

# Environmental Report 1998

As a large corporation, aiming at satisfying the basic human demands, RWE has a particular responsibility to support the concept of sustainable development.





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## Foreword by the Chairman of the Board.

Within the goals and guidelines of the RWE Group, we have committed ourselves to act responsibly with respect to clients, shareholders, staff, society and the environment. The discussion of development opportunities by future generations which commenced at the 1992 Earth Summit in Rio, highlighted the possible conflict between the conservation and expansion of prosperity, the resulting effects on the natural environment, as well as the use of finite resources. Sustainable development is based on a balanced consideration of all three dimensions: economic efficiency, social acceptability and effective environmental protection. As a large industrial group, aiming at satisfying the basic human demands, we have a particular responsibility to support the concept of sustainable development.

With this first corporate Environmental Report we want to demonstrate, using concrete information, how we respond to this corporate responsibility. This includes documenting the environmental impact of our operations and the environmental control systems that we put in place to minimise it. Through transparency and openness, this Environmental Report aims to add to the credibility of our group and to increase the level of trust of both government and society in our operations.

In line with the structure of the corporation with its seven group divisions, this Environmental Report will present the data and facts regarding the operations and environmental impact of our group separately for each division. In spite of the great variety and diversity of our operations, we have endeavoured to be brief. Initially, the report focuses on our operations in Germany. In future we will include our international operations. This Environmental Report has been based on the 1996 publication "Environmental Protection at RWE". It has been prepared with consideration of the DIN-Standard for Environmental Reporting which has been published in the meantime.

We are exploring new areas with this reporting process, and in the course of compiling the information and data, gaps became apparent which will need to be filled in future. We want to approach the goal of sustainable development through the enhanced coordination of our corporate environmental management system, without affecting the fundamental responsibility for environmental protection by each group division. A consistent environmental management system also contributes towards a reduction in the use of resources and therefore also towards a potential reduction in costs. We want to demonstrate how we, as a group, intend to proceed.

The preparation of this Environmental Report gave us ideas, as to which questions the corporation needs to ask and respond to in the future. In view of the comparatively high level of environmental protection in many sectors, continual improvement can only be realised at very high cost levels, which are virtually economically unacceptable. During the continued development of environmental protection we want to review, to a greater extent as in the past, what environmental impacts our products and services have, especially in the long run.

Within this context we believe that new tools within the framework of environmental policy are necessary. Environmental protection, merely obeying the principle of "command and control" is increasingly losing power in view of the ongoing globalisation of the economy. Instead the principle of cooperation between government and businesses needs to be strengthened, to achieve the economical efficiency and social acceptability of ambitious proposals of environmental policy. An excellent example of such an approach is the declaration of commitment of the German industry towards atmospheric protection. Government, society and economy need to continue along this path. Only that way can we retain and increase the high technological, economic and social standard of Germany, as well as its efficiency within the context of environmental protection.

*Dietmar Kuhnt*



**Dr. Dietmar Kuhnt,**  
**Chairman of the Board of RWE AG**





Portrait of the Corporation.

# RWE

## The Group That Knows How.

The RWE Group is one of the leading German industrial enterprises. In 1997/98, a staff of 145,000 generated a global turnover of more than 72 billion DM and a profit of around 1.4 billion DM. As the strategic management holding, RWE AG controls the management portfolio and leads the seven group divisions: Energy, Mining and Raw Materials, Petroleum and Chemicals, Environmental Services, Mechanical, Plant and Equipment Engineering, Telecommunications and Construction and Civil Engineering. The RWE, which was founded in Essen in 1898, has, in the course of the past years, developed into the largest German energy supplier and to an extensive supplier of infrastructure services on an increasingly international basis.

The seven divisions of the RWE Group operate independently on a day-to-day basis, but report to the corporate holding regarding their business policies and their financial results.

**Energy.** The group division Energy belongs to the largest and most productive energy suppliers in Europe. It is engaged in the supply of electricity, gas, thermal energy and water. For the supply of electricity, RWE Energie relies upon a proven mix of energy sources, lignite and bituminous coal, nuclear energy, gas, as well as the renewable energy sources. In the course of the liberalisation of the European electricity supply market, RWE Energie is pursuing the aim of becoming the market leader amongst the private companies offering energy services in Europe.

**Mining and Raw Materials.** With Rheinbraun as the leading company, the group division Mining and Raw Materials is the international market leader for mining and refining of lignite. It also has a leading position within the area of recultivation and compensation measures within the field of aquatic resource management, as well as within the field of the development of environmental protection technology. Rheinbraun holds considerable international shares within the sector of mining of bituminous coal.

**Petroleum and Chemicals.** RWE-DEA is an important German petroleum enterprise with world-wide operations. The activities of Exploration and Production comprise the exploration and production of oil and gas – nationally and internationally – as well as natural gas storage. The refining of crude oil and semi-refined feed-stocks into petroleum products and petrochemical base materials is undertaken under the name DEA. Chemical activities are globally undertaken under the name CONDEA. Detergent raw materials, fatty alcohols, alumina, solvents, and fine chemicals are some of its products.

**Environmental Services.** RWE Umwelt offers a broad spectrum of services. The companies within the area waste and recycling offer a wide range of waste management services, starting from waste collection and transport, to pretreatment, thermal treatment and waste disposal. Within the business area of environmental consultancy expert reports and safety assessments are prepared for national, as well as international clients. Further, concepts for the remediation of contaminated sites, waste minimisation and for appropriate waste disposal are developed. The business area water/waste water focuses on the planning, construction and operation of installations for water treatment and supply.

**Mechanical, Plant, and Equipment Engineering.** The activities embrace manufacturing of printing machines, electrotechnical installations, components for energy technology, engineering services, medical technology, technical equipment of buildings and the construction of installations. Most of the companies are internationally oriented.

**Telecommunications.** A main share of our management company, RWE Telliance, is o.tel.o communications and over it E-Plus. It offers a wide range of telecommunication services which include the transfer of written and spoken information via fixed networks, mobile communication and cable television.

**Construction and Civil Engineering.** HOCHTIEF is one of the leading companies within the German construction industry with world-wide operations. The company is increasingly developing into a systems leader, taking over the responsibility of the planning, financing, construction and operation of all types of projects. Within this context it concentrates on high rise buildings, airports, bridges, dams and tunnels.

Amidst this diversity of services, the business areas of RWE have one thing in common: they satisfy fundamental, basic demands – especially in places, where complex technology is required: heat, energy, light and water – living and working environments – information and communication – mobility and logistics – environmental quality and health.

Furthermore, the diversity of RWE ensures stability. The results of changes in business cycles and structures are largely balanced through the diversity of the corporation. The broad pallet of offers opens up the entry into new market areas. Particularly in the course of entering markets abroad, the RWE businesses can offer each other valuable support.

The RWE Group is ready to face the intensive competition, resulting from internationalisation and liberalisation. The corporation, which also belongs to the largest investors in Germany, also increasingly makes use of the opportunities for growth within the international market. Within this context the corporation has committed itself to be aware of and respect national cultures in its international operations.

# From Taking Precautions to Becoming Fit for the Future.

Within the RWE Group environmental protection has always played an important role. Its history has, amongst others, been influenced by the development of environmental legislation in Germany. As the Federal Immission Control Act became effective, the first officers for air pollution control were appointed in the affected business areas Energy and Petroleum and Chemicals from 1974 onwards. Parallel with the expansion of legislative requirements and the proclamation of the EC-Eco-Audit Regulation 1993, the environmental protection organisations within the corporation were tailored towards the requirements of modern environmental management systems.

The group division Mining and Raw Materials underwent its own development, as the mining legislation also dictates the means by which environmental protection should be structured and applied. Within the context of environmental protection, mining is more tightly regulated by legislation and authorities, than other business areas.

When the RWE Group was restructured in 1990 and thus changed from an energy corporation to a very diverse mixed corporation with at that time six leading management companies, it became necessary to co-ordinate the issue of environmental protection for the group as a whole. The prerequisites for this central, corporate co-ordination were set by the appointment of the Environmental Co-ordinator and the establishment of the central department "Environmental Protection" within the holding.

The biggest milestone of environmental protection technology was the installation of emission abatement measures into our coal-fired power stations, as a result of the Ordinance on Large Combustion Plants 1983. Following a preparatory phase, which went on for several years, the upgrading was successfully completed in 1988 and the emissions were thus be significantly reduced.

