obligation exists to dismantle and remove a nuclear power plant after its ultimate closure. The legal requirements of closure are regulated in the Nuclear Law (Article 7, Clauses 3 and 9a). According to Article 9a of the Nuclear Law, all incidental radioactive residues and radioactively contaminated facility parts are to be decontaminated.

Until 1994 the Nuclear Law recognised the primacy of the recovery of residual substances in relation to their disposal as waste; as of 30 June 2005 the supply of radioactive nuclear fuel elements to reprocessing facilities is no longer allowed.[149] In order to be able to temporarily store further incidental radioactive nuclear fuel elements, power generators requested their safekeeping at nuclear power plant sites. They received permission to store waste for 40 years from the reposition of the first containers.

The **financing** of nuclear disposal is regulated in Articles 21 and 21a of the Nuclear Law. The basic principles are cost coverage and the benefits principle. Thus, an inspection obligation exists for radioactive waste, and financial contributions are levied to cover the cost of this.[150] To cover the costs of necessary expenditures for planning, research, development, construction, expansion and renovation of these disposal sites, the federal government can collect financial contributions from and insist that provision is made for costs that will be incurred in the future from those who possess permission for the operation of a legal nuclear facility requiring a licence, or who have applied for such a licence, if it will become necessary to dispose of radioactive waste in the future (Article 21b of the Nuclear Law and repository financing ordnance).

Due to the legal obligations described, nuclear power plant operators are obliged, according to share corporation law and commercial law, to already have established financial provisions for closure, dismantling, and deconstruction during the nuclear power plant's operational period. This is to ensure that future obligations to the general public to dispose of waste and decommission plants are reflected in the competitiveness of the plant during its operating phase. Thus, these provisions or funds take into account the fact that, after the end of the operational period, the reactor no longer generates income from which closure, dismantling, and decontamination costs can be financed. Making such financial provision for future costs is eminently reasonable.

These provisions are calculated in relation to the future point in time when funds will have to be available in the largest amount, and the amount to be set aside annually is calculated on this basis over the years of the operation of the plant. In this calculation, the following distinctions are made:

- Operators are permitted to accumulate provisions or funds to cover the cost of a power plant's closure and dismantling over 25 years.[151] The regulations that apply to the tax treatment of the

[149] Information sector nuclear energy, report on performance with Dr. Bruno Thomauske on 26.10.2004 in Berlin

[150] Reich 1989, p. 78ff

[151] Incidentally this regulation also applies to the so-called "core", so essentially the first charging of nuclear fuel elements.

nuclear industry's provisions were last changed in the tax relief law 1999/2000/2002 (valid as of 1999). Prior to this, an accumulation time of 19 years was applied.

- Provisions for the **recovery of nuclear fuel elements and for the decontamination of operational waste**. Here the tax law differentiates between benefit in kind and cash benefit obligations. While provisions for benefit in kind obligations are discounted until the point where their realisation begins, cash benefit obligations are discounted until the point where they will have been repaid. Because each stage of decommissioning can last for decades, this difference can be considerable. The investment costs of the repository for waste are considered to be cash benefit obligations and are discounted up until the repository's expected initiation time (for example 2030 for a repository for highly radioactive waste). By far the majority of the provisions for decontamination of nuclear fuel elements and the operations cases are, however, only discounted until the point in time when the decontamination work begins. This is the point in time, according to the tax authorities, when the spent nuclear fuel elements are extracted from the nuclear power plant's special pit. In practice this occurs some four years after the removal of nuclear fuel elements from the reactor and thus some eight to nine years after the initial irradiation of the nuclear fuel elements. The provisions for the decontamination of the nuclear fuel elements are accumulated over the four to five years in which they are used in the reactor.

The most recent available indication of the amount of total provisions (or decommissioning funds) in Germany was 26.6 billion Euros at the end of 2007.[152]

In November 1999, ten German public utility companies (represented by the lawyers Becker/Büttner/Held) filed a petition at the EU Commission to initiate proceedings based on Article 87 ff of the European Community Treaty due to the granting of competition-distorting aid through the tax exemption of provisions for nuclear power plant decontamination and closure. In November 2001, the EU Commission came to the decision – in line with justifications put forward by the

152 Federal Government 2008d; it is not known how the federal government calculated the total provisions of Vattenfall Europe and E.ON for Germany and Sweden. The sum of the accumulated net provisions of German nuclear power plant operators amounted to 27.4 billion € until 31.12.2005 in their consolidated accounts (cf. also Federal Government 2007a). Thereof 12.9 billion € were allotted to E.ON, 8.7 billion € to RWE, 4.4 billion € to EnBW, 0.8 billion € to Vattenfall, and 0.6 billion € to Munich Public Works. Contained here are also the provisions for the ongoing, as well as for already closed nuclear power plants, like, for example Würgassen, Stade, Mülheim-Kärlich, or Hamm-Uentrop. The payments from the newer business reports after 2005 do not lend themselves to be added to a sum for the German nuclear power plants' accumulated net provisions simply by implication, because to some extent only the total, not the provisions attributable to countries, are displayed in the consolidated accounts of E.ON and Vattenfall Europe.

According to information from the federal government the timeline of provisions for the last few years are described as follows:

	Provisions in billions of €	**Source**
2003	28.1	Federal government 2006c, BT-Drs. 16/2690
2004	27.6	
2005	27.3	Federal government 2007a, BT-Drs. 16/6303
2006	27.4	
2007	26.6	Federal government 2008d

Why the provisions in the last few years, according to the federal government, have sunk slightly is not known here. One reason could be the EU-wide compulsory reorganisation of accounting practices for companies listed on the stock exchange as of 1.1.2005 of the internationally accepted US-GAAP and IAS/IFRS system (for background information on this see http://de.wikipedia.org/wiki/United_States_Generally_Accepted_Accounting_Principles and www.ifrs-portal.com). This leads, for example, to the exact costs no longer being known. As well, the increase in the interest rate for the discounting of provisions from 5.0 to 5.5% caused a decrease in provisions (see e.g. Vattenfall 2008, p. 73).

German federal government – that provisions for the nuclear industry do not constitute aid in the sense of Article 87 of the European Community Treaty, because they originate from general regulations valid for all companies and therefore present no selective benefits for the nuclear industry.

The following arguments counter this:[153]

- The tax regulations concerning decontamination provisions are made possible through special regulations in German tax law explicitly for the nuclear sector, which are not generally established in the nature or internal structure of the tax system.
- The obligations which the German nuclear sector's provisions should meet do not fulfil the strict criteria of the Supreme Court for Issues Concerning Taxation (BFH) for the firm establishment of unspecified liabilities.
- The sector's future obligations do not justify the value of provisions made by the German nuclear sector.
- The German nuclear sector is de facto selectively favoured in relation to its competitors due to the high value of provisions.

In March 2002 four public utility companies filed a plea for annulment against the EU Commission's decision at the European Court of First Instance (ECFI) based on Articles 230 and 231 of the European Community Treaty. On January 26 2006, the ECFI decided that the case was permissible but unfounded, because the Commission's decision was authorised.[154] The core of the Court's argument was (based on the EU-Commission) that the tax regulations on provisions indeed imply economic advantages, but that no selective favouritism and no aid in the sense of the EU aid control was present. Tax deductibility of provisions was valid for all companies in all branches; provisions could always be used freely. In proportion to the costs of decommissioning, the provisions are not excessive. The ECFI therefore did not share the opinion of the plaintiff that the advantages granted in the area of provisions represent aid in the sense of Article 87, Clause 1 of the European Community Treaty.

After this the public utility companies filed a plea for annulment of the decisions of the ECFI at the European Court of Justice (ECJ), represented by the attorneys Dörte Fouquet and Peter Becker, but the ECJ conclusively refused the case on November 29 2007. The plea was rejected as inadmissible by the ECJ, and therefore it no longer came to the question of reasonable grounds and whether aid was available or not. The main argument for the refusal of the case was that the ECJ saw no adequate evidence that the placement of the public utility companies in the electricity market would be noticeably affected by the contested aid.[155] The ECJ therefore disputed technical question above all and did not investigate the plaintiffs' arguments regarding the competition-distorting advantages benefiting the nuclear sector with regard to tax advantages for decommissioning funds.

[153] Fouquet/Uexküll 2003, p. 315.

[154] ECFI 2006

[155] ECJ 2007

b) Quantification of the Effect of Aid

The German practice of obligatory decommissioning funds or provisions leads to economic advantages for the nuclear sector in three ways:

1. **Interior financing advantage: The use of provisions for corporate activities**
Preliminary note: It is indisputable that the use of provisions for interior financing represents a significant economic advantage to the nuclear sector. However, there are no sources known to us that have undertaken a quantification of this advantage. Here we will provide, for the first time, an estimate of this and would like to put the methods, assumptions, and results up for discussion. We would like to thank Dr. Wolfgang Irrek (Wuppertal Institute) and Dr. Dörte Fouquet (Kuhbier Attorneys and European Renewable Energies Federation) for their valuable encouragement.
A preferable solution from an environmental-economic point of view – paying provisions into a publicly managed fund – will be taken as a reference case. In this case, funds would grow at the same interest rate as e.g. long-term federal bonds, and the interest yield would be added to the funds available. This would generate an average return of 7.0% by the time funds would be spent.[156] Instead of using such a fund as a solution, provisions for the nuclear sector in Germany were and still are available for the internal financing of corporate activities in telecommunications and decontamination, as well as equity capital for other energy provider companies. Based on consultations with experts, literary analysis on competition in the electricity market, and the question of excessive electricity prices (see also chapter IV.C.2 on the advantages from incomplete competition in the electricity market), we contend that on average an equity capital return of at least 10 to 15% could be attained in the electricity market.

Based on this information, we assume an additional gross return of 4% (before tax) for the use of provisions for internal financing in comparison to our reference case of a capital contribution into a public fund. To what extent profit taxes should be considered depends on further use of the profits: If they are distributed, profit taxes should be considered for the calculation of the net advantage from the use of provisions. After an average 30% taxation, an additional 2.8% return is yielded.[157] Annual provisions are valued in relation to these additional returns. We have based our calculations below on the model-theoretical predicted progression of provisions payments since 1969 from the Wuppertal Institute and the Eco-Institute (research carried out in 2000), as real figures for provisions are not available.[158] Real figures are used wherever available.

The result of this calculation is that additional returns up until 2008 amounted to 6.2 billion Euros economic advantage per percentage point for nuclear power plant operators. For a 2.8

156 This amount was determined with the calculation of the average return of long-term federal bonds. It was calculated with the help of a long timeline (1968-2008) from the REXP. The REX Performance Index (REXP) of the German Stock Corporation is the appropriate performance index for the loan portfolio of the German annuity index (REX). It can used as a timeline for the returns from long-term federal bonds. For information on the REXP see: http://www.bundesbank.de/statistik/statistik_zeitreihen.php?func=row&tr=wu046a&showGraph=1

157 According to a call on 27.7.2009 with the Federal Economic Ministry (Mr. Höfer, Tel. 030-20146263) the average marginal tax rate for capital corporations is just under 30%.
What still needs to be further discussed is the question of whether a net calculation in the form of an adjustment of profit taxes should be undertaken for the evaluation of the advantage from the use of provisions for interior financing. In a typical case the capital contribution of provisions to a puble fund would indeed pay no profit taxes. This question should be more closely discussed with experts; we have undertaken a net calculation as a precautionary measure to prevent overestimations.

158 Wuppertal Institute/Eco-Institute 2000b

percentage point additional return (net, after taxes), the cumulative economic advantage until 2008 would therefore amount to **17.3 billion Euros** nominal; in 2008 prices, this is 21.7 billion Euros.

Beginning in 2009, an advantage of about **24.6 billion Euros** will occur, according to the assumptions outlined above from the use of provisions for internal financing.[159]

However, should the proceeds from the provisions not be distributed, but rather be used for other projects, first, no profit taxes would be due, and second, the compound interest effect would reinforce the cumulative additional revenues from the use of provisions for internal financing. In this case, the cumulative advantage until 2008 would amount to 37.7 billion Euros, i.e. more than twice as much as the variant used here, in which the compound interest effect is not considered and the net advantage (after taxes) is calculated. In this respect, we have made a very careful estimation of the aid value of provision regulations.