Apart from that, since the beginning of the generation of electricity, the group division Energy enjoyed a leading role in the efficient use of combustion fuels through the size and effectiveness of its power stations. This leading role was proven from 1998 on, when it established its first so-called BoA, a lignite-fired power station with optimised plant technology.

We would also like to emphasise the internationally acknowledged standards that were achieved within our group division Mining and Raw Materials. These standards are related to landscape recultivation following the closure of a mine, as well as measures for the conservation of valuable wetlands.

At the same time the other corporate companies continuously applied measures to minimise emission levels and to change to environmentally sound production processes. When the installation of the drilling and production platform "Mittelplate" commenced in 1986, stringent measures were taken to protect the sensitive tideland eco-systems from the potential impact of petroleum production. These measures are still widely recognised as leading examples of marine protection.



With the foundation of the RWE Entsorgung in 1989 (since October 1998 RWE Umwelt), the group became increasingly active in the field of environmental protection through the establishment of its own business sectors for waste disposal and recycling, as well as environmental consultancy services and wastewater treatment. Within specialised areas, the HOCHTIEF Umwelt and ERM Lahmeyer International complement this active involvement in specialized fields.

After the main goals of taking precautions for environmental impacts have been achieved, it is becoming evident that the most important problems that will need to be addressed in the future are the following: the preservation of resources, climate protection and overall the support of sustainable development. The RWE Group will address these problems proactively.

## History of Environmental Protection

Year	Area	Measures
1971	●	First experimental plants for flue gas sulphurisation
1973	●	Development of the dry additive process (TAV) to reduce SO <sub>2</sub> -emissions
1974	●	Appointment of the legally required Environmental Coordinators
1975	●	Appointment of the officers for Environmental Protection, the establishment of the committee "Environmental Protection", as well as the introduction of organisational regulations
1978	●	Trials using the dry additive process in a power plant
1979	●	Foundation of the "Environmental Protection" department
1980	●	Development of environmental protection units within the operational areas
	●	Until 1986: construction of offshore oil production platforms in the North Sea and the Baltic Sea, introduction of environmentally more sound production processes
	●	Establishment of a department for environmental protection within Rheinbraun
1981	●	Until 1990: construction of multi-stage wastewater treatment plants
	●	Commissioning of first plant for recovery of secondary raw materials at Trienekens in Neuss
1982	●	Construction and operation of a dry additive process (TAV) – demonstration installation at a 300 MW lignite-fired power station
	●	Finalisation of management measures for conservation of wetlands, Garzweiler
1983	●	Programme for reduction of emissions from fossil-fuelled power plants (SO <sub>2</sub> , NO <sub>x</sub> , particulates)
	●	Programme for reduction of emissions from our captive power plants (SO <sub>2</sub> , NO <sub>x</sub> , particulates)
	●	Programme for reduction of emissions from furnace installations (SO <sub>2</sub> , NO <sub>x</sub> , particulates)
1984	●	Ecological requirement profile for Garzweiler
1985	●	Appointment of a central Officer for Environmental Protection
	●	Upgrading of the Amstetten plant of Heidelberger Druckmaschinen using state-of-the-art environmental technology
1986	●	Compilation of regulations into the "Environmental Guidelines of RWE AG"
	●	Emission reduction by means of installation of vapour recovery systems in refineries and oil storage tanks
	●	Foundation of "Environmental Protection and Technology" Department within Lahmeyer International GmbH

● RWE AG ● Energy ● Mining and Raw Materials ● Petroleum and Chemicals ● Environmental Services  
 ● Mechanical and Plant Engineering ● Telecommunications ● Construction and Civil Engineering

# History of Environmental Protection

Year	Area	Measures
1988		<b>Acquisition of Deutsche Texaco AG</b>
		Foundation of the Department "Soil and Groundwater Remediation"
1989		<b>Foundation of RWE Entsorgung AG (since October 1998 RWE Umwelt AG)</b>
		Project "Environmentally Sound Cleaning in the Area of Offset Printing" by Heidelberger Druckmaschinen
1990		<b>Foundation of the RWE AG</b>
		First plant for the decomposing of refrigerators with complete FCHC recovery by Bresch GmbH
1991		Establishment of the Environmental Protection Department, commitment of CONDEA to the Responsible Care initiative, Adoption of environmental protection guidelines of the Petroleum Industry Association by DEA, introduction of the DEA Oil Vendor
		Establishment of a division for environmental protection at LAUBAG
		First internal environmental audit
1992		Upgrading of service stations: vapour recovery systems and sealing of drive ways
		Commissioning of a thermal soil decontamination plant
		Retro-fit programme for the turbines of thermal power stations by 1997
1993		Introduction of Environmental Impact Assessment (EIA) into legalisation procedure for lignite
		Implementation of an environmental management system
		Environmentally relevant management guidelines and annual environmental report at Heidelberger Druckmaschinen
		Environmental protection guideline of RWE Energie
1994		Declaration of intention for partial renovation of power station park in case of permit of Garzweiler II
		European transport award for DEA Oil Vendor oil dispensing unit
		Framework for the organisation of environmental tasks, working group "Integrated Management System"
1995		Board decision on environmental reporting
		Systematic environmental audits
		First Plant for Dry Mechanical Preparation of Electronic Scrap
		Switch to CFC-free polyurethane foams at MAQUET
		Commissioning of a microbial soil decontamination plant
1996		Leaflet: "Environmental Protection at RWE"
		First internal environmental audit in a power plant
		Certification of operational units for waste management
		Registration of Heidelberg's plant in Amstetten, according to the EEC-Regulation on Eco-Audits
1997		Nomination of an Environmental Co-ordinator within the Board of Management
		Environmental Policy statement takes effect
1998		Establishment of the central department "Environmental Protection"
		Implementation of an environmental management system
		Laying the foundations of the first BoA power station with 43% efficiency
		Nomination of environmental representatives for open-cast mines and factories
		Development of environmental guidelines
		Adaptation of environmental management system to new corporate structure
		Environmental policies and guidelines at LAHMEYER
		Environmental Management System in compliance with DIN ISO 14001 at Piller-GmbH
		Foundation of ERM Lahmeyer International as environmental consulting organisation
		

 RWE AG 
  Energy 
  Mining and Raw Materials 
  Petroleum and Chemicals 
  Environmental Services 
  Mechanical and Plant Engineering 
  Telecommunications 
  Construction and Civil Engineering

# Measure of Our Actions.

We have presented our guidelines on environmental protection in the booklet "Environmental Protection at RWE" to increase the corporate environmental awareness. They continue to be valid as a guide of our actions. The companies use these guidelines as a basis for the development of their own specific guidelines, which are more detailed and individually tailored towards their specific business.

Simultaneously the discussion of the issue of sustainable development has led to a critical reflection regarding the level of our environmental awareness. Up until now environmental protection was primarily understood as the avoidance of emissions. The careful use of resources has been based mainly on economic considerations. Now we want to critically review how a strategy for sustainable development can provide input for future-orientated management. This strategy for sustainable development will systematically address the preservation of resources, whilst considering economic and social interests. Within this context we will need to update our existing environmental guidelines accordingly.

## ● Preservation of Natural Resources

Natural resources, in particular fossil raw material, not only represent the foundation of our business, but also the essential basis for our very existence and that of future generations. For this reason we must and will do our best to conserving them wherever possible with regard to a sustainable economy.

## ● Reduction of all Types of Emissions and Waste Products

In all the technical and industrial processes of our companies, our aim is to minimise their impact on soil, water and air. Wherever economically viable, our efforts exceed legal requirements.

## ● Responsible Behaviour of Staff

We provide environmental training for our staff. It involves increasing environmental awareness and information about new developments and legislation. Each member of staff has the duty to act with a sense of responsibility towards environmental protection, when performing his or her job

## ● Use of state-of-the-art Environmental Protection Technology

Our commitment to research and development is crucial to solving complex environmental problems. Far-reaching investment in promising and innovative technologies puts us in a position to systematically continue to enhance environmental protection.

## ● Free Access to Information

We promote dialog with our business partners and the general public. We consider this to be essential to reach a consensus for effective solutions for environmental issues.

The Aim of Sustainability.



# Accepting Social and Global Responsibility.

The global environment and development programme, Agenda 21, was introduced at the United Nations Conference in Rio de Janeiro in 1992. Since then the concept of sustainable development has become an international guideline. Politicians, communities, societies and scientists are discussing the best way to follow this aim.

“The aim of sustainable development is to safeguard the natural basis for life, to retain economic efficiency and to distribute employment, income and opportunities fairly. Every economic and social development is based upon the conservation of the natural environment. At the same time, the ecology can take a fundamental role to accelerate innovation and employment security and to increase economic efficiency.

Currently, solutions for economic, social and ecological challenges are generally not researched or sought together. This is the case for both developed, as well as lesser developed countries. The importance given to economic, social and ecological goals varies amongst global regions, but quite often the three key issues are used as arguments against each other.

The innovative chances of an integrated approach are fraught by conflicting interests and by the lack of necessary political, social and economic structures and institutions. This is even though the economies on the one hand and poverty and environmental risks on the other hand are becoming increasingly globalised.”

(Interim Report of the Enquete-Commission of the German Parliament, 1997).

## Consequences for RWE

We consider the statements that were made by the Enquete-Commission 'Protection of Mankind and the Environment' in the Interim Report on the concept of sustainability in 1997 as a challenge. Sustainable development is not only a prerequisite for the preservation of our business success in the long-term. We also feel responsible for our environment, being a significant employer and a corporation with history and tradition. Further, as a leading German industrial group which operates internationally, we have the opportunity to contribute to sustainable development globally. Last, but not least, the nature of our business which aims to satisfy the basic human demands, such as the need for heat, light, energy, water, living space, environmental quality and communication, leads to the strong responsibility to contribute towards a liveable future.

## Actions of RWE

The aim of sustainability sets the direction, but needs to be translated into concrete actions. In view of the possibilities and challenges that we face, the acceptance of our economic and social responsibility, as well as national and international environmental protection represent our areas of action. We have already achieved a lot and want to build upon these achievements and review and continue to develop our actions in the sense of sustainable development.

### 1. Safeguarding Stable Economic Development through Long-Term Planning

We deliberately aim at a long-term and continuous increase in value and therefore turn mainly to investors which think in the longer-term. Stable and successful economic development of our group is also a prerequisite for safeguarding existing employment opportunities and for development of new business sectors which offer additional employment options. At the same time, an increase in productivity is a prerequisite for the adoption of sophisticated environmental protection measures. This applies particularly to those measures which prevent the generation of waste or emissions at the source and therefore integrate environmental protection into the production processes.

Our Annual Report 1997/98 shows a distributed profit of 1,000 million DM. At the same time the expenses for environmental protection were 2,160 million DM. Thus, for every distributed DM, 2.16 DM was spent on environmental protection. The upgrading of the power station park in the Rhenish Brown Coal Mining District, requires investments of up to 20 billion DM to the year 2030. These investments contribute greatly to the reduction of off-gases affecting the global climate, as the upgraded power stations are far more efficient.



## The Aim of Sustainability.

### 2. Qualification and Participation of Staff

The fundament of successful business development are qualified and motivated staff. We support qualification on all levels by providing specialised advanced education which focuses mainly on the issues of technology, data management, as well as management and cooperation. By providing this education opportunity, we enable our staff to remain flexible in the face of changing requirements, such as more intensive client contact or the application of new technologies and communication systems. At the same time they become involved in the development of our corporation. Education also helps to strengthen the sense of responsibility and the initiative of staff – a factor which supports individual expansion and – beyond the boundaries of the corporation – also has an influence on society.

In 1996/97 approximately 70,000 staff members participated in almost 15,000 training courses. A special event is the Dream-Team-Action of the RWE Group which occurs every two years. Within this framework trainees get involved in issues which extend beyond their professional education programme. Last time approximately 500 trainees took part in approximately 100 projects which addressed topics such as education, environment, social issues, client orientation and technical innovations.

### 3. Accepting Social Responsibility

We acknowledge our responsibility by creating employment for trainees, by supporting the development of future-orientated infrastructure and by participating in discussions regarding social issues. To enable the entry into the professional world for as many people as possible, RWE offers more than 5,800 trainee jobs in the ongoing business year. That is about 40% more than required for our own needs.

To accept social responsibility also means that we need to minimise the inevitable impact of our operations as far as possible. For this reason Rheinbraun and LAUBAG plan well ahead when communities affected by lignite mining need to be resettled and new locations need to be selected. In the past the resettlement process itself was adapted to continually changing requirements and conditions. This serves to ensure that the new locations do not only meet the requirements and expectations of individuals, but also those of the established communities as a whole. Between 1948 and today around 30,000 people have been resettled in the Rhenish Brown Coal Mining District. Amidst the concern that was created due to the abandoning the old communities, many people realised a chance for a meaningful new beginning.

As a contribution to shape our society in a future-orientated manner, RWE also familiarises young people from outside the corporation with socio-economic concepts: Within the framework of the RWE Summer-Academy, annually around 100 pupils and trainees have the opportunity to reflect on issues of future development for a week. Amongst the discussion partners are economists, politicians, journalists and managers of the RWE Group.

On the occasion of its centennial, RWE AG created a grant scheme to support professional qualification, social integration and social commitment of young people. Its main aim is to help prevent young people from taking criminal action by developing and supporting suitable projects. The additional aim is to involve young people increasingly in social and public issues.

#### 4. Consideration of Environmental Issues in Product Policy

Ecological criteria need to be considered at the planning stage, if environmentally compatible products and services are to be offered. Within this context, consideration of the future needs of our clients and of society need to be included at an early stage. This is seen as a large strategic task.

Already to date environmental considerations have been included in a variety of production and planning processes. For example Heidelberger Druckmaschinen have developed offset printing equipment which has to virtually no emissions. For the pre-press applications, the company has developed a computer-to-plate technology which operates according to a thermal film exposure process. Photo chemicals are no longer required. For sometime DEA has been marketing lubricants containing components made e.g. from rapeseed oil. The development of fuels containing max. 1% benzene also reflects the consideration of environmental issues in product policy. There are some relevant examples within the relatively young business area of telecommunication as well. For instance travel can be avoided by taking advantage of the multitude of services, such as the use of conference calls.

#### 5. Application of the Recycling Economy

Sustainable development as a strategy for a modern industrial society requires consideration of the closed substance cycle principle. The companies of the RWE Group have applied this concept on numerous occasions. The recycling of water and use of waste as raw material belong to this concept.

Since environmental protection has become an integrated part of management, it contributes to the strengthening of productivity. The minimisation or re-use of waste, as well as cautious use of water and energy lead to considerable cost reductions themselves.

For example the ashes and slag from the power stations of RWE Energie, as well as the lignite ashes from the Lausitz area are used to fill up the excavation pits of the mining operations. Gypsum from the flue gas de-sulphurisation processes of power stations is conditioned and reused as a substitute for natural gypsum. The HOCHTIEF uses conditioned construction and demolition wastes as additives during road construction. DEA was the



## The Aim of Sustainability.

first in the industry to sell motor oil in reusable bottles to minimize package waste. The efforts of RWE Umwelt need to be emphasized particularly. By using innovative processes, the majority of the materials of used products are returned into the economy as secondary raw materials or contribute to the conservation of primary energy by serving as substitute fuels.

### 6. Further Developments in the Energy Sector

The energy sector is an important focal point for the cautious use of resources and the reduction of CO<sub>2</sub> emissions. Both aspects have been central considerations for us for several years. We can make a valuable contribution through the increased efficiency in the use of energy. This ranges from the increase in the efficiency of our power stations to the provision of advice and support to our clients in the rational use of energy. Further examples are the use of steam from power stations for local and regional heating and the construction of buildings which utilise geothermal or solar energy.

To open up new environmentally compatible possibilities, we are involved in the testing and development of processes which utilise renewable energy. Within this context RWE Energie AG installed 27 facilities in the past few years which produce energy from wind and solar sources. This was done within the framework of their green tariff. Our company Angewandte Solarenergie – ASE produces photo

voltaic installations at two plants. In this general focus, however, RWE Energie is engaged in energy generation using renewable energy sources. One example is the photo voltaic plant in Toledo, Spain. This plant delivers an annual average of 950 MWh of electricity. Near Osnabrück in Germany we are currently operating the largest wind-driven power plant away from the coast. Aiming at building a sustainable energy industry, we take part in the "eta Initiative" which is supported by the German electricity industry. Under this initiative, companies that manage to reduce their specific consumption of energy through installation of innovative processes are presented with awards.