2. **In addition, there is an interest advantage from deferment of tax payments.** Every allocation of funds to its provisions decreases the nuclear power plant operators' profits to be taxed in the calculation of profits and losses in a particular year and therefore ceteris paribus the amount of taxes to be paid. In a year when an expenditure for closure, dismantling, or decontamination must actually be made, this expenditure then does not lead to an accumulation of expenses, but rather to laying claims to the calculated provisions. Hence, the tax payment will be made up for in this year. This in effect defers a tax payment for several years or even decades – with a **resulting interest advantage** for nuclear power plant operators.

a) Provisions for decommissioning. Here an interest advantage results from the fact that the provisions have accrued to their full amount after 25 years, yet closure only begins in the 32nd year. While provisions are being set aside, the cost of decommissioning and dismantling has in effect been brought forward, and profit to be taxed during this time is reduced accordingly. The DIW quantifies this effect in a short report in 2007 at about 2.805 billion Euros in total for 17 nuclear power plants or 88 million Euros in each of the 32 operating years.[160]

b) The DIW calculated the advantage from **provisions for decontamination of nuclear fuel elements** at 87 million Euros per year for the 17 nuclear power plants in operation or 2.797 billion Euros over the entire 32-year operational period.

The DIW estimates the total interest advantage from the practice of provisions to be at least 175 million Euros per year (an 88 million Euros tax advantage for decommissioning provisions and 87 million Euros for provisions for decontamination of nuclear fuel elements).

In the overview of the aid for nuclear energy presented in the table, the total sum calculated by the DIW for the tax advantage of provisions of **5.6 billion Euros** is assumed. To some extent, this advantage will begin to accumulate in the future. However, because the DIW made a

159 The further development of provisions is not known. For a rough estimation we have assumed that the sum of total provisions until 2014 (25 years of accumulation time for dismantling provisions for the nuclear power plants that were in operation until 1989) will at least remain constant. As of 2014 it will be simplistically assumed that the sum of the provisions will decrease linearly to zero by 2070. This rough estimation requires further differentiation.

160 Please see (in German) DIW 2007, p. 93.

cumulative calculation of the interest advantage, a breakdown of these advantages by individual year, and therefore a price adjustment, is not possible. Because we have insufficient information on the distribution of past and future years, we have halved this advantage between the time period up until 2008 and from 2009.

3. Last but not least, provisions decrease the foreign capital demand and this, in turn, improves the rating position of a power supply company, making it easier for these companies to find additional corporate financing at lower interest rates. This effect cannot be quantified here, but points to a further financial advantage attributable to the German provision system.

Table 14) Overview of the Results:

Actual Aid	Expenditures until 2008 in billions of Euros nominal	Expenditures until 2008 in billions of Euros real	Expenditures as of 2009 in billions of Euros nominal
1. Use of provisions for internal financing	17.3	21.7	24.6
2. Interest rate advantage from the deferral of tax payment to the future	2.8	2.8	2.8
Total	**20.1**	**24.5**	**27.4**

c) Effects and Evaluation of the Provisions

Problems with current regulations concerning provisions:[161]

- Inadequate financial security: i.e. the insolvency risk for operating GmbHs (limited companies) and corporations. If long time periods spanning several decades and the frequent occurrence of insolvency of large corporations in the past few years are considered, then there is a risk that provisions may no longer be available in the full amount when they are needed.
- Distortions in competition due to internal financing possibilities in large amounts and over a long, predictable time period; also facilities in remote energy areas. Provisions used to be incredibly relevant to competition advantages for nuclear energy operators and remain so today.
- No interest on the part of operators in premature closure of nuclear facilities and in the timely construction of waste storage facilities.

The best theoretical solution to this problem would be the **conversion of provisions into a public-legal fund**; however, this is hardly legally and politically feasible.

In a research project commissioned by the EU Commission, the various methods for financing the closure, dismantling, and decontamination of nuclear facilities in the EU were compared.[162] The Wuppertal Institute/Irrek (2007), who led the project, suggest the following additional regulations in a report on the situation in Germany, in case an external fund is not enforceable:

- Publishing of data and information: central data collection, cost benchmarking.[163]

161 See Wuppertal Institute/Irrek 2007a and Wuppertal Institute/Irrek 2007b

162 Wuppertal Institute/Irrek 2007b http://www.wupperinst.org/de/projekte/proj/index.html?&projekt_id=167&bid=137

163 Among others the various components of decontamination provisions must be balanced by the nuclear power plants.

- Two types of financial guarantees, for example anchored in operating licences: a) in case of closure before the end of the accumulation period for provisions (cf. the cases of Hamm-Uentrop and Mülheim-Kärlich); b) in case actual costs for the 'back-end' exceed the sum of the accumulated provisions following decommissioning of a plant. Also binding letters of comfort between operating limited companies (GmbHs) and corporations; if necessary, a guarantee pool.
- Investment regulations similar to those in the insurance industry.

2. Tax Benefits in Energy Taxation

a) Current Regulations/Actual Aid

While oil and gas were taxed as an input to power generation until the Energy Tax Law of 1 August 2006, nuclear fuels were and remain un-taxed. As of 1st August 2006, inputs to power generation are no longer taxed in Germany.

A distinctive and selective advantage for nuclear energy can thus be identified in the years leading up to the 2006 Energy Tax Law, because other energy sources were taxed as inputs to power generation inputs. This selective advantage was corrected on 1 August 2006.

b) Quantification of the Effect of Aid

In order to be able to comprehensively identify tax benefits, a model for energy taxation must first be defined, so that subsequent discrepancies may be detected as tax benefits. FIFO/Thöne (2005, p. 59ff) describes this as the difficult choice of a benchmark tax system, within the framework of which tax units, assessment bases, and standard rates are to be established.

The standard rate of a CO_2/energy tax with additional charges for the use as fuel in the transport sector is defined here as a model or benchmark. All discrepancies to this standard rate are defined as tax benefits. Thereby we will proceed as follows:[164]

1. The calculation of a (hypothetical) tax revenue from an energy tax developed according to environmental and economic criteria. The reference case for a systematic, environmental-economic energy tax is understood here to be a combined CO_2 / energy tax. This means that, in principle, the energy carriers will be taxed according to their energy content, while a CO_2 component ensures that energy carriers with high specific CO_2 emissions will be taxed more.

2. A specific rate should be established for nuclear energy, due to its specific external costs and risks in comparison to other energy carriers. Due to difficulties in quantifying the external costs, we will proceed according to the UBA method convention for calculating external costs (UBA 2007), which states that the value of the next-worse energy carrier is used. For coal, a rate approximately 17% higher than for fuel oil arises from a CO_2/energy tax. This reference tax rate will also apply to nuclear energy.

3. Over time, this 1.17 magnification of each valid tax rate for light fuel oil will be taken as a reference tax rate: As of 1 January 2003, the tax rate for light fuel oil has been 6.14 cents/litre.

4. The tax revenue that should be raised from nuclear energy is then calculated through the multiplication of each reference tax rate by a primary energy supply fee.

5. The shortfall due to tax benefits is defined and calculated, as the difference between the tax revenue that would have been raised under our CO_2/energy rate and actual tax revenue.

6. The coal penny levied from 1975 to 1996 and the electricity tax levied since 1 April 1999 are considered to be the actual tax revenues, although both taxes were not levied as primary energy taxes. Tax revenue raised by the coal penny and from the electricity tax is attributed to energy sources in proportion to their share in electricity generation.

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164 For a detailed documentations of the approach see Meyer 2006.

A Sample Calculation for 2008

1.-4. The tax rate for light fuel oil amounts to 6.14 cents/litre, so 1.69 Euros/GJ. The tax rate for nuclear should be 17% higher, so 1.98 Euros/GJ. The primary energy supply fee of nuclear energy amounts to 1.622 PJ. The tax revenue that would have been raised by such a tax would thus amount to 3.21 billion Euros (1.98 Euros/GJ * 1.622 PJ).

With reference to point 6. The tax revenue for the electricity tax amounted to 6.26 billion Euros in 2008. Of this, 1.46 billion Euros is proportionate to nuclear energy's 23.3% contribution to electricity generation.

With reference to point 5. The net tax benefit for nuclear energy amounts to 1.75 billion Euros in 2008.

If the current incomplete energy taxation system remains in place, then the net tax benefit to the nuclear power plants is worth 14.6 billion Euros. This advantage is because, instead of using a CO_2/energy tax as a reference case for a primary energy tax, only an electricity tax is levied, and within this electricity tax, a large amount of consumptions are not taxed at all or are taxed at significantly reduced rates. Actual tax revenue is thus far lower than the tax revenue of a CO_2/energy tax designed according to environmental and economic criteria would be.

Table 15) Overview of the Results:

Actual Aid "Tax benefits in energy taxes"	**Expenditures until 2008 in billions of Euros nominal**	**Expenditures until 2008 in billions of Euros real**	**Expenditures as of 2009 in billions of Euros nominal**
Total	**34.8**	**40.5**	**14.6**

c) Effects and Evaluation of the Provisions

The non-taxation of nuclear fuels in the context of energy taxes has a high aid value and has led to a significant competition advantage, particularly when compared with gas power plants.[165] With the abolition of all taxes on inputs to electricity generation in the Energy Tax Law from 1 August 2006, the selective favouring of nuclear energy was also abolished.

Thus, current taxation in energy taxation cannot justify the introduction of a nuclear fuel tax. Yet they can highlight why it is important to end advantages to nuclear resulting from emissions trading and for holding nuclear power plant operators responsible for financing the decontamination of various nuclear projects (among others Asse and Morsleben).

165 However, the coal input into electricity generation was not incorporated into energy taxation, so that nuclear and coal had the same competition specifications for energy taxation.

C. State Provisions Independent of the Budget

1. Aid Value of the Increase in the Price of Electricity through Emissions Trading

a) Current Regulations/Actual Aid

The EU-wide emissions trading introduced in 2005 covers CO_2 emissions from the energy sector and industry. Emissions trading caused an increase in the wholesale price of electricity, which in turn generated windfall profits for energy companies, including and indeed particularly for power generation from nuclear energy.

b) Quantification of the Effect of Aid

1) First Trading Phase 2005-2007

There are various studies concerning the estimation of the increase in electricity price through emissions trading:

a) DIW/Diekmann 2007 assume a shifting effect of about 0.5 Euros/MWh (=0.005 cents/kWh) per Euros/t CO_2. For 2005 [2006], DIW/Diekmann estimate the increase in electricity price from the average certificate price of 18 [17] Euros/t CO_2 at 0.91 [0.87] cents/kWh. Because of this, nuclear power plant operators each achieved profits of 1.5 billion Euros in 2005 and 2006.
b) A Schwarz/Lang paper found an increase in the price of electricity for 2005 of 1.37 cents/kWh (=13.7 Euros/MWh) through emissions trading, at an average 2005 price of 18.14 Euros/t CO_2 in the EEX; this is consistent with a shift of 0.076 cents/kWh per Euros/t CO_2.
c) The average CO_2 emissions of German power plant facilities allow for an expected increase in electricity price of 0.063 cents/kWh per Euros/t CO_2. However, electricity prices are not dependent on average CO_2 emissions, but on the emissions of those particularly marginal power plants also required to meet electricity demand.
d) If this marginal power plant is an older lignite power plant, costs of up to 1.5 t CO_2 per MWh of electricity can accrue. Given a certificate price of 26 Euros/t, this marginal plant would result in a 3.9 cent/kWh increase in electricity price.

Table 16 summarises alternative estimates for the effects of electricity price from emissions trading.

For 2005/2006 we cautiously assume an increase in electricity price of about 1.1 cents/kWh from emissions trading. At the beginning of 2007, emissions certificates were only worth about 2 Euros, following revelations of high surpluses of certificates in relation to actual emissions: subsequently, the price sank to just a few cents for the rest of the year. Thus, the average price is less than 1 Euros. We assume an electricity price increase of 0.06 Ct/kWh and corresponding marginal windfall profits from emissions trading in 2007.

Table 16) Overview of Alternative Estimation Models for the Effect of Emissions Trading on Electricity Price

	CO_2 emissions in kg/kWh (=t/MWH)	Electricity price rise in Ct/kWh per Euros/t CO_2 certificate price	Resulting electricity price increase (in Ct/kWh) *for a certificate price (in Euros/t) of:* *10*	*18*	*22*	*26*	*30*	*39*	Euros/t
a) DIW/Diekmann		0.050	0.5	0.9	1.1	1.3	1.5	2.0	Ct/kWh
b) Schwarz/Lang study		0.076	0.8	1.4	1.7	2.0	2.3	3.0	Ct/kWh
c) Average emissions of German power plants	0.63	0.063	0.6	1.1	1.4	1.6	1.9	2.5	Ct/kWh
d) Emissions of a lignite power plant (as marginal power plant)	1.50	0.150	1.5	2.7	3.3	3.9	4.5	5.9	Ct/kWh

2) Second Trading Phase 2008-2012

An expected price of 22-26 Euros/t CO_2 for emissions certificates for the second trading period as of 2008 implies an electricity price increase of 1-4 cents/kWh. Using a 'best guess' electricity price increase of 1.5 cents/kWh, this price rise generated a 2.2 billion Euros advantage for nuclear energy in 2008.