RWE together with Rheinbraun also supports research projects involved with studying the greenhouse effect and its impact on the environment. A programme of the Massachusetts Institute of Technology (MIT) combines the modelling of climate changes and economic development. The aim is to examine the scientific, ecological and economic aspects of the greenhouse effect. Another programme, which is financed by the International Energy Agency (IEA), examines the necessary technology, the costs and environmental impacts for the removal of CO<sub>2</sub> and other relevant gases from the emissions of fossil-fuelled power plants. Together with other companies of the energy sector as well as automobile producers, RWE started an initiative regarding energy strategies in the transport sector. This initiative is supported by the federal Government.

## 7. The Transfer of Know-how to Support Sustainable Development World-wide

By transferring environmental know-how and established processes to countries which are just starting to develop their infrastructure and economy, a lot can be achieved for the principle of sustainable development. The RWE Group can contribute to this transfer in several ways-either through direct participation or by providing advice and support to development projects.

Jointly with the other world-wide largest energy suppliers, which together have formed the E7 Group, RWE offers its experience, competence and know-how, which has been acquired over decades, to support particularly developing countries in the environmentally acceptable generation and use of electricity. Within the framework of E7 Projects, experts of RWE have passed on their knowledge of efficient and specialised technologies to local electricity suppliers in Indonesia, Mongolia, China, India and South Africa, amongst other countries. Apart from limiting CO<sub>2</sub>-emissions and improving environmental protection, the E7 Initiative contributes towards economic and social development at the same time.

In June 1998 the members of the E7 Group have voluntarily agreed upon a set of rules within the context of a sustainable strategy. They respect these rules during their operations. The aim is to convince the other main players in the electricity sector, world-wide, to accept these rules as well. At the same time, E7 Members have established a fund in Paris, which supports representative energy projects aiming at sustainability.

Jointly with Rheinbraun, RWE Energie is shareholder of plants for the mining and utilisation of coal, owned by the Hungarian company MATRA. Both companies, Rheinbraun and RWE Energie finance the equipment of the local power plant units

with flue gas de-sulphurisation installations and the achievement of a higher efficiency. In Croatia, RWE Energie is currently installing a coal-fired power plant with flue gas de-sulphurisation, as part of a joint venture with the local energy supplier. Environmental know-how was welcome in the Czech Republic as well. RWE Energie played a dominant role within a consortium involved in constructing a heating power plant. This plant will supply a local industry and the community with heat. Together with the Prague Gas Works, RWE Energie also founded the company Prometheus, which will support the use of natural gas instead of coal for heating in private households.

RWE-DEA is a shareholder of the Kazgermunai joint venture in Kazakhstan developing an oil field in the south-eastern part of the country. The company is responsible for the planning, construction and commissioning of the production facilities with the related pipelines, a gas and oil treatment plant, as well as a 60 km dual-string pipeline. RWE-DEA expertise safeguards compliance with strict environmental and safety standards.

Under the Responsible Care initiative, all CONDEA companies share knowledge and experience on a regular basis. The aim is to optimise production and process technologies and to develop consistent safety and environmental standards. For example, the production of fatty alcohols using the Ziegler process has been further optimised. In addition to the increase in process reliability, a substantial reduction of emissions and energy consumption was achieved.

Our companies which are involved in civil engineering and construction have already on many occasions supported the consideration of environmental protection during the construction of new installations. For example the Klöckner Industrie-Anlagen



## Vision

installed one of the first flue gas de-sulphurisation installations in Eastern Europe: in 1997 four lignite-fired power stations, which comply with stringent German emission standards, joined the grid. Lahmeyer International has provided consultancy services to communities and enterprises in many countries, regarding, amongst others, their management of water and waste, as well as energy supply.

ERM Lahmeyer International makes valuable contributions towards know-how transfer in developing countries through a number of projects. Examples are education programmes for environmental protection in Latin America, institutional strengthening in Latin America and Asia, as well as the development of waste management in Southern India and Lebanon.

RWE is aware that sustainable actions, in terms of the equal consideration of economic, ecological and social interests, are not always feasible. Nevertheless, we aim to include equal consideration of all three aspects throughout our corporate operations and decisions. Sustainable management shall become a decisive criterion within the context of strategic planning within the RWE Group. Showing concrete examples we have illustrated how the idea of sustainability influences our business already today. These examples shall stimulate our staff to incorporate the idea of sustainability increasingly in their considerations and decisions.

Within the group itself, as well as outside it, the exchange of know-how and experiences regarding sustainability should be intensified.

Sustainable development can, however, only be achieved, if everyone is aware of the responsibility and makes a contribution. Within this context, political support and guidance is required. Measurable conditions are needed to substantiate the aims of sustainability. Thus, a communal and compulsory basis for action is required. This is essential for companies which need to plan far ahead, due to their responsibility as an employer and shareholders. We would therefore welcome political initiatives aimed at creating suitable conditions for future-orientated management by setting an obligatory framework.



# Corporate Co-ordination Opens Opportunities.

Only a few years ago, environmental protection was regarded as a technical subject only. Today it has become a priority task for management. Environmental protection needs to be integrated into all business processes, if it is to be effective. Our environmental awareness has developed accordingly. More and more chances emerge, where environmental issues can play a role. As a Group with a large diversity of operations, we have a considerable potential for future-orientated and sustainable development. In order to utilise this potential, there is a need to integrate environmental aspects into the overall strategy of the corporation. Another reason for the necessity of corporate co-ordination of environmental issues is the often close relationship of environmental activities between the various business areas.

Our Corporate Directives on the Co-ordination of Environmental Protection was issued in 1998. It was designed to reflect these thoughts and to support an overall strategy orientated towards environmental issues and the future. The guideline defines the co-ordination tasks of the holding company and ensures that the environmental organisations within our group divisions are set up according to comparable standards. The holding is responsible for the co-ordination of corporate-wide issues, in agreement with the lead business units and also provides guidance. The corporate companies are responsible for the operational implementation of this guidance.

In the following, a detailed description of the overall structure and of the co-operation between the holding and the group divisions is presented. Details regarding the respective environmental management systems of each group division are presented in the relevant chapters of this Report.

## Environmental Co-ordinator

A member of the Board of Management of the holding is responsible for the overall co-ordination of environmental issues. In December 1997, Rudolf Schwan was nominated as Environmental Co-ordinator of the RWE AG.

He represents the corporate environmental interests of the RWE AG towards the public. He is also responsible for the co-ordination of measures that need to be taken to achieve the environmental goals, and he is member of the Corporate Emergency Task-Force. His duties include the following:

- co-operation with the lead business units within the Steering Group for Environmental Protection,
- review, co-ordination and control of the development of the environmental management system within the RWE-Group,
- development of framework concepts for environmental and risk management, as well as the development of an internal environmental reporting system,
- co-ordination of the assessment of significant environmental risks within the corporation itself, as well as during acquisitions,
- publication of the corporate Environmental Report,
- regular reporting to the other members of the Board of Management of the RWE Group.

## Corporate Organisation of Environmental Protection.

### Central department "Environmental Protection"

A central department was created within the holding to support the Environmental Co-ordinator. It is responsible for implementing the measures that emerge from the Co-ordinator's tasks. Regular reporting to the Environmental Co-ordinator is undertaken.

### Steering Group "Environmental Protection"

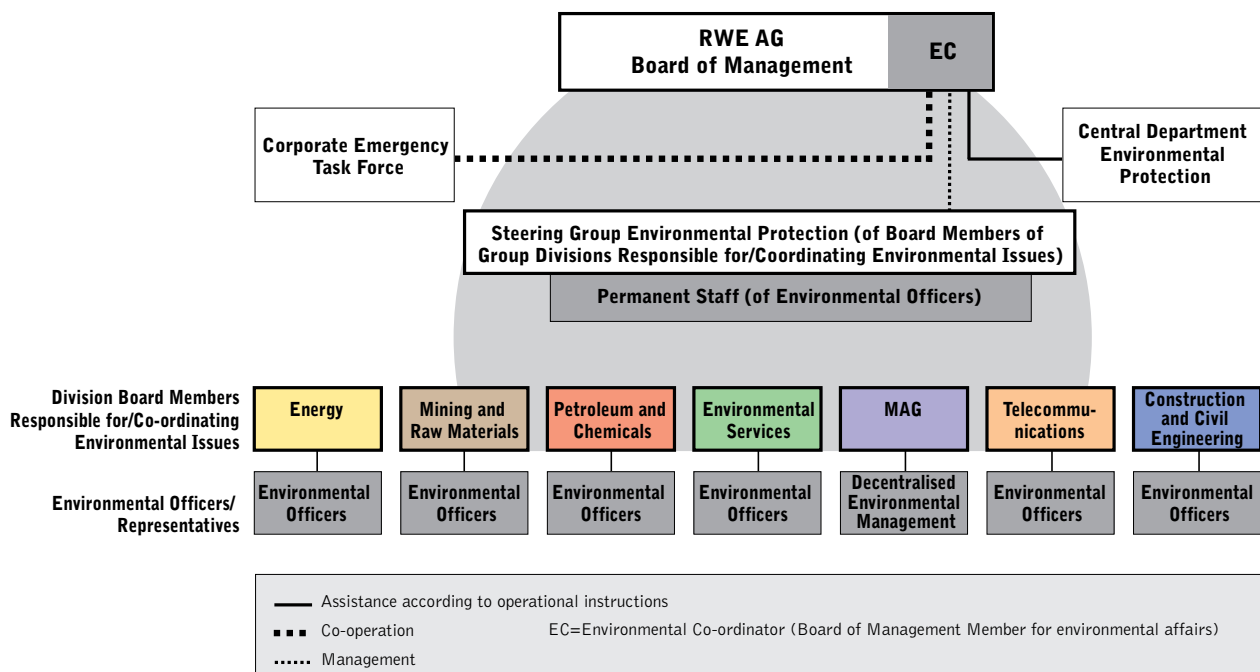
The Steering Group forms the link between the holding and the group divisions for issues relating to environmental management. The Environmental Co-ordinator, as well as those board members of the lead division units who are responsible for environmental matters, are members of this Steering Group. The Steering Group facilitates the discussion and agreement of corporate measures and enables the exchange of experience between the Group divisions. The members of the Steering Group also have the

responsibility for developing the concept for the corporate Environmental Report which is published every two years. Within this context they review the contributions that are made by the individual group divisions. The Environmental Co-ordinator is the head of the Steering Group.

### Permanent Staff of the Steering Group "Environmental Protection"

The permanent staff gives technical advice to the Steering Group. The members of the central department "Environmental Protection" of the holding as well as the environmental representatives of the group divisions belong to this staff. It deals with the tasks of the Steering Group and makes recommendations. Apart from that, it co-ordinates and reviews the contributions of the lead division units to environmental report.

#### Environmental Management within the RWE Group



## Environmental Management within the Group Divisions

The boards of the lead division units have individually defined the tasks and the respective organisational structure for environmental protection, in accordance with the activities of the companies, as well as in consideration of legislative requirements.

Responsibilities are individually defined, in order to guaranty the implementation and maintenance of the environmental management system for all environmental-related tasks on all levels from managerial to operational staff.

The aim of the co-operation between the Environmental Co-ordinator and the Environmental Representatives of the lead division units within the framework of the Steering Group is to achieve consistency in the compliance of the entire corporation with the requirements of environmental management. These requirements include the following:

- development of an environmental policy, specific to each business,
- development of environmental programmes with targets and measures,
- documentation of the organisation and operation of the environmental protection,
- nomination of persons responsible for environmental management and protection,
- documentation of environmental duties detailed in environmental legislation, licences etc,
- demonstration of measures to integrate environmental protection into the business processes,
- introduction of a reporting, review and control system for the implementation of requisite measures to optimise environmental management,
- training of staff involved in activities that have an environmental bearing,
- development of directives for risk management.

## Reporting System

Every two years the RWE AG publishes an Environmental Report to initiate an open discussion of the environmental issues of the corporation. At the end of 1998 we will also introduce an internal environmental reporting system which will summarise environmental data and facts on an annual basis. It will offer the basis for external reporting, as well as serve as an important management tool to support the continuous improvement of environmental protection measures, as well as risk management. The main topics covered by the reporting system of each Group company are the following:

- organisation of environmental protection,
- progress in the implementation of environmental programmes,
- data on material and energy streams,
- investments in environmental protection,
- environmental management reports and audits,
- special incidents, accidents.

## Risk Management

The individual businesses have had organisational and technical measures for situations in place since a long time. These measures include plans for the prevention of danger, the establishment of fire fighting departments, as well as precautions, which have been agreed with the local authorities.

On the corporate level we will complement these measures by an effective communication system. In the course of developing our environmental management systems, we will make sure that the emergency communication system is completed and that the relevant contacts within the corporation, as well as within the authorities, are clearly stated.

Further, we will summarize all the significant risks that the corporation could face regarding economic issues as well as in its relationship with the public.

These measures enable the RWE AG to initiate an active dialog, even in emergency situations.

## Transparent Environmental Reporting.

"In December 1997, the Board of RWE AG decided to introduce a corporate Environmental Management System. Its primary aim is the co-ordination of environmental protection and the consistency of environmental reporting within the various group divisions. The Environmental Report 1998 for the RWE Group represents a part of this Environmental Management System.

In future the Environmental Report will be published on a regular basis to inform the public as well as our staff about the environmental performance and effects of our corporation. We want to use the Environmental Report as an opportunity to report openly on the environmental aspects of our operations, since openness is an important prerequisite for the social acceptance of our organisation and therefore for a successful business. We are well aware that information on environmental issues needs to be as accessible as that on business development.

Transparent environmental policy requires a reliable database. Through the development of a consistent environmental reporting system we will be able to compile data on the environmental effect of our operations and hereby substantially increase our capacity to include environmental aspects in the decision-making process. At the same time we will create a strong basis for the evaluation of our contribution to sustainable development, an issue which is becoming increasingly prominent during public discussions and within our corporate decisions.

The environmental reporting system also aims to enable responsible persons on all levels to recognise the risks and dangers of their operations systematically and at an early stage. Mitigation measures can be developed and updated on a continuous basis.

The public often senses a certain powerlessness in view of highly complicated facilities and contexts, but also in view of large corporations and investments. It tends to immediately become concerned when irregularities occur. The concern about the events surrounding the transport of spent nuclear fuel early summer of this year demonstrated clearly that inadequate com-



**Rudolf Schwan,**  
**Environmental Co-ordinator within**  
**the Board of Management**

munication and information regarding problems which may be minor – technically speaking – is perceived by the public as a deficiency, or even as a threat. We try to take this into account by a continuous and accurate reporting system within the corporation itself and to the public. Within this dialogue all issues should be addressed and openly discussed. At the same time we want to demonstrate that effective internal control mechanisms are in place and that in those places where there are deficiencies, these deficiencies will be addressed. We therefore improve the transparency of our corporation internally as well as externally. The appointment of an independent commission to look into and resolve the issue of the transport containers for the spent nuclear fuel and to develop recommendations for improvements should be seen within this context.

In its Final Report of August 1998, the commission confirmed that RWE Energie acted appropriately in the course of treating the contamination. RWE Energie immediately implemented recommendations to improve organisational and information processes. Jointly with the other German operators of nuclear power stations, it has also developed a concept for the transport of fuel assemblies which is improved in terms of technical and organisational aspects. This concept aims to avoid the possibility of increased container contamination and ensures that the public and the authorities receive the requested information.

A transparent reporting system represents a substantial contribution towards the credibility of our corporation. We will consistently follow this path."

# Relevant Material and Energy Flows.

All Group Divisions have compiled the environmental data which support this Environmental Report within a systematic input-output scheme. To simplify matters for this environmental report, only data for national operations and for which RWE is a major shareholder, were gathered. Wherever possible, the Divisions gave an indication of the main material and energy flows of the past five years. For some companies, however, only data for a shorter period were available. At the same time information on the source and quality of the data was collected. This information contributes towards the internal reporting system. The financial year was taken as the basis for data collection, as the majority of data related to it. Irregularities, due to different financial years (1 to 31 December or 1 July to 30 June) were accepted as being inevitable.