Alternative calculation: For the second phase of the EU emission trading system (2008-2012), an Eco-Institute research report on the windfall profits of German electricity producers is available. The Eco-Institute estimates this at a total of 35.5 billion Euros, so an average of 7.1 billion Euros per year.[166] The basis for this estimate is the factoring of CO_2 certificate costs into the electricity price.

According to the Eco-Institute, windfall profits worth 4 billion Euros are enjoyed by CO_2-free energy sources, of which 3.4 billion Euros can be attributed to nuclear energy. According to this calculation, the advantage for nuclear energy from emissions trading would be around 1.2 billion Euros higher per year (in 2008-2012) than the more cautious estimate put forward here.

Table 17) The advantage to nuclear energy through emissions trading 2005-2008

2005	1,1	1.8	1.9
2006	1.1	1.8	1.9
2007	0,06	0.1	0.1
2008	1.5	2.2	2.2
Cumulative		**6.0**	**6.2**

166 Eco-Insitute 2008

3) Third Trading Phase 2013-2020

Due to the further scarcity of emissions certificates in the third phase of EU-wide emissions trading (starting in 2013), higher prices for emissions certificates are expected, which will lead, in turn, to further windfall profits for electricity providers.

Based on the amount of residual current provided by German nuclear power plants as of January 1 2009 (see BfS 2009), the advantage for nuclear energy from emissions trading can be calculated for the period starting in 2009.

Alongside the amount of residual current, an estimate of the average electricity price increase due to emissions trading is required. This depends significantly on the development of the price of emissions trading certificates, which, in turn, will be determined through the following influencing factors:

- The actual structure of the international climate agreement to build on the Kyoto Protocol and the Copenhagen Accord for the period after 2013.[167] An intensification of emissions restrictions in EU emissions trading is envisioned as of 2013, should an ambitious international agreement materialise in the near future on climate protection. In this case, the EU has already announced it will undertake a reduction of greenhouse gases of 30% by 2020, while without more widespread commitment to reduce emissions, it has announced a reduction of 20%. Regulations for emissions trading beyond 2020 currently assume the 20% goal, but likewise, these would be revised following a corresponding climate protection agreement.
- Regulations on using carbon credits – CERs, certified emissions reductions – from the flexible Clean Development Mechanism (CDM), as well as other mechanisms which may come into force in the future.
- Effectiveness of CAP in the second trade period and the resulting banking of emissions certificates in the transition between the second and third trading periods.
- Economic development.
- Development of mitigation technologies.

In its Impact Assessment, the EU Commission assumes certificate prices of 30-39 Euros/t for emissions trading in the third trading period (respectively, with and without the Clean Development Mechanism).[168] Depending on the marginal power plant, this implies an electricity price increase of 2-5.9 cents/kWh (see the table above).

For every cent the electricity price is increased through emissions trading, a cumulative advantage of 12.4 billion Euros accrues for the nuclear energy industry. This is the case from January 1 2009 to the end of the third trading period.

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167 At the time of translating this report, the non-binding Copenhagen Accord was the only result of the COP15 negotiations. Negotiations will continue in 2010 and it is hoped that a binding agreement can be reached by the end of the year at the COP16 in Mexico.

168 For the policy and further documents on EU-wide emissions trading see http://ec.europa.eu/environment/climat/emission/index_en.htm

Table 18) Advantages to nuclear energy through emissions trading from 2009

Surplus amount of power as of 1.1.2009	1,241,446.38	GWh
Average increase in electricity price through emissions trading 2009-2020	0.025	Euros/kWh
Resulting profit-taking for nuclear power plant operators as of 2009 (cumulative)	31.0	billion Euros
Average per year 2009-2020	2.6	billion Euros

Here a best guess of 2.5 cents/kWh was used for the increase in electricity price. Given this assumption, the future advantage for nuclear energy from emissions trading as of January 1 2009 will amount to 31.0 billion Euros.

Table 19) Overview of the Results:

Actual aid "Aid value of emissions trading for nuclear energy"	Aid until 2008 in billions of Euros nominal	Aid until 2008 in billions of Euros real	Aid as of 2009 in billions of Euros
Total	**6.0**	**6.2**	**31.0**

c) Effects and Evaluation of the Provisions

The advantages for nuclear power generation from emission trading are very relevant to the competitiveness of the industry.

For those sectors participating in emissions trading, windfall profits will be restricted in the future through partial auctioning from 2008, and through full auctioning scheduled to begin in 2013 in the energy sector. Advantages remain in that the ETS is a climate-related steering mechanism that acts in favour of electricity generation by energy carriers who can offer lower CO_2 costs than the marginal provider. Nuclear energy enjoys a particular advantage in this regard, because it enjoys the advantages of increased electricity prices without having to suffer the disadvantages of participating in the scheme, and because policy instruments for the internalisation of specific nuclear energy costs and risks are completely inadequate.

It seems logical at first glance that nuclear energy should profit from CO_2-oriented instruments like emissions trading. However, it is extremely problematic that the specific external costs and risks associated with nuclear energy are not taken into account by means of other policy instruments.

The existing and increasing advantages for nuclear energy from emissions trading should be compensated for by a nuclear fuel tax.[169]

169 For definition questions on a nuclear fuel tax see Meyer 2008

2. Aid Value of Incomplete Competition in the Electricity Market

a) Current Regulations/Actual Aid

Methodical issue: Why regulations can lead to advantages similar to subsidies

Regulations, as a rule, are not defined as subsidies in the literature on energy subsidies, and where they are conceptionally defined, they are not quantified. The following reasons speak against a classification of the regulation of the electricity industry as a form of state subsidy: The omission of an effective, competition-oriented regulation has a different quality to deliberate state action; and for the same reason, the lacking internalisation of external costs is often not classified as an incidence of subsidy. Furthermore, state regulations do not have a direct effect on public budgets.

All other features of subsidies are to be found in regulations with subsidy characteristics, however: A selective advantage arises for a group of recipients; competition between energy carriers is distorted; the advantage is achieved through state activities (type of regulation). Lacking or incomplete competition makes it possible for electricity producers to claim excessive network-user fees and electricity prices, and to attain above-average profits. The subsidy definition by the OECD, UNEP and IEA (see Table 3 on p. 19) seems to be encompassing perfectly advantages through regulations. In 2005, the OECD also includes energy sector regulations with reference to UNEP/IEA 2002 in its energy subsidy report.[170]

Indicators for Advantages to the Energy Supply Industry through Excessive Electricity Prices

Four large corporations (E.ON, RWE, EnBW, and Vattenfall Europe) command 80 per cent of the power plants and around 90 per cent of the energy distribution to consumers.[171] At the same time, they are the owners of the high voltage power grid. Based on this fact there are a range of theoretical and empirical indications for, and identification and quantification of, the advantage the electricity industry enjoys from excessive electricity prices:

- The **theory of monopoly price fixing** states that profit maximising providers inflate the 'market price' through a scarcity of choice and therefore attain a monopoly income.
- In addition, monopolies produce inefficiently due to a lack of competitive pressure.[172]
- A further indication of excessive prices and monopoly incomes is the **expansion of energy provider corporations, particularly into the waste, water, and telecommunications sectors** (earlier indication: Deregulation Commission 1991, p. 47), as well as increasing vertical and horizontal integration within the electricity industry.
- **Cross-subsidisation**: Profits from energy provision were offset against deficits, e.g. from public transport.
- **Empirical studies** – e.g. based on **comparisons of electricity prices** with other European states – have revealed that German electricity prices are excessive. In 2005, German electricity prices

170 These are individually named: demand guarantees, mandated deployment rates, price controls, market access restrictions (OECD 2005, p. 50)

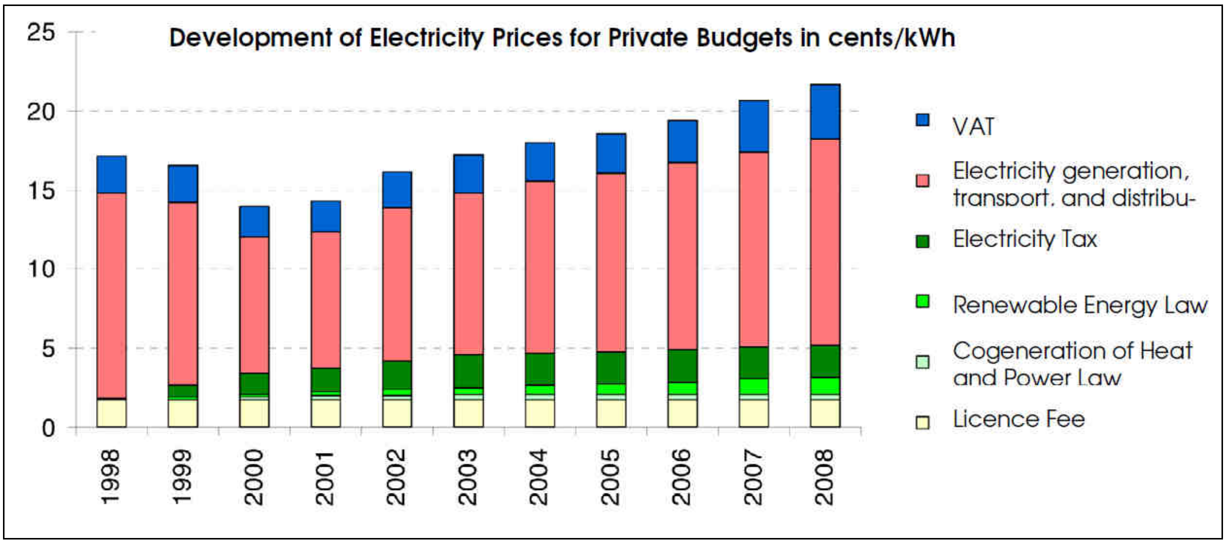
171 Federal Government 2008c

172 Deregulation Commission 1991, p. 49

for industrial users were 1 cent/kWh higher than the European average, and for private consumers nearly 3 cents/kWh higher.

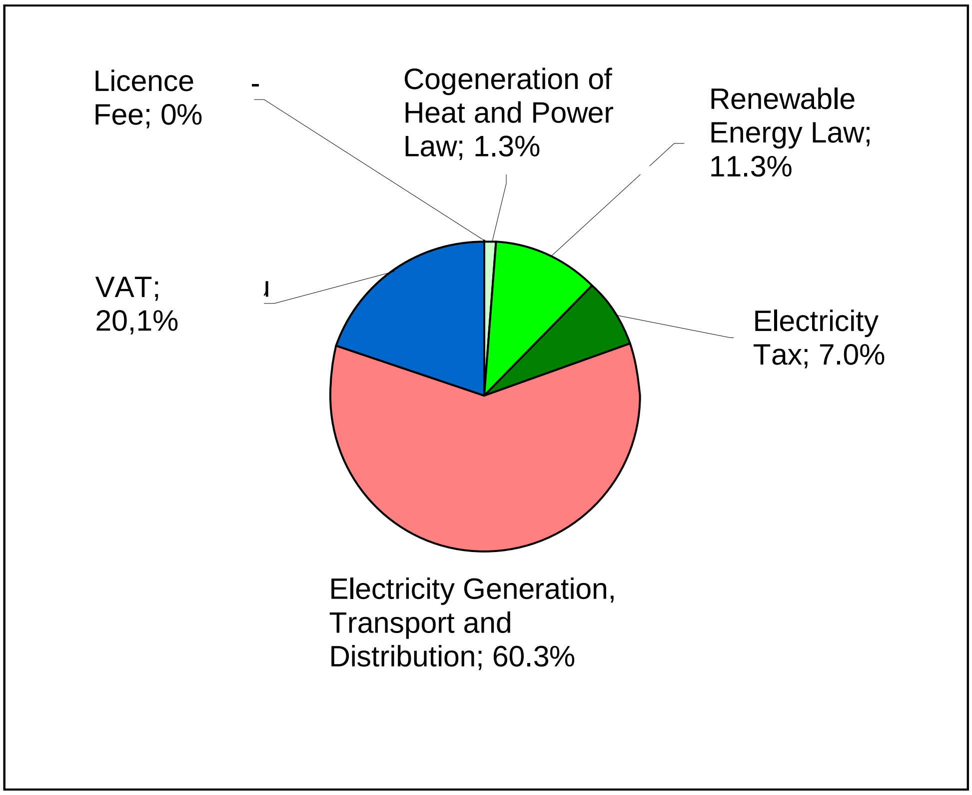
Former Federal Economic Minister Glos (CSU) stated, during his presentation of a package of measures to increase competition in the electricity industry, that a **2 cent/kWh electricity price cut**, and therefore 10 billion Euros relief for energy consumers, was realistic (Speech on 24 November 2006 for the 2nd and 3rd reading of the federal budget). The Federation of German Consumer Organisations (Bundesverband der Verbraucherzentralen) seemed to agree (Focus, 20 November 2006). According to their estimates, the price of household electricity is as much as 3 cents/kWh too high (Energy Dispatch 12/2006).

- **Timeline of Electricity Price Development:**
  After the liberalisation of the electricity industry in Germany, there were reductions in electricity prices in 1999 and 2000 for industrial users. According to an RWE estimate, "in 2000 the industry could record a liberalisation advantage of about 5.6 billion Euros." However, what is especially striking is the increase in the net electricity price since 2001. The "electricity generation, transport, and distribution" cost pool increased by 12.9 cents/kWh between 2001 and 2008, which is a rate of increase of 61%. This increase can be only partially explained by fundamental cost-relevant data, such as increased prices for coal, gas, and uranium, or by factoring in emissions certificates received at no cost. Also, the three environmental-politically motivated allocation mechanisms (the Renewable Energy Law (EEG), Cogeneration of Heat and Power Law, and electricity tax) have only increased marginally since 2003; in total the increase from 2001 to 2008 amounted to 4.2 cents/kWh. The increase of the VAT from 16% to 19% is the main cause of the increase in 2007.



Source: Federal Environment Ministry 2009d

In total the electricity price increase between 2001 and 2008 accounted for 61% of the power sector's cost pool for "electricity generation, transport, and distribution", while the three state contributions (Electricity Tax, Renewable Energy Law, and Cogeneration of Heat and Power Law) accounted for around 20%: of the difference.



Source: Federal Environment Ministry 2009d; own calculations

- **Market Power**
  Various studies present indications for the supposition that increasing concentration and market power explain some of the price increase.[173]
  The EU Commission argues in its **report on the investigation of European gas and electricity sectors** (KOM (2006) 851 final) from 10 January 2007 that trading in electricity has indeed developed further, although sales in the wholesale electricity market reflect the high concentration in the power generation sector. The analysis of trade in the electricity market shows that producers have the possibility to utilise the **market power in some electricity markets to raise the prices** – a drawback criticised by many customers. The analysis of trading positions in futures markets, where the concentration is lower overall, reveals that the electricity markets are dependent on a few producers with 'long positions' (this means corporations that produce more than they sell). Furthermore, an analysis of production portfolios shows that the most important producers have the ability to reduce output in order to inflate prices.

  The **EU Commission report summarising its investigation of the sector** also mentions Germany in relation to the influence holding back capacity has had on price increases.

  The EU Commission has also opened **infringement procedures** against Germany and 15 other Member States. The charge claims that dominant firms and national markets were protected

[173] See in particular EU Commission 2007, Hirschhausen et al contracted by the VIK 2007, Federal Cartel Office 2006

by regulated prices, or that they discriminate against third parties for network access.[174] Commissioner Piebalgs labelled liberalisation in Germany 'inadequate'.[175]

In Hirschhausen's opinion, in the 2007 VIK brief, actual electricity prices were compared with the reference price of a (fictional) competitive market. Thereby, Hirschhausen came to the conclusion that the prices in the European Energy Exchange (EEX) in the first half of 2006 were, on average, almost one quarter higher than they would have been in a functioning competitive market. He also argued that the power supply industry passed on increasing prices for emissions certificates more swiftly to consumers than decreasing costs. The **manipulation of stock exchange prices** took place by means of withholding power plant capacity, or giving strategically excessive quotes.

The recent infraCOMP study commissioned by the Federal Environment Ministry, and that of Becker contracted by the parliamentary political party Bündnis 90/Die Grünen (the Greens) also showed that the stock exchange prices for electricity are prone to manipulation by corporations that dominate the electricity production market.[176] By withholding the quantity of electricity produced, the electricity price can be inflated.

- There are extensive **transparency and control deficiencies** in the German **electricity market**. Stricter information obligations are necessary for both production and network data.[177]
- The profits of the four largest electricity industry corporations are continually higher than average – despite the liberalisation of the electricity industry. The following table shows the gross returns from three of the four largest electricity producers from 2004 to 2008.[178]

	2008	2007	2006	2005	2004	Average
RWE	9.1%	11.8%	11.6%	9.1%	9.3%	10.2%
E.ON	2.7%	14.1%	9.1%	18.1%	13.8%	11.6%
EnBW	7.6%	10.1%	9.1%	10.0%	7.3%	8.8%

Following a record-high year in 2007, the largest electricity corporations were able to increase their profits by an average 11% in the first three quarters of 2008 (E.ON 8%, Vattenfall 19%, RWE 7%). 2008 profits would have been greater if E.ON had not had to report its losses in the course of the financial crisis. From 2002 to 2007, the electricity corporations made about 80 billion Euros in profits.[179]

Vattenfall pursued the goal of 15% equity returns on its average net worth and, according to its own information, this goal was, on average, reached in the first two quarters of 2008 (13.9%) and 2009 (17.0%).[180]

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174 FTD 13.12.2006

175 Trade newspaper (Handelsblatt) 25.1.2007

176 See infraCOMP 2009; Becker 2009

177 See White & Case study/NERA 2007 contracted by the Saxon Ministry of Economics

178 Comdirect Bank 2009a, b, and c

179 Leprich 2009

180 Financial Goals of Vattenfall Europe http://www.vatenfall.de/www/vf/vf_de/225583xberx/231617finan/231947finan/232037finan/index.jsp

- The **Federal Network Agency** (Bundesnetzargentur) has enforced various reductions in electricity network fees in recent years. Thus, they enacted a **decrease in conduction fees** in 2006 for 20 distribution system operators; e.g. 18% for Vattenfall, 16% for E.ON, and 9% for RWE (Focus, 20.11.2006). Furthermore, the Federal Network Agency brought charges of abuse against the largest electricity providers, i.e. in connection with price fixing within the framework of emissions trading, and for calculations of regulating energy and loop flows that were too high.[181] The EU commission also conducted an investigation of the largest German energy providers in 2006, based on the suspicion of competition violations, and filed various formal preliminary proceedings.[182] An agreement between the largest producers followed, to submit to pressure from Brussels and to sell on their electricity networks to independent third parties within three years. In January 2009, the Federal Network Agency released a report on the amount of standard benefits in the electricity network for the four power grid operators. It came to the conclusion that standard benefits can be reduced by a total of over 400 MW while retaining the same security within the system, and that an annual savings potential for regulating energy inputs exists worth a two-digit figure in million Euros.[183]

- In addition to the possibility of demanding excessive electricity prices through excessive market power, two further effects have led to increased additional profits for electricity generation corporations in the last 10 years (**windfall profits**):
  - Price fixing according to marginal costs
    Even in the case of non-excessive electricity prices, certain power plants profit from being able to produce electricity at prices lower than the existing marginal price. Because an almost-amortised power plant capacity of well over 100 GW existed in Germany in the 1990s, operators of these power plants profited disproportionately.
  - Free distribution of CO_2 emissions certificates in connection with the transfer of the market value of certificates to the price of electricity. This effect is discussed separately on data sheet C.1.

Thus there is a strong indication in favour of a presumption that there are excessive electricity prices, and monopoly and even oligopoly profits, in the electricity industry. This advantage from failed state competition-oriented regulations is certainly available to all energy providers equally, in principle, and in this respect is not a selective advantage for nuclear energy. **A specific advantage for nuclear energy** exists only insofar as:

- Its growth phase occurred when high electricity prices were particularly easy to demand, and

- That nuclear energy only generates electricity, while other energy sources also face competition in the heat and fuel markets.

In the findings for this analysis we have measured the aid value of the incomplete competition in the electricity market only in sum 3, in which other aid is considered alongside subsidies in the narrower sense.

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[181] Der Spiegel, Nr. 15 from 7.4.2008

[182] Federal Government 2008c, BT-Drs. 16/11538

[183] Federal Network Agency 2009b

Based on the above-named study and arguments, the following **assumptions are made with respect to the advantage per kilowatt hour based on the possibility of charging excessive electricity prices**:

- From 1990 to present: Tentatively estimated at an average and real 1 cent/kWh. For private households, this was more likely 2-3 cents/kWh during the last few years.
- Exception: 0 cents/kWh in 1999 and 2000, when noticeable decreases in the electricity price occurred due to the emergence of new providers.
- 1970-1989: 0.5 cents/kWh real (in 2008 prices) as a tentative assumption for the advantage from incomplete competition in times of regional monopolies in the electricity market.
- As of 2009: 1 cent/kWh

  As of 2009 one can assume, on the one hand, that the EU-wide liberalisation and national regulations for the electricity market will increasingly successfully hinder excessive electricity prices, and thus no further advantages will exist for electricity producers from then on. On the other hand, actual analyses from 2009[184] show that at that time the competition situation in the electricity market had not yet fundamentally improved, and that there were further strong indications of excessive electricity prices.

  Based on the increases approved by the Federal Network Agency, clearly higher network charges in incentive regulations, and thus higher electricity prices, have been stipulated for the duration of the first regulation period (until 2013).[185] Therefore it should not be expected that the incentive regulations will lead to a decrease in network usage fees in the short-term in their current form, as would occur under normal competition circumstances. The network charges make up almost one-third of the electricity price.

  Added to this is the above-outlined effect, in which already-amortised power plants achieve windfall profits, even when excessive electricity prices are not present, because they can produce electricity at costs lower than the marginal costs fixed by the market.

  All in all, we think the assumption of a financial advantage for nuclear energy from incomplete competition in the electricity market of 1 cent/kWh from 2009 for the remaining running period of nuclear power plants is accurate.

Bearing this assumption in mind, **nuclear energy enjoys the following advantages from incomplete competition in the electricity market**:

184 See infraCOMP 2009, Leprich/Junker 2009, Monopoly Commission 2009

185 Lichtblick 2009 lists the following as actual reasons for the increase in network charges in his analysis:

1. The policy permits the network operators to increase their equity interst rates and therefore permits higher returns. As of 2009 the equity interest rates for network operators approved by the Federal Network Agency in the context of the incentive regulations amounted to 9.29% for new facilities and 7.56% for old facilities (Federal Network Agency 2009, p. 150)
2. The allowed equity rate for network operators lies considerably over the commercially available level.
3. Efficiency standards that are too low in the context of the incentive regulations.
4. The efficiency standards for individual network operators rely on an intransparent comparison of the operators among themselves. Yet, even as of now, no network operator can even approximate being called ideal.
5. The costs for the retrieval of energy losses have increased due to the higher wholesale price level.

Table 20) Overview of the Results:

Actual aid "Aid value of imperfect competition"	Aid until 2008 in billions of Euros	Aid until 2008 in billions of Euros	Aid as of 2009 in billions of Euros
Total	**26.8**	**33.0**	**12.4**

D. External Costs and Liabilities

An estimate of external costs incorporates conceptually e.g. the expected costs resulting from nuclear disaster and the external costs of uranium mining. Thus, external costs and liability are closely interconnected. Liability and financial security are determined by the costs and risks of nuclear disaster. In the case of complete liability, all external costs would be internalised at the same time.

Below, research on external costs is summarised and liability regulations are examined. A brief excursus considers the external costs of uranium mining.

1. External Costs

a) Current Regulations/Actual Aid

External costs are costs that the beneficiary of a service does not carry, but rather, are carried by a third party. In the energy sector, the most relevant external costs result from the emissions of air pollutants and greenhouse gases. For nuclear energy, the risks and costs of a nuclear disaster, of nuclear waste disposal, and of uranium mining are most significant. An explicit internalisation of the external costs of providing energy has not occurred in Germany. At best one could interpret the energy and electricity taxes as instruments of at least partial internalisation.