The value of 0.63kg of CO<sub>2</sub> per kilowatt hour of electricity, which has been derived from the German energy mix, was used as the conversion factor for the CO<sub>2</sub>-emissions which relate to the use of electricity. The Group Division Energie used the factor 0.74 for the calculation of CO<sub>2</sub>-emissions from externally supplied electricity, based on the known structure of supplying utilities.

This Environmental Report represents the entry into a systematic and continuous internal and external environmental reporting system.

The collection of data aims to support efficiently the following tasks:

- the identification of weaknesses and problem areas and an indication of optimisation potentials,
- the development of concrete environmental goals,
- the documentation of continuous improvements,
- the internal and external communication of environmental efforts.

In the longer term we are planning to develop corporate environmental indicators to enable the rapid review of environmental efforts by management. Through these means the consideration of environmental issues shall be firmly integrated into business management.



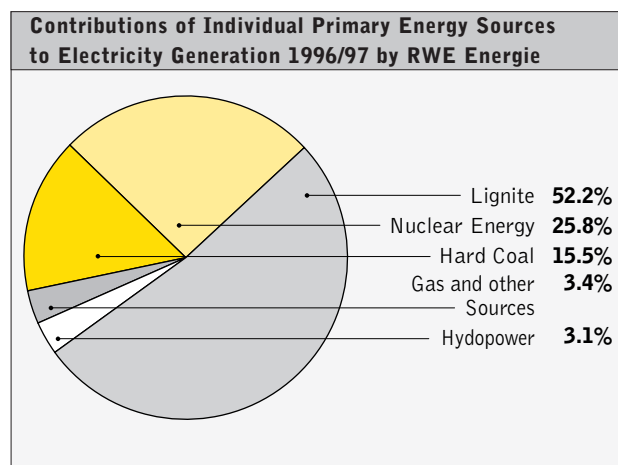
Energy.

# Increase of Efficiency.

The main task of the group division Energy is the supply of electricity, as well as gas, water, district heating and process heat. Most of this supply is provided by RWE Energie AG, which employs approximately 20,000 people. For this purpose the company operates a series of various types of power stations, and an extensive transmission and distribution network.



The lignite-fired power station Neurath, with an output of 2,100 MW, is the youngest addition to RWE Energy's power station park.



Particularly relevant, in environmental terms, are the operations of fossil-fuelled power stations (lignite, hard coal, oil and gas), of a refuse incinerator, as well as the operation of nuclear power stations. A large number of hydro-electric plants, as well as numerous wind power and photovoltaic belong also to the power station pool, which includes RWE Energie's own as well as contracted power plants. The park has a total output of 26,700 Megawatts. The transmission and distribution networks for electricity, district heating, gas and water similarly need to be considered within the environmental context.

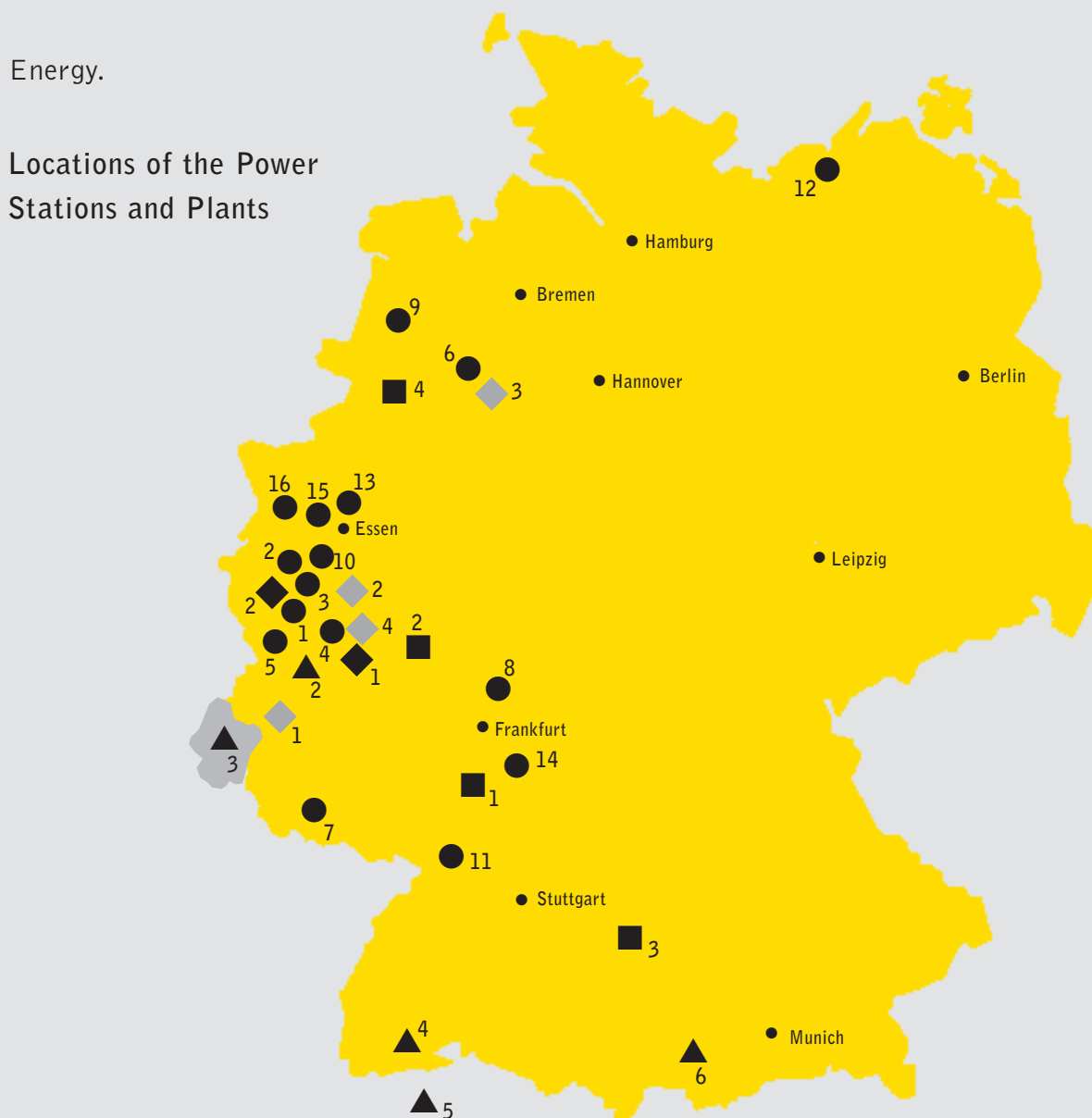


**"This year's summer, uncharacteristically hot in large parts of the world, has lead yet again to disputes, as to whether this is proof of the impact of human activities on the climate, or whether it is simply a natural climatic fluctuation. We do not know. But we are taking precautions and are doing everything in our control to minimise potential impacts of the electricity generation from fossil fuels, which the world can not do without for the foreseeable future. Some of our measures are the improvement of efficiency, the responsible use of nuclear energy, the promotion of techniques to use renewable energy sources efficiently, the promotion of techniques and awareness regarding the economical use of energy. In the sense of sustainable management we can not forget, however, that the environment is only one of limited resources. Neither natural gas, which is environmentally more acceptable than coal, nor the financial means to make everything desirable reality, are unlimited either."**

Dr. Dirk Kallmeyer, Director of the central unit of fossil-fueled power plants (RWE Energie AG)

Energy.