Many indicators of subsidisation and state aid with subsidy characteristics apply to non-internalised external costs:

- Selectivity and advantages for particular groups
- Distortionary effects on competition, disadvantaging renewable energy providers
- Monetary benefits for the recipient (through lack of internalisation)
- Losses in tax revenue for the state

The deliberate intervention of the state is lacking – although not intervening can also be understood as a deliberate decision.

b) Quantification of the Effect of Aid

The identification and quantification of external costs is very much dependent on the assumptions and methodology used. This especially applies to the external costs from greenhouse gas emissions and nuclear disasters. The estimates of the external costs of nuclear energy range from anywhere between 0.1 cents/kWh to 270 cents/kWh.[186] The varying estimates therefore diverge by a factor of 2,700. For an overview of studies of energy provisions' external costs and their central conclusions see the Green Budget Germany background paper on external costs of energy provision.[187]

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186 See CEPN 2005, EA 2007, EDF 2007, EEA 2008, Committees of Inquiry 1994 and 2002, EU Commission 2001, Ewers/Rennings 1992, Hohmeyer 2002, IER 2005, IER 2009, Moths 1992, NEEDS 2007 and 2009, PROGNOS 1992, PSI 2008, UBA 2007, Ziesing 2003

187 Meyer 2009

We do not believe it is possible to base a method on a best guess from this range of values. The Federal Environment Agency wrote the following for the Convention on External Cost Methods:

"The ranges that have been presented from various assessments are meaningful if one compares the various results of external costs from power plants. While the current ExternE Study has estimated external costs of power plants at 0.2 cents/kwh, the majority of the Committee of Inquiry into Sustainable Energy Provision (2002) acts on the assumption of external costs of up to 200 cents/kWh. The variability of the estimates is attributed to different assumptions applied (for example on discounting) and different qualitative evaluations of damages and risks. To illustrate this: the estimates of the damage from a nuclear fusion disaster in Germany vary from 500 billion Euros (Friedrich 1993, Krewitt 1997) to 5,000 billion Euros (Ewers/Rennings 1992), and the incidence rates lay between 1:33,000 (Ewers/Rennings 1992) to 1:10,000,000 (Krewitt 1997). …
The assumed disaster costs are then displayed in this range, but do not present an adequate foundation, according to today's information, to justify any decisions with it. Decisions about the exposure of such catastrophic risks must ultimately stem from a social and political discourse." (UBA 2007, p. 29)

We see the following plausible possibilities for the containment of this range:

1. The **2 cents/kWh** average indicated as the value of energy provisions' external costs in Germany, according to ExternE 2005, are taken as a basis. A cumulative 84.5 billion Euros in external costs for nuclear energy would already have resulted with a 2 cents/kWh real price, starting in 1950 (or since 1966, the year from which a supply fee for nuclear energy was shown in the energy trade accounts for the first time).

2. The Federal Environment Agency suggests taking the external costs of the "next worst" energy carrier that becomes established during the time it takes for nuclear electricity generation to be phased out in Germany (UBA 2007, p. 30). According to the ExternE study commissioned by the EU Commission, external costs of about **3 cents/kWh** can be expected for coal power plants built in 2010 (IER/Friedrich 2009).[188]

3. A mean value from the whole range of studies of external costs will be used. As illustrated in a Green Budget Germany background paper on external costs of energy provision (see Meyer 2009), one could take, for example, **7.5 cents/kWh** of electricity as a basis. Here 317 billion Euros in external costs would result for nuclear energy from 1950-2008.

4. The value of 0.2 cents/kWh for nuclear energy's external costs from the ExternE study will be used, but it will be applied with the additional risk aversion factor of 100 suggested by the Federal Environment Agency in its Convention on External Cost Methods. This method arrives at an external cost for nuclear energy of **20 cents/kWh**.

5. The current necessary calculated insurance premium will be determined for a measured liability amount. This would proceed as follows:
-Derivation and substantiation of a measured amount of coverage
-Regulation of the insurance premiums necessary for this
-Exchange of the insurance premium for the cost overruns in cents/kWh of nuclear electricity.

IF the 5.500 billion Euros (=8.040 billion Euros in today's prices) damage amount taken as a base by Ewers/Rennings in 1992 is measured for today's values and IF the 13.3 million Euros actual liability premium can be linearly extrapolated for a coverage amount of 265 million

[188] According to the ExternE study, coal power plants existing in Germany in the 2000s cause external costs of 3-6 cents/kWH (EU Commission 2001) so that the use of 3 cents/kWh over a long period of time would be a tentative estimate.

Euros, an insurance of an 8.040 billion Euros damage amount would cost a calculated insurance premium of **262 cents/kWh**. Such insurance would not be available in the market, because the insurance could not handle the claim in the case of damage.

The following table compiles the spectrum of estimates of external costs found in the literature, how high the external costs are in billions of Euros based on the electricity provided by nuclear power plants until the end of 2008, and the amount of electricity to be available from 2009 in line with the currently planned phase-out period.

Table 21) Overview of the Results:

	All Amounts in Billions of Euros	Aid Value 1950-2008 Nominal	Real (2008 Prices)	Aid Value as of 2009
D.	**External Costs**			
	a) Assuming: 0,1 Ct/kWh	3.3	4.2	1.2
	b) Assuming: 1 Ct/kWh	33.3	42.3	12.4
	c) Assuming: 2 Ct/kWh	66.7	84.5	24.8
	d) Assuming: 7,5 Ct/kWh	250.0	317.0	93.1
	e) Assuming: 20 Ct/kWh	666.6	845.4	248.3
	f) Assuming: 270 Ct/kWh	8,999.4	11,413.4	3,351.9

c) Effects and Evaluation of the Provisions

Should the external costs of energy provision be internalised (for example through an emissions-oriented energy tax), this would have serious effects on the competitiveness of individual energy carriers: For one thing, renewable energies as energy carriers would benefit proportionally, as they have the lowest external costs. In addition, the internalisation of external costs would make conservation of energy and efficient technologies more profitable.

2. Liabilities

In Germany nuclear power plant operators must have a compulsory liability cover worth 2.5 billion Euros to cover power plant disasters. 256 million Euros of this is covered by liability insurance, and the premium currently amounts to 13.3 million Euros annually for all 17 nuclear power plants, or 0.008 cents/kWh.[189] The remaining 2.244 billion Euros of this compulsory cover is provided by the German nuclear power plant operators through reciprocal written guarantees.

The following overview shows the resulting cost for alternative liability amounts per kWh of nuclear power, if one linearly extrapolates the current nuclear liability insurance. Such an insurance policy would not be available in the market, because no insurer would be able to raise the funds required in case of a disaster. The risk of a worst case scenario is simply uninsurable, and thus the calculations below reveal the magnitude of favouritism nuclear power plant operators receive through this lack of commercially available liability insurance. It should also be pointed out that, in reality, presumably no linear extrapolation of insurance premiums would be effected; with general theoretical considerations of risk in mind, it is to be expected that the premium would increase disproportionately in relation to the coverage amount.

	Coverage total In Billions of Euros	Liability premium In Millions of Euros	In Euros Ct_{2008} /kWh
Actual insurance premiums 2007	0.256	13.37	0.0084
Premium per billion insured	1	52.2	0.033
Premium for insurance of billions of Euros	10	522.3	0.326
	50	2,611.3	1.632
10% of GDP 2008	249	13,004.4	8.128
Claim total of Ewers/Rennings 1992	5,500	287,246.1	179.5
Ewers/Rennings 1992 in today's prices	8,040	419,901.6	262.4
Moths 1992 in Euros Ct_{2008} /kWh			270.5
Moths 1992 in Euros Ct_{2008} /kWh			184.0

Some suggestions for reading the overview:

For liability insurance to cover costs of 10 billion Euros in, a liability insurance premium of 522.3 million Euros must be paid. Converted to 160 TWh of nuclear power, this would imply a price increase of 0.326 cents/kWh.

For the 5.500 billion Euros amount of damage assumed by Ewers/Rennings in 1992 for a worst case scenario, a liability insurance premium of 287 billion Euros must be paid. Nuclear power would become 179.5 cents/kWh more expensive. The extrapolation of today's insurance premiums therefore yields the same magnitude of nuclear energy costs for full insurance that Moths calculated in 1992, and as was repeatedly used by the 1994 and 2002 Committees of Enquiry.

189 Harbrücker 2007

3. Excursus: External Costs of Uranium Extraction

Conceptually, studies on external costs take the entire process chain of the conversion and use of energy sources. The external costs of uranium mining are an explicit part of the ExternE study series, and therefore do not need to be separately covered again here. Nevertheless some information on the external costs of uranium mining is compiled below.

Current Regulations/Actual Aid

For both **uranium mining in third party countries** and for the **disposal and decontamination of uranium** used in German facilities, but decontaminated in third party countries, external costs can accrue. In both cases, this concerns numerous emissions of radioactive materials through inadequate safety measures, with the corresponding effects on people in the surrounding areas through the ground, air, and groundwater. According to information from the federal government, the countries of origin for German uranium imports since 2003 have primarily been France, Canada, and Great Britain; but smaller amounts also came from the USA, Eritrea, and Russia (see Table 22).[190] Indeed, some information has already become known concerning the external costs of uranium mining in Australia, Niger, Malawi, and Namibia. The spillover effects of 45 million tonnes of radioactive uranium waste that was stored in Niger in the open air are shown in the shocking results of research on the health of miners and the local populations of the Rössing-Mine in Namibia that has been in operation for 40 years, or the ongoing overuse and pollution of the Australian water circulation system. Detrimental effects on the environment and health of residents are documented and significant.[191] Similar effects are also to be observed in Canada, from where uranium is directly exported to Germany.[192]

However, a quantification of the outlined spillover effects is difficult. An approximate value lends itself to calculation through the conversion of decontamination costs from the German Wismut per tonnes of uranium to the amounts of uranium consumed in German nuclear power plants. In this way at least a portion of the costs can be calculated that occurred in the mining lands through the operations of German nuclear power plants.[193] However, the results of such a calculation would not be accurately substantiated and therefore would not be complete. The actual damages, and therefore the costs to the third party countries, are often markedly higher than the damages in Germany were. The extent of neglectful uranium handling varies from country to country. Germany exemplifies how high the costs for decontamination can be. In the mining countries, however, these costs do not

[190] Federal Government 2009a

[191] IPPNW 2009, see also: Bundestag Fraktion the Greens 2009, see also the Federal Association of Citizen's Action Committees for Environmental Protection (Bundesverband Bürgerinitiativen Umweltschutz) 2008

[192] Society for Threatened Peoples 2007

[193] Wismut: Costs per tonne of Uranium: nominal: 5.1 billion €/231,000 tonnes = 0.0220779 million €/tonne; real: 6.1 billion €/231,000 tonnes = 0.0264069 million €/tonne.

Because the amounts of Uranium accumulated since 1950 in German nuclear power plants cannot be determined, the amount of nuclear power produced until now in German nuclear power plants was chosen as a basis for the calculation of Uranium imports. 2003-2007 was chosen as a base time period when the corresponding values were available. Therefore one comes to the following conclusions:

Deconatimation cost extrapolation for 1950-2008 (nominal): 68584.81434 tonnes * 0.0220779 million €/tonne (period: 220779) = 1.51 billion €

Decontamination cost extrapolation for 1950-2008 (real): 68584.81434 tonnes * 0.0264069 million €/tonne (period: 264069) = 1.81 billion €

accumulate in terms of monetary value, but rather mainly in the form of degradation of the ecosystem and the deterioration of health in general. Lower standards and weak regulations inflate these costs, which accumulate in that particular population. The longer such problems drag on, the higher the resulting costs are.

Table 22) Overview of the Countries of Origin for German Nuclear Imports 2003-2007:

Supplier countries of German uranium imports (natural uranium) since 2003[194] (Percentage >5%) are			
2007		France	28.5%
		Canada	25.5%
		Great Britain	24.4%
		USA	11.3%
	3192 t	Eritrea	10.5%
2006		France	51.4%
		Canada	29.5%
		USA	13.2%
	2731 t	Great Britain	5.9%
2005		Canada	45.8%
		Great Britain	32.6%
		France	13%
		Russia	8.7%
	3184 t	USA	0.4%
2004		Canada	46.9%
		Great Britain	25.6%
		Russia	19.2%
	930 t	France	8.2%
2003		Great Britain	34.2%
		USA	26.8%
		Canada	22.7%
	2950 t	France	16.3%

Furthermore, there are other bilateral projects that Germany finances in addition to those to which it contributes through its share of the EU budget, the future costs of which are not yet appreciable. It is equally unclear who will ultimately pay these costs. In this way, the reprocessing facilities Sellafield, in Britain, and La Hague, in France, must be decontaminated. The same applies to the storage of German nuclear waste in Russia. More on La Hague and Sellafield can be found in chapter A.3.2. .

194 Federal Government 2009a

E. Other State Payments in Favour of the Nuclear Sector

1. Police Protection for Nuclear Transport

a) Current Regulations/Actual Aid

The costs of protection for castor transports are completely borne by public actors. The police deployment in connection with castor transports to Gorleben is addressed by the Federal State Government of Lower Saxony in the following answer to an enquiry from the left-wing party *Die Linke*:[195]

"The Federal Republic of Germany fulfils its obligations under international law by accepting radioactive elements returning from reprocessing abroad when it accepts the castor transports. During the implementation of this, protests, blockades, and acts of sabotage regularly occur. The goals of many protesters for this was and is, first, to inflate the costs of police deployment as much as possible, and second, to hinder or stop the castor transports. Because of this, massive protection of the transports through police power is regularly necessary.

The personnel and material costs borne by the police must be attributable to the actions of an individual, so that these costs can be charged to them. In general, the costs of police deployment cannot be allocated to individuals or to a certain group according to jurisprudence. As far as the costs can be attributed to individual saboteurs, the costs – as in other police operations – will be passed on to the saboteurs within the framework of legal regulations.

The necessary large-scale operation by the police and protection costs resulting from the actions of the demonstrators are not attributable to the operators of the interim storage facilities.

The main incidence of this generally occurs in Lower Saxony, especially in the jurisdiction of the Lüneburg police department.

The incidental costs of police deployments, which include the additional costs incurred due to the use of police power from other federal states for the deployment, are covered by Lower Saxony. Efforts to make other federal states share in paying, at least partially, for the required additional costs, have, as of yet, had no success: Since 2001 the federal government has not charged for the additional costs required for deployment that accumulate for the implied powers of the federal police force."

b) Quantification of the Effect of Aid

We have compiled Lower Saxony's expenditures for police protection of castor transports to Gorleben through news reports; no or very incomplete information is available to us on the expenditures for federal police force deployment, and on costs incurred in North-Rhine Westfalia for transports to Ahaus (and, where applicable, expenditures from other federal states). In total, public expenditures up until now for police protection of nuclear transports worth 345 million Euros can be documented.

The first castor transport took place in 1995. A complete timeline of Lower Saxony's expenditures for nuclear transport protection is available. It does not include the costs borne by the federal gov-

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[195] Lower Saxony Landtag 2009: Drs. 16/1167

ernment. According to information from the Lower Saxony Landtag (parliament), "the payments reported for transports in 1995, 1996, and 1997 are not comparable with those of the following years, because not only were the required additional expenses from deployment considered in a cost calculation, but so were the continuous costs (for example personnel costs) in a microeconomic inclusion."[196] A retroactive itemisation is impossible. This mean the costs in the first three years of the timeline are actually higher than what is reported by Lower Saxony. The values for 2008 partially included projected values. Since 2003, costs to Lower Saxony have been itemised according to the following categories: reimbursements to other countries, additional personnel expenses, properties/buildings, planning, management tools and operating resources, subsistence, business needs, and other.

Until April 1997, about 18.5 million Euros from the federal budget was spent for the Federal Border Guard's protection of castor transports.[197] The federal government spent 26,000 Euros in additional costs for the federal police force's support in castor deployment in 2006.[198]

For the transport of nuclear fuel elements from Rheinsburg to the Lubmin interim storage facility in 2001, the security authorities in Brandenburg prepared for large protests, and spent 15 million DM, or 7.5 million Euros, on the protection of the transport by the federal state police.[199] The protests largely failed to appear.

Costs to federal government from 1997, and the costs to the federal state of North-Rhine Westfalia were not systematically ascertainable within the framework of this investigation. Further costs of note in this chapter are police deployment costs for large demonstrations, particularly in the past at controversial nuclear sites during the planning and construction phases, such as in Wyhl, Kalkar, Brokdorf, Grohnde, and Gorleben. These costs are very difficult to ascertain, because they occurred in disparate times and places and are not separately included in budget plans.

Table 23) Overview of the Results:

Regional Authority	Provisions until 2008 in billions of Euros nominal	Provisions until 2008 in billions of Euros real	Provisions as of 2009 in billions of Euros nominal
Federal (until 1977)	0.0185		
Brandenburg	0.0075		
Lower Saxony	0.3265		
North Rhine Westphalia	?		
Total	**0.345**	**0.4**	No data

c) Effects and Evaluation of the Provisions

Police costs are generally not charged to the initiators, not even for large police deployments for sport or cultural events or other demonstrations. Because of this, we did not consider this point in the calculation of total public aid to nuclear energy. One could also classify the costs of police protection of nuclear transports and of large anti-nuclear-power-plant demonstrations to be "costs of

196 Lower Saxony Landtag 2009: Drs: 16/1167

197 Federal Government 1997: BT-Drs. 13/7248

198 Federal Government 2006b

199 Liebsch 2009, p. 147

democracy". However, it should not remain unmentioned that the state tried repeatedly to enforce "demonstration costs" on demonstrators in the form of fees in court, for example for the clearing of sit-in demonstrations.

In addition to specific aids to the nuclear industry, one would have to consider the argument that the particularly high risks and costs and the heated societal controversy resulting from this necessitates particularly intensive police protection. Should nuclear power plant operators have to bear the police costs, nuclear power would become correspondingly more expensive.

2. National Nuclear Administration Costs

a) Current Regulations/Actual Aid

Licensing and inspection costs are borne by the operators. This is laid down in the Nuclear Energy Cost Regulation (Atomrechtliche Kostenverordnung).[200] There, the following investigative tasks which are liable to incur fees are listed:

1. According to Articles 6 and 9 of the Nuclear Law, measurements and analyses for inspection
   - of the dissipation and proliferation of radioactive substances,
   - of operating conditions relevant for the detection of a disturbance,
   - of radioactivity in the vicinity including meteorological propagation ratios

   through governmentally authorised monitoring stations or through government agency surveillance facilities; the cost obligation also encompasses the transmission and analysis of test and inspection results;

2. Testing of alterations to facilities which do not require a licence according to Article 7 of the Nuclear Law, or changes to operations according to Articles 4, 6, and 9 of the Nuclear Law;

3. Measures by the regulating authority based on significant safety-related discrepancies in the normal operation of facilities according to Article 7 of the Nuclear Law, or discrepancies in operations according to Articles 4, 6, and 9 of the Nuclear Law;

4. Checking the results of safety inspections in accordance with Article 19a of the Nuclear Law;

5. Recurrent testing of facilities in accordance with Article 7 of the Nuclear Law, or testing of operations in accordance with Articles 6 and 9 of the Nuclear Law;

6. Other inspections and controls of facilities in accordance with Article 7 of the Nuclear Law, and inspections and controls of operations in accordance with Articles 4, 6, and 9 of the Nuclear Law, as far as the involvement of experts is required;

7. Inspection, in accordance with Article 12 b of the Nuclear Law, regarding the reliability of people who are employed in the construction and operation of facilities, in accordance with

[200] Federal Ministry of Justice 2009

Article 7 of the Nuclear Law, or people who are employed in operations, in accordance with Articles 4, 6, and 9 of the Nuclear Law;

8. Inspection of compliance with standards for the protection of flying personnel from exposure to cosmic radiation required by Article 103 in connection with Articles 93 and 94 of the Radiation Protection Ordinance.

The following is quoted from the Nuclear Energy Cost Regulation (Atomrechtliche Kostenverordnung), Article 5, Costs of Inspection:

Paragraph 2: The fees amount to between 25 and 500,000 Euros, for inspections based on paragraph 1, Number 6, 25 to 500 Euros for every person inspected.

Paragraph 3: The fee obligation accrues with the completion of the fee incurring agency operations in the case of paragraph 1, Number 1 at the end of the month in which measurements and inspections have been undertaken. For regularly recurring operations on the part of the authorities, deductions can be imposed notwithstanding paragraph 1, which are to be charged in accordance with the following determination of charges.

Paragraph 4: Lump sum fees can be established for the compensation of multiple similar agency operations in accordance with paragraph 1, Numbers 1 through 7.

b) Quantification of the Effect of Aid

The incomes and expenditures from the **Federal Agency for Radiation Protection's** 2008 budget for nuclear energy yielded a negative balance of almost 33 million Euros, and for 2009, this figure amounted to circa 35 million Euros. In total, the Federal Agency for Radiation Protection's budgets for 2001 through 2009 yielded a negative balance of circa 294 million Euros. Because it is only possible to perform a limited breakdown of the budget plan, particularly for expenditures regarding fees, this expense segment is a little uncertain. Expenditures clearly not associated with the nuclear sector, like, for example, those for the measurement of UV radiation, were not considered in this calculation. Likewise, the provisional benefits for final storage repositories were not considered here.

Because the costs of nuclear administration to **federal states'** budget plans are cannot even be gathered separately for individual years – and certainly not along a timeline – they must be deliberately calculated in cooperation with state administrations. To do this, the nuclear administration workforce would have to be included and their salaries weighted in to the calculation. A corresponding willingness to provide information from the participating state administrations is an essential requirement for such a calculation. Individual declarations could be extracted from the federal state budget: for Baden-Württemberg, nuclear administration expenditures and revenues could be extracted from the budgets, and yielded a negative balance of circa 530.8 million Euros from 2002 to 2009. In 2008, Bavaria spent 1.7 million Euros in this area and plans to spend a further 1.4 million Euros in 2009. There is no information on revenues in this area of the Bavarian federal state budget, as is also the case with many other federal state budgets.

By way of example, we can estimate the magnitude of the funding gap by referring to the Schleswig-Holstein state budget: In Schleswig-Holstein, around 1.5 million Euros per year in fees was earned in the last few years from the inspection of three nuclear power plants. The nuclear department employs 41 workers,[201] of which 16 are in higher office and 25 are in the upper or middle grades of the civil service. Assessed with the current amounts for the "measurement of fees according to the expenditure of time in the state sector"[202], one can estimate the personnel costs (including the maintenance premium, employee benefit costs, premiums for temporary staff and other fixed personnel costs) at about 5.6 million Euros per year. Thus personnel expenditures alone are higher than the fee revenues by a factor of 3.6.

All in all, strong indications point to the fact that the nuclear **administration fees** (similar to those from the Federal Agency for Radiation Protection) are also **not cost-covering** in the federal states, among other things because they have additional functions aside from those activities for which fees are charged. For instance, routine inspections are not charged for. This is not unique to nuclear administration, but rather customary in facility authorisation regulation.

c) Effects and Evaluation of the Provisions

A conclusion as to whether non-cost-covering fees for the activities of nuclear administration result in a specific advantage can only be reached if, for one thing, the magnitude of the funding gap can be systematically calculated and, for another, if a comparison with the level of cost coverage in other official authorisation processes could be undertaken (for example from industrial facilities from other sectors).

3. Costs of Developing and Maintaining a Regulatory and/or Parastatal Infrastructure

The creation of institutions in the nuclear sector was partially paid for using state funds (see the data sheets in the appendix on institutions in the nuclear sector). However, in the majority of the 32 investigated organisations, authorities, or working groups, these are state entities whose public aid was already recorded in other sections. One example is the research centres, today consolidated into the Helmholtz Association of German Research Centres, such as the research centres Jülich and Karlsruhe. Research or working groups, on the other hand, were previously established for limited periods of time, controlled by a ministry and financed through its budget, such as the Committee on a Site Selection Procedure for Repository Sites (Arbeitskreis Auswahlverfahren Endlagerstandorte – AkEnd), which was active from 1999 to 2002. The AkEnd was a forum of experts whose task was to debate the issue of finding "scientifically-based criteria for the search of a repository site in Germany".[203] Whether AkEnd should be viewed as a part of the search for a suitable repository for nuclear waste merits consideration – for if so, there is an argument that it should be co-financed by the energy providers in the context of funds set aside to pay for a repository.

A further obstacle to producing an exact breakdown of costs is presented by the frequently-changing areas of work and renamings over the years. The Federal Ministry for Atomic Issues, for one, was founded in 1955, and by 1957 it was already renamed the Federal Ministry for Nuclear

[201] In addition, on the one hand, there are some unoccupied positions and, on the other, it is to be expected that some employees work part-time. Because no more precise information is available for these two points, these factors are removed for the rough estimate undertaken here.

[202] Here the current hourly rate is 77 € for higher service, 59 € for the upper grades of the civil service, and 49 € for the middle grades of the civil service are estimated.

[203] BFS 2008b

Energy and Water Management, and accordingly had two main tasks yet one common budget, not completely allocated to the development of the nuclear industry.

Finally, companies who were financed and equipped by the industry are included in the list. In order to identify and quantify the public support they received, access to their annual reports would be necessary. Legal difficulties and the amount of time that has passed result in major difficulties in this case; for example, the commercial retention period for annual reports is only 10 years.[204] Without being able to demonstrate this in every individual case, we surmise that public expenditures for the above-named facilities – in particular insofar as they are related to the development, protection, or dismantling of nuclear facilities – have already been covered in other chapters of this study. In addition, in view of the small quantitative significance of the budgets of these public institutions, we have generally not covered public instances of aid. The data sheets can be found in appendix I.