## Locations of the Power Stations and Plants



### ● Conventional Power Plants

	Net Output in MW
1 Niederaußem	2,650
2 Frimmersdorf	2,137
3 Neurath	2,112
4 Goldenberg	171
5 Weisweiler	2,066
6 Ibbenbüren (76%)*	709
7 Ensдорf	273
8 Hoechst	108
9 Meppen	610
10 Huckingen	580
11 Ludwigshafen	394
12 Rostock (24.6%)*	509
13 Scholven (50%)*	1,344
14 Dettingen	93
15 Karnap	37
16 Voerde (25%)*	1,288

### ■ Nuclear Power Plants

	Net Output in MW
1 Biblis	2,407
2 Mülheim-Kärlich	1,219
3 Gundremmingen (75%)*	2,572
4 Emsland (12.5%)*	1,290

### ▲ Hydro-Electric Plants

	Net Output in MW
1 Hydropower Group Herdecke	184
2 Hydropower Group Bernkastel	252
3 SEO Vianden	1,096
4 Schluchseewerk (50%)*	1,730
5 Albruck-Dogern (Radag) (77%)*	80
6 Bawag-Stufen, Lech (50%)*	351

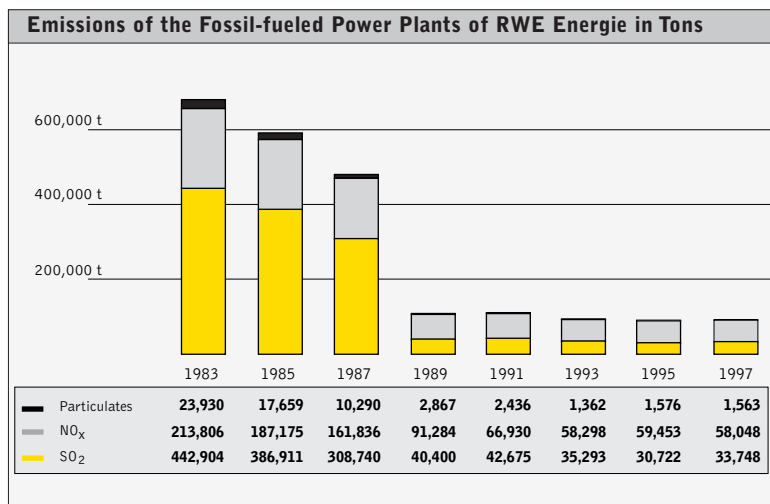
### ◆ Photovoltaic Plants

	Net Output in MW
1 Koblen-Gondorf	0.34
2 Neurather See	0.36

### ◇ Wind-Driven Plants

	Net Output in MW
1 Kirf	1.0
2 Grevenbroich	0.6
3 Stewwede	1.5
4 Sechtem	0.6

\* ownership of RWE Energie



Fundamental environmental aspects of electricity and heat generation are the air emissions, particularly sulphur dioxide (SO<sub>2</sub>), nitric oxides (NO<sub>x</sub>), particulates, carbon dioxide (CO<sub>2</sub>), steam, heat and noise. Other aspects are the generation of wastes, impacts on the aquatic environment and impacts on landscapes and the terrestrial environment through land use. Further, electrical installations create low frequency electromagnetic fields.

## Environmental Management

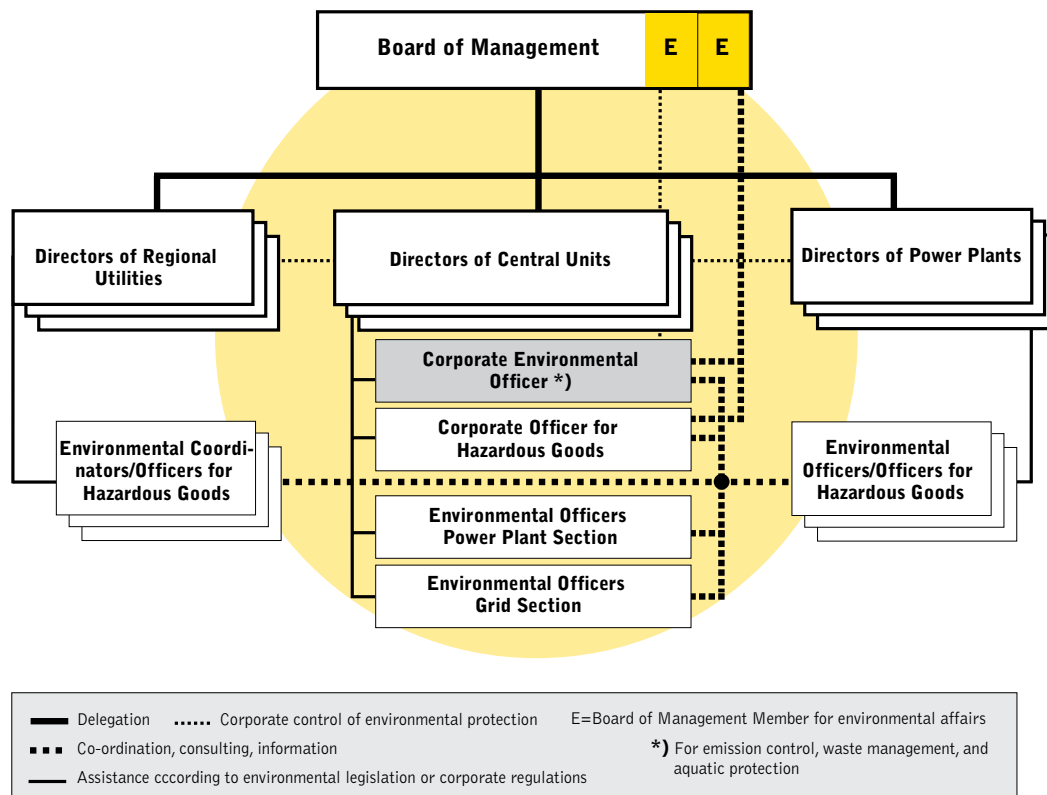
The corporate goals of RWE Energie which represent the commitment of the company, address the economical use of energy, from generation to end use (from cradle to grave). They therefore complement the environmental directives of RWE AG by being more specific to the particular business of the electricity sector. RWE Energie has installed a powerful management system which is laid down in its environmental directive. All units and individuals which have special responsibilities and tasks concerning environmental protection are included. Within the Board of Directors, one member has been nominated as the environmental representative for the power stations and one as the environmental representative for the powerline network. The operational management is documented in the 'Power Unit and Environment Manual' (for conventional

power stations), the 'Organisational Manual' (for nuclear power stations) and the chapter 'Environmental Protection' in the 'Construction Site Manual'. Within the area of the powerline networks, detailed instructions regarding the most important environmental considerations have been issued. A comprehensive manual is being prepared. Overall, approximately 150 Environmental Officers and Coordinators look after environmental management at the various locations. This includes the prevention of air and water pollution, waste disposal, hazardous goods, prevention of hazardous incidents, radiation protection, as well as nature conservation and the protection of landscapes. To enable the exchange of information and experiences, regular workshops for the representatives of the various areas are held.

To facilitate the utilisation of the experience and knowledge of as many staff as possible, environmental protection is part of the corporate suggestion system. Ideas which can be realistically implemented, are rewarded appropriately. For the purpose of overall co-ordination, the persons that are mainly concerned with environmental tasks within headquarters, regularly meet for a so-called 'Environmental Protection Round Table'. A special task force deals with all questions arising at the interface between environmental protection and occupational health and safety, and co-ordinates those tasks which are relevant for both areas.

Energy.

### Environmental Protection Organisation RWE Energie AG



The regular review of the environmental organisation and management through audits is part of the risk management of RWE Energy. At the same time compliance with legislative requirements and internal environmental regulations is constantly controlled. Further precautions are represented by the fire-fighting teams, fire-water retention systems, emergency plans and plans for hazardous incidents, as well as the establishment of an emergency task force. Additional organisational duties are set out in the Environment Manual. Last, but not least, all hazardous substances used in the plants are labelled and listed, according to their level of hazard with respect to industrial health and safety, as well as to environmental protection. All data, as well as corresponding instructions and guidelines for the handling of these substances, are compiled in a data base.

### Training and Education.

Environmental protection is not only a constant part of training, but also of further education. Thus, the following elements of environmental education are provided – in addition to those required by legislation:

- courses focussing on all environmental topics, as part of the company's education programme,
- special seminars on current issues,
- the discussion of environmental issues at regular business meetings,
- courses for power station workers.



## Procurement and Logistics

Ecological criteria are taken into account during procurement. For this purpose, the procurement staff discusses the use of environmentally more compatible products with the technical staff. If need be, the Waste Management Officers are consulted as well. Special waste management conditions have been developed for waste disposal contractors.

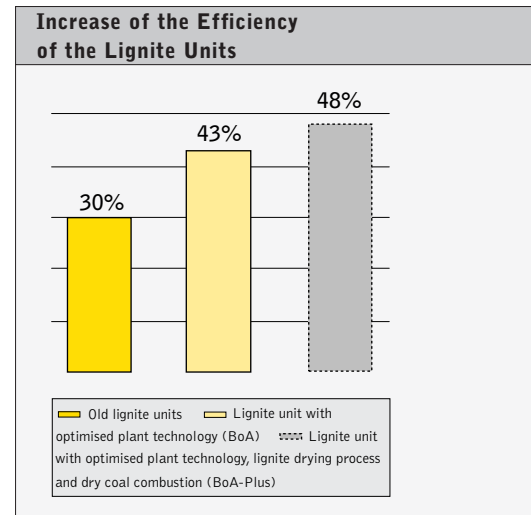
Most power stations and the larger works have rail connections for the purpose of rendering transport as environmentally friendly as possible. The conveyor systems which deliver lignite to the power stations, as well as remove the ashes, are equipped with dust and noise protection installations. The vehicle fleet needs to have low emissions and noise levels. To achieve this, the fleet is regularly monitored and serviced.