All in all, it is to be concluded that, at the time, the state was very interested in the realisation of nuclear projects, as demonstrated by its active role in the development of the sector and the very generous attitude of public actors. A good example of this would be the German Atomic Energy Commission, which operated between 1956 and 1971. It was supposed to advise the Federal Ministry for Atomic Issues (renamed the Federal Ministry for Nuclear Energy and Water Management in 1957) on all important matters that had to do with the research and use of nuclear energy for peaceful purposes. According to Radkau, the German Atomic Energy Commission was responsible for directing the substance of German atomic policy.[205] This included decisions regarding the type and amount of subsidies.[206] This should be viewed critically, particularly in view of the fact that the German Atomic Energy Commission was dominated by private actors from big business.[207]

4. Costs of Catastrophe Protection Regarding Risks of Nuclear Disaster

A further cost that is difficult to quantify, but should not remain unmentioned, is the necessity to maintain an appropriate infrastructure for protection in case of nuclear catastrophe, due to the high operational risks associated with nuclear facilities. The requirement to have special equipment and qualified personnel on hand for nuclear catastrophes is cost-intensive. This holds true for the fire department, hospitals, and the German Federal Agency for Technical Relief.

[204] cf. Federal Government 2009b Drs. 16/12532

[205] Radkau 1983, p. 40

[206] Radaku 1983, p. 43

[207] Radkau 1983, p. 41

APPENDIX I: ORGANISATION PROFILES

1. Arbeitskreis Auswahlverfahren Endlagerstandorte (AkEnd) (Committee on a Site Selection Procedure for Repository Sites)

www.akend.de

a) Established:

February 1999 to December 2002[208]

b) Function:

"Our goal is to develop a process and determine criteria to search for and select the best possible sites for the final storage of radioactive waste, according to the principles of safety, acceptance and application of resources."

c) Supporting organisations / holdings :

BMU (German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety)

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable.

Not specified.

2. Arbeitskreis zur Koordinierung der Forschungsarbeiten der GSF und GfK auf dem Gebiet der Tieflagerung radioaktiver Rückstände (AkoTL) (Working Group for the coordination of research by GSF and GfK in the field of radioactive residue deep storage, AkoTL)

No information available.

[208] Auswahlverfahren für Endlagerstandorte Dezember 2002, www.bmu.de/files/pdfs/allgemein/application/pdf/akend_bericht.pdf

3. Bundesamt für Strahlenschutz (German Federal Office for Radiation Protection)

http://www.bfs.de

a) Established:

1989

b) Function:

The BfS works to ensure the safety and protection of people and the environment from the harmful effects of ionizing and non-ionizing radiation. Examples related to ionizing radiation include medical applications of X-Ray diagnostics, safety in working with radioactive materials in nuclear technology, and protection from increased levels of natural radiation.

c) Supporting organisations / holdings:

Federal Government (BMU - German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety)

d) Budget

Target budget 2008: Total revenue 93m Euro / Total expenditure 196m Euro.[209] These values include the total expenditure and income of the federal government for the BMU/BfS.

e) Sources of funding, including proportion of public funding, where applicable

See supporting organisations, above

[209] BMF 2009: Bundeshaushaltsplan (Federal Budget) 2009, Tgr 16, Chapter 1607, http://www.bundesfinanzministerium.de/bundeshaushalt2009/pdf/epl16.pdf

4. Bundesministerium für Atomfragen bzw. für Atomkernenergie und Wasserwirtschaft (BMAt) (German Federal Ministry for Atomic Issues, Nuclear Energy and Water Management)

Precursor organisation of the BMBF

a) Established:

1955

1957 Renamed Bundesministerium für Atomkernenergie und Wasserwirtschaft (German Federal Ministry for Atomic Energy and Water Management)

from 1962 Bundesministerium für Wissenschaftliche Forschung (German Federal Ministry for Scientific Research)

from 1969 Bundesministerium für Bildung und Wissenschaft (German Federal Ministry for Education and Science)

from 1972 two ministries: Bundesministerium für Forschung und Technologie (BMFT) ((German Federal Ministry for Research and Technology) and Bundesministerium für Bildung und Wissenschaft (BMBW) (German Federal Ministry for Education and Science)

from 1994 BMBF (Federal Ministry of Education and Research)

b) Function:

National nuclear research program, also scientific/military issues.

c) Supporting organisations / holdings:

Federal government

d) Budget

Nuclear-related expenditures are listed under Research Programs (see paragraph III.A.1)

e) Sources of funding, including proportion of public funding, where applicable

Federal budget

5. Deutsches Atomforum e. V. (DAtF) (German Atomic Forum)

http://www.kernenergie.de/kernenergie/

a) Established:

1959

b) Function:

To support the peaceful use of atomic energy in Germany. According to its charter, the organisation is exclusively and directly concerned with non-profit making objectives, as described in the paragraph on "tax-deductible purposes" of the Tax Code. Furthermore, it should act altruistically and does not primarily pursue its own economic interests.[210]

c) Supporting organisations / holdings:

Members (companies from industry and business, research institutions, organisations and individuals)

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

Not specified.

210 Kernenergie (2009): Satzung des Deutschen Atomforums e. V., http://www.kernenergie.de/kernenergie/Ueber-uns/DAtF/Satzung/ , §3

6. Deutsche Atomkommission (DAtK) (German Atomic Commission)

http://www.ssk.de/vorstell/geschi.htm

a) Established:

1956-1971

b) Function:

To advise the Federal Ministry for Atomic Issues (as of 1957 the Federal Ministry for Atomic Energy and Water Management) on all significant matters concerning the research and utilisation of atomic energy for peaceful purposes. According to Radkau, the DAtK was responsible for directing the substance of German nuclear policy.[211] This included making decisions on the nature and extent of subsidies. [212] This should be viewed critically, particularly in view of the fact that the German Atomic Energy Commission was dominated by private actors from big business.[213]

c) Supporting organisations / holdings

Federal Government (set up by the federal government with the objective of advising the Bundesministerium für Atomfragen (Federal Ministry for Atomic Issues).

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

Not specified.

[211] Radkau 1983, S. 40

[212] Radkau 1983, S. 43

[213] Radkau 1983, S. 41

7. Deutsche Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen (DWK) (German Association for Nuclear Fuel Reprocessing)

a) Established:

1979-1989

b) Function:

Development and construction of a reprocessing infrastructure.

c) Supporting organisations / holdings:

Nuclear power plant operators (E.ON, EnBW, RWE und Vattenfall)

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable.

Power plant operators.

8. Deutsche Gesellschaft zum Bau und Betrieb von Endlagern für Abfallstoffe (DBE) (German Company for the Construction and Operation of Waste Repositories)

www.dbe.de

a) Established:

1979

b) Function:

In accordance with §9a, section 3, of the German Atomic Energy Act, the Federal Republic of Germany, represented by the Federal Office for Radiation Protection (BfS), Salzgitter, commissioned the German Company for the Construction and Operation of Waste Repositories, (DBE), as a third party to design, construct and operate the federal repositories for radioactive waste.

c) Supporting organisations / holdings:

Initially the German state, then privatised during the 1980s and sold to electricity companies.[214]
The BfS is the main contractor.

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

The federal government has made non-redeemable contracts, has committed to bearing all costs, and on top of this, guarantees the DBE a profit.[215]

94 million Euros in 2007 from the BfS

214 http://www.udo-leuschner.de/energie-chronik/081112.htm

215 http://www.udo-leuschner.de/energie-chronik/081112.htm

9. Entwicklungsgemeinschaft Tieflagerung (EGT) (Development Association for Underground Storage)

a) Established:

1977 along with the Gesellschaft für Strahlen- und Umweltforschung (GSF) Neuherberg (Association for Research into Radiation and the Environment)

b) Function:

c) Supporting organisations / holdings:

(Very probably German state)

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

10. Gesellschaft für Strahlenforschung (GSF) (Association for Radiation Research)

http://www.helmholtz-muenchen.de/neu/Wir_ueber_uns/Geschichte/index.php

a) Established:

1960, renamed in 2008 as „Helmholtz Zentrum München - Deutsches Forschungszentrum für Gesundheit und Umwelt (HMGU)“ (Helmholz Centre Munich – German Research Centre for Health and the Environment)

b) Function:

Original function: research into radiation and training in radiation protection. Nowadays much broader sphere of operation, including research for the German Human Genome Project.

c) Supporting organisations / holdings:

BMBF

d) Budget

2005: 82m[216]

e) Sources of funding, including proportion of public funding, where applicable

No information available.

216 According to Federal Budget (Bundeshaushaltsplan) 2007

11. Gesellschaft zur Wiederaufarbeitung von Kernbrennstoffen (GWK) (Association for the Reprocessing of Nuclear Fuels)

a) Established:

1964-1979 (then handed over to the DWK, the daughter organisation of the EVU)

b) Function:

Planning, construction and operation of the reprocessing facility at Karlsruhe (WAK)

c) Supporting organisations / holdings:

Founder: Hoechst AG (50%), NUKEM (25%), Gelsenberg AG (25%), in 1967 half of the Hoechst shares went to Bayer; 1979 taken over by EVU (RWE und Veba)[217]

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

217 Bundesregierung 2009: Antwort auf die Kleine Anfrage der Fraktion Bündnis 90/Die Grünen, Rolle der Wiederaufarbeitungsanlage Karlsruhe bei der Herkunft des radioaktiven Inventars im Atommülllager Asse II, BT-Drs. 16/12532, Anfrage vom 26.03.2009

12. Gesellschaft für Kernenergieverwertung in Schiffbau und Schifffahrt mbH (GKSS) (Company for the Commercial Exploitation of Nuclear energy in Ship Building and Shipping)

http://www.gkss.de

a) Established:

1956 (Precursor of KEST, Studiengesellschaft für Kernenergieverwertung in Schifffahrt und Industrie e.V., founded in 1955)

b) Function:

Construction of the FRG-1 research reactor at Geesthacht and the nuclear propulsion system for civilian shipping, developed by GKSS

c) Supporting organisations / holdings:

Financed by the German state / BMBF within the framework of the Helmholtz-Gesellschaft

d) Budget

60 Mio. from the BMBF (2007[218]). In accordance with the breakdown of information under e) below, the total budget for 2007 was approximately 95m Euro.

e) Sources of funding, including proportion of public funding, where applicable

Around 70 per cent of funding for the Helmholtz-Zentren is borne by the German state (90%) and Länder (10%), 30 per cent are so-called third-party funds.[219]

[218] According to Federal Budget (Bundeshaushaltsplan) 2009

[219] BMBF: http://www.bmbf.de/de/238.php

13. Hahn-Meitner-Institut für Kernforschung Berlin (HMI) (Hahn-Meitner Institute for Nuclear Research Berlin)

http://www.bmbf.de/de/10683.php

a) Established:

1959

b) Function:

Nuclear research centre

c) Supporting organisations / holdings:

BMBF (within the framework of support for the Helmholtz-Gemeinschaft: Federal Government 90%, State of Berlin 10%)

d) Budget

Approx. 75m Euro[220]

e) Sources of funding, including proportion of public funding, where applicable

Around 70% of the funding for the Helmholtz Centres is borne by the German federal government (90%) and Länder (10%), the remaining 30% are covered by third-party funds.[221]

220 BMBF, http://www.bmbf.de/de/10683.php

221 BMBF, http://www.bmbf.de/de/238.php

14. International Atomic Energy Agency (IAEA)

http://www.iaea.org/

a) Established:

The IAEA was established on 29 July 1957 under the auspices of the "Atoms for Peace" programme, at the UN offices in New York, with its administrative headquarters in the UNO-City in Vienna, Austria. Regional offices are located in Geneva, Swizerland; New York, USA; toronto, Canada; and Tokio, Japan.

b) Function:

The safe and peaceful utilisation of nuclear energy and nuclear technology, proliferation issues

c) Supporting organisations / holdings:

146 countries are currently members of the IAEA. Further details are available here: http://www.iaea.org/About/Policy/MemberStates/

d) Budget

2007: 283m Euro[222]; a target has been set to raise an additional 57m Euro of funding for the technical cooperation fund

2009: 293.7m Euro[223]; a target has been set to raise around an additional 60 Mio. Euro of funding for "technical cooperation"

e) Sources of funding, including proportion of public funding, where applicable

In the 2009 federal budget, 29,593 Mio. Euro have been allocated, which amounts to over 10% of the budget.

222 http://www.iaea.org/About/index.html

223 http://www.iaea.org/About/budget.html

15. Institut für Tieflagerung (IfT) (Institute for Underground Storage)

Institute at the GSF

a) Established:

1965[224]

b) Function:

Operation and research in the Asse Nuclear Waste Storage Facility

c) Supporting organisations / holdings:

GSF (ultimately also the Federal Government)

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

[224] www.fzk.de/fzk/idcplg?IdcService=FZK_NATIVE&dDocName=ID_067979

16. Kernreaktor-Finanzierungs-Gesellschaft mbH (Nuclear Reactor Funding Association)

a) Established:

1956

b) Function:

Development of nuclear reactors, operation of nuclear reactor centres, later responsible for the Karlsruhe research centre.
The intended goal of the organisation was investment in the Karlsruhe research centre. As it became evident that actual costs exceeded the planned costs, the organisation left the project and handed over its interests to the German state free of charge in 1963.[225]

c) Supporting organisations / holdings:

at inception: 65 commercial enterprises later expanded to 100 enterprises[226]

d) Budget

Initial investment at inception 15 million, later 20 million DM

e) Sources of funding, including proportion of public funding, where applicable

Founding businesses

225 http://www.ipp.mpg.de/ippcms/de/pr/publikationen/.../1_Forschungspoli_Umfeld.pdf

226 http://www.ipp.mpg.de/ippcms/de/pr/publikationen/.../1_Forschungspoli_Umfeld.pdf

17. Kernreaktor Bau- und Betriebsgesellschaft mbH (Reactor Construction and Operation Society)

Precursor of the Kernforschungszentrum Karlsruhe GmbH (KfK) (Nuclear Research Centre Karlsruhe)

a) Established:

1956

b) Function:

Development of nuclear energy (research reactor 2 and prototype breeder reactor)

c) Supporting organisations / holdings:

90 per cent German state, 10 per cent federal state of Baden-Württemberg

d) Budget (current, also cumulative for select previous years, as far as possible)

No information available.

e) Sources of funding, including proportion of public funding, where applicable

2007: 295m[227] from BMBF /support of the Helmholtz-Zentren

[227] BMF 2007. Bundeshaushaltsplan 2007. Tgr 30, Kap. 07 Tgr. 13, http://www.bundesfinanzministerium.de/bundeshaushalt2007/html/ep30/ep30kp07perszuw.html

18. Kernbrennstoffwiederaufarbeitungsgesellschaft (KEWA) (Nuclear Fuel Reprocessing Company)

Very little useful information for analysis

a) Established:

? was taken over in 1977 by the DWK (previously PWK)

b) Function:

No information available.

c) Supporting organisations / holdings:

1975 in equal shares Hoechst, Bayer, Nukem, Gelsenberg.

Owners of the DWK: “EnBW 12%, Bayernwerk Konzern 18%, HEW 7,5%, NWS 7%, VEW 5,5% RWE Energie 25,5%, PreussenElektra has a 24,5% share via the Norddeutsche Gesellschaft zur Beratung und Durchführung von Entsorgungsaufgaben bei KKW mbH (NGB).“[228]

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

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228 Forschungsstelle für Umweltpolitik 1999, FFU-Report 99-6, Lutz Mez, Annette Piening, Mirjam Müller: Ansatzpunkte für eine Kampagne zum Atomausstieg in Deutschland, http://web.fu-berlin.de/ffu/download/Rep-99-6.PDF

19. Kernforschungsanlage Jülich (KFA)

http://www.fz-juelich.de/portal/

a) Established:

1960, evolved out of the „Gesellschaft zur Förderung der kernphysikalischen Forschung (GFKF)“ (Association for the promotion of Nuclear Physics Research), which in turn was established in 1953.

1967 Became a limited company GmbH, Gesellschafter Bund (90%) and Land NRW (10%)

b) Function:

Nuclear research, research reactors Merlin and Dido, later pebble-bed reactor (AVR)

c) Supporting organisations / holdings:

Bund (90%), Land NRW (10%)

d) Budget

Budget 2007: 436m Euro[229] (The research reactors were shut down in 1985 and 2006 respectively and are being decommissioned.)

e) Sources of funding, including proportion of public funding, where applicable

BMBF 2007: 262m Euro (from support for Helmholtz-Zentren)

229 http://www.fz-juelich.de/portal/ueber_uns/zahlen_fakten

20. Kernforschungszentrum Karlsruhe (KfK) / Gesellschaft für Kernforschung (GfK) (Karlsruhe Nuclear Research Centre / Society for Nuclear Research)

www.fzk.de

a) Established:

1959 (GfK)[230], renamed Kernforschungszentrum Karlsruhe GmbH (KfK) in 1978

b) Function:

Main brief is the research and use of nuclear energy for peaceful purposes. The scope of activities is increasingly being extended into non-nuclear fields of research.

c) Supporting organisations / holdings:

Federal government 75 % / Land Baden-Württemberg 25%; legal successor FZK: Federal Republic of Germany (90%), Land Baden Württemberg (10%)

d) Budget

2005 (FZK):

In the area of research (including non-nuclear): 317m Euro, of which 70m is own income.
In the area of decommissioning of nuclear facilities (not including Wiederaufarbeitungsanlage Karlsruhe GmbH (Karlsruhe reprocessing plant) 73m Euro, of which 21m is own income.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

230 http://www.fzk.de/fzk/idcplg?IdcService=FZK&node=4228

21. Kerntechnische Gesellschaft (KTG) (Society for Nuclear Technology)

www.ktg.org

a) Established:

1969, known as “Kerntechnische Gesellschaft e.V." (KTG) since 1978

b) Supporting organisations / holdings:

Founded on the initiative of the German Atomic Forum

c) Budget

2008: 216.000 Euro[231]

d) Sources of funding, including proportion of public funding, where applicable

No information available.

[231] Tätigkeitsbericht KTG 2008: http://www.ktg.org/documentpool/ktg/ktg-jb2008.pdf

22. Kraftwerk Union AG (KWU) (Power Plant Union)

http://w4.siemens.de/archiv/de/beteiligungen/kwu_tu.html

a) Established:

1969

b) Function:

Development and manufacture of conventional and nuclear power stations.

c) Supporting organisations / holdings:

Siemens, AEG; went over to Siemens completely in the "AEG crisis" of 1977, where it was incorporated into the energy management section.

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

Businesses

23. Nuclear Energy Agency

http://www.nea.fr/

a) Established:

Renamed in 1972, previously (since 1958) known as the European Nuclear Energy Agency

b) Function:

To promote a safe, environmentally friendly and economical use of atomic energy.

c) Supporting organisations / holdings:

OECD

d) Budget

10,4m Euro Secretariat, 3,0m Euro Database (+ revenue of research projects e.g. Halden Reactor Project = 15m Euro per year over 50 years)

e) Sources of funding, including proportion of public funding, where applicable

No information available.

24. Projekt Sicherheitsstudien Entsorgung (PSE) (Safety Studies Waste Disposal)

Project at the HMI

a) Established:

b) Function:

c) Supporting organisations / holdings:

Funded by and carried out by order of the Bundesministerium für Forschung und Technologie (German Federal Ministry for Research and Technology).[232]

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

[232] Bundesregierung 1983: Antwort auf die Kleine Anfrage der Fraktion Die Grünen, Bt.Drs. 10/251, 14.07.1983

25. Physikalisch-Technische Bundesanstalt (PTB) (Federal Institute of Physical and Technical Affairs)

www.ptb.de

a) Established:

1887 as the Physikalisch-Technische Reichsanstalt

b) Function:

Since the PTB to a large degree also carries out work on standardisation, testing of toys etc., it is difficult to give a complete and clear description of the support it receives relevant to nuclear.

c) Supporting organisations / holdings:

No information available.

d) Budget

2005: 133m Euro

2006: 130,5m Euro

2007: 132,9m Euro[233]

e) Sources of funding, including proportion of public funding, where applicable

Fees: 2005 = 8,9m Euro; 2006 = 9,8m Euro; 2007 = 10,5m Euro

Third-party funds: 2007 = 7,4m Euro

Various German Federal Ministries, e.g. Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development).
Government support was made available; however, the precise level of funding for nuclear research is not apparent from the available documentation.

233 http://www.ptb.de/de/publikationen/jahresberichte/jb2007/zahlen_fakten/zuf.pdf

26. Reaktorsicherheitskommission (RSK) (Reactor Safety Commission)

www.rskonline.de

a) Established:

1958

b) Function:

The RSK advises the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in safety-related matters and thus matters concerning the physical protection of nuclear installations and radioactive waste management.

c) Supporting organisations / holdings:

According to responsibility for the safety of nuclear installations and radiation protection:

1958-1962: Bundesministerium für Atomkernenergie und Wasserwirtschaft (Federal Ministry for Atomic Energy and Water Management)

1962-1969: Bundesministerium für wissenschaftliche Forschung (German Federal Ministry for Scientific Research)

1969-1972: Bundesministerium für Bildung und Wissenschaft (German Federal Ministry for Education and Science)

1972-1986: Bundesministerium des Inneren (The German Federal Ministry of the Interior)

1986-heute: Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (German Federal Minsitry for the Environment, Nature Conservation and Nuclear Safety)

d) Budget

Along with the SSK (Radiation Protection Commission) and ESK (Waste Management Commission) reportedly 2008: 45m Euro.[234]

e) Sources of funding, including proportion of public funding, where applicable

BMU (German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety)

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[234] BMF 2009. Bundeshaushaltsplan 2009, Chapter 1604, Reaktorsicherheit und Strahlenschutz, http://www.bundesfinanzministerium.de/bundeshaushalt2009/pdf/epl16.pdf

27. Strahlenschutzkommission (Commission on Radiological Protection)

www.ssk.de

a) Established:

1974 (Successor of the „Fachkommission IV Strahlenschutz“ in the Atomkommission, founded in 1956)

b) Function:

The Commission on Radiological Protection advises the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) on issues involving protection against dangers of ionising and non-ionising radiation.

c) Supporting organisations / holdings:

see Reaktorsicherheitskommission (Reactor Safety Commission) (also d-f)

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

28. United Reprocessors GmbH (URG)

a) Established:

1971

b) Function

Operation of reprocessing facilities.

c) Supporting organisations / holdings:

British BNFL, French Cogema, West German KEWA (now DWK)

"At the time, the British BNFL, the French COGEMA and the West German KEWA - now DWK – founded the tri-national United Reprocessors GmbH with the goal of avoiding "ruinous competition for the reprocessing of nuclear fuel." In the context of the campaign, it should be noted that all parties concerned, including the Germans, profit from this enterprise. COGEMA and BNFL also profit directly from the reprocessing. The German nuclear industry meanwhile enjoys the opportunity of being able to set aside provisions (funds set aside for future waste management) and pass on the costs to electricity consumers."[235]

Consequently, it is not accurate to speak of government support, but rather of dubious cartelisation, which disadvantaged electricity consumers.

d) Budget

No information available.

e) Sources of funding, including proportion of public funding, where applicable

No information available.

235 Forschungsstelle für Umweltpolitik 1999, FFU-Report 99-6, Lutz Mez, Annette Piening, Mirjam Müller: Ansatzpunkte für eine Kampagne zum Atomausstieg in Deutschland, http://web.fu-berlin.de/ffu/download/Rep-99-6.PDF

29. Wiederaufarbeitungsanlage Karlsruhe (WAK) (Karlsruhe Reprocessing Plant)

http://www.wak-gmbh.de/

a) Established:

1967. In 1979 the WAK BgmbH becomes a subsidiary of the DWK; from 1991-2005 it existed as the WAK Betriebsgesellschaft mbH (Decommissioning/dismantling). Since 2006, the federal government-owned Energiewerke Nord GmbH (EWN) has taken over the WAK.

b) Function:

Designing and constructing the reprocessing plant.

c) Supporting organisations / holdings:

Forschungszentrum Karlsruhe (Karlsruhe research centre) / federal government

d) Budget

Operating costs ? / cost of dismantling approx. 2,6bn (2007 prices)[236]

e) Sources of funding, including proportion of public funding, where applicable

The total dismantling costs are split between the federal government (approx. 55%), the federal state of Baden-Württemberg (approx.5%), and industry (approx. 40%).

236 http://www.wak-gmbh.de/ewngruppe/wak/das-unternehmen/kostentermine.html

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http://www.auswaertiges-amt.de/diplo/de/Aussenpolitik/Weltwirtschaft/ForschungTechnologie/Fusionsforschung.html;
Further information (in German) on ITER and the (entirely public) financing of the international research facility is available at http://www.ipp.mpg.de/ippcms/de/presse/pi/14_07_pi.html
Since this text on the founding of the international ITER-Organisation was published, a Design Review (http://www.ipp.mpg.de/ippcms/de/news/aktuell/iter_ic2.html) resulted in some changes to the installation design and estimated costs.

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