## Environmental Protection Measures

RWE Energie has, over the years, put a number of measures in place to reduce the environmental impact associated with the generation of electricity and to contribute towards the careful use of resources.

- All power stations are equipped with flue gas desulphurisation plants to reduce the emission of sulphur dioxide. On average the emissions are more than 90% lower than in 1983. At the same time the emissions of nitric oxides have been decreased by more than 70%. This was achieved through the reconstruction of the boilers of all lignite-fired power stations, as well as through employing catalysts in the hard coal-fired power stations.

- From today's view the only way to reduce the emission of CO<sub>2</sub>, which inevitably is released during the combustion of fossil fuels, is to increase the efficiency of the power stations. Thus, the more electricity that can be generated per unit of fuel, the lower are the specific CO<sub>2</sub>-emissions. The increase of the efficiency of the power stations also contributes to the conservation of the resources. Within the framework of the retrofitting programme, which was completed according to plan, the larger turbines of the power stations were technically improved. This leads to an increase of their efficiency of about 1%. Assuming a stable level of electricity generation, this measure decreases annual CO<sub>2</sub>-emissions by approximately two million tons. The next step will be the construction of the first lignite unit with optimised plant technology (BoA). Its efficiency is nearly 13% higher compared to the older units that will be replaced.



- Using co-generation, RWE Energie provides thermal energy for customers. This is done in existing, as well as new power stations. The thermal energy is supplied as district heating and for process heating. Particularly the replacement of the old plants of larger customers with modern gas-fired combined heat-and-power plants, leads to a substantial reduction in emissions because of their high energy efficiency.

## Energy.

- Revamping and retrofitting measures of turbines and control devices of hydro-electric plants have led to a more efficient use of hydro-energy and therefore to an increase in electricity generation from renewable sources. The programme is being continued.
- The lignite-fired power stations conserve water by recycling it. Through these means they were able to retain their water use on the same level, despite the extensive plant extensions that were required for the installation of flue gas desulphurisation equipment. Effluents were reduced by about 50% at the same time.
- To prevent aquatic pollution, extensive monitoring programmes have been performed at all underground waste water pipes. This has been done for all transformer stations and will be completed for the power stations by the end of 1998. Appropriate repair measures have been taken or have been firmly planned.
- There are plans to improve the collection systems for oil leakage at a third of the 42,000 transformer stations within the distribution system. To date already 5,000 stations have been retrofitted.
- The hydro-electric plants have changed the use of oil as a lubricant to water or biologically easier degradable oil at a number of turbines.
- Lime from the water treatment plants is used in the flue gas desulphurisation plants. This is one practice that is used to minimise waste and to conserve resources through internal or external re-use. The ashes and slag from the hard coal-fuelled power stations are used as raw materials for construction materials. The ashes from the lignite-fired power stations are used to back-fill open-cast mines. The gypsum that is generated by the flue gas desulphurisation scrubbers is used as a raw material by producers of construction materials. Possibilities for re-use were developed for a wide range of other wastes. These measures and procedures are defined within the waste management concepts for the power stations and the regional utilities.

## Communication

The division 'Public Relations and Information' maintains contact with environmental journalists and regularly issues press releases on environmental issues. Staff of RWE Energy receive information on environmental protection through the company magazine 'Verbund' and through publications, such as circulars and leaflets of the various plants. The power stations and the regional utilities organise regular open days for the public and offer public viewing of the plants. Business reports and numerous brochures on a variety of environmental topics are available for customers and suppliers. Customers at tariff rates can obtain advice on energy conservation at the more than 75 customer forums that RWE Energie has set up within the towns of its supply area. To expand the exchange of environmental know-how beyond the boundaries of the company, representatives are part of relevant committees and working groups of numerous national and international federations and associations. RWE Energie co-operates with plant producers and research institutions within research and development projects to continuously improve the technology of power generation. In the past years, close contact has also been kept with nature conservation and ornithological societies.

# In Focus.

## Nuclear Energy

The advantage of nuclear electricity generation is that it does not cause emissions of CO<sub>2</sub> and air-borne pollutants. As disadvantage, the issue of nuclear plant safety was predominant in the public discussion for a long time. Today, the main concern is rather the lack of an acceptable solution for waste disposal. The three nuclear power stations of RWE Energie AG are amongst the safest in the world. They are strictly controlled through their own technicians, as well as the supervising authorities. Within the framework of the programme of Power Station Surveillance, termed 'KFÜ', data on emissions, plant conditions and radiation of the surrounding environment are continuously gathered and automatically passed to the authorities. In the case of anything unusual, the authorities contact the respective power station immediately. The units in Biblis and Gundremmingen made, together with a 12.5% share in the Emsland nuclear plant, a contribution of 25.8% to the total electricity generation of the business period 1996/97. The power station in Mülheim-Kärlich has not been able to commence operation again, due to permit disputes within the authorisation procedure.

There are 784 fuel assemblies within each unit of the boiling water reactors of the power station in Gundremmingen. On 31.12.1996, 80 of these fuel assemblies contained mixed-oxide fuel originating from the reprocessing of earlier used nuclear fuel. The pressurised water reactors in Biblis contain 193 fuel assemblies per unit. In the financial year of 1996/97, a total of 288 new uranium assemblies and 32 new mixed-oxide assemblies were inserted in Gundremmingen and a total of 172 new uranium assemblies were inserted in Biblis.

Since 1977, a total of 233 containers with spent fuel assemblies were transported from the RWE Energie nuclear plants. 192 were delivered to the reprocessing plant of COGEMA in La Hague (France), 37 went to BNFL in Sellafield (UK), three of them went to the intermediate storage facility in Ahaus and one went to the intermediate storage facility in Gorleben. On arrival, 30 containers from Biblis and 9 from Gundremmingen showed radioactive contamination which was higher than the limit value of 4 Becquerel per square centimeter. However, rather than the Becquerel value, the dose of radiation, which is measured in Sievert, is relevant as a potential health hazard. The radiation dose emanating from the transport of the containers, which can affect staff involved in the operation, was consistently below 0.1 Millisievert. It therefore represented a maximum of 5% of naturally occurring radiation in Germany. The investigations of the radiation protection commission confirmed this finding. Apart from one container stored in Ahaus, which showed a minor exceeding of the limit value, no contamination was reported after 1994. To enable renewed transport as soon as possible, RWE Energie has become involved in a joint programme with other nuclear plant operators. The aim is to use improved methods of protection and decontamination, intensified controls and measurements, as well as a greater transparency regarding responsibilities and processes. By order of the Federal Ministry for the Environment and Nuclear Safety the "Gesellschaft für Reaktorsicherheit" (Institution for Nuclear Safety) has scrutinized and approved the main elements of that programme. For the detailed procedures of application agreements have to be brought about with the competent authorities of the Federal States.

The licensed storage facilities at Gorleben and Ahaus are available for long-term and secure intermediate storage of the spent fuel rods, as well as of highly radioactive reprocessing wastes. Gorleben and Mitterteich are intermediate storage facilities for low- and medium-level wastes. Such wastes are also temporarily stored at the power station sites themselves. Low-level wastes from operation and decommissioning are currently transported to the final repository in Morsleben. After completion of the current licensing procedures, final storage of these wastes will be in the underground repositories Konrad and Gorleben.

During the fiscal year 1996/97, a total of 36 events which have to be reported to the authority occurred within the nuclear power stations of RWE Energie. According to the three-stage German registration ordinance, 35 of these events belonged to the lowest category N (Normal). These are events that have no, or only minor safety significance and which have to be reported to the authorities only within 5 days. Solely one incident belonged formally to the category E, although it was insignificant in terms of practical safety. Within this category, incidents need to be reported within a 24-hour period. Similar to the previous years since the introduction of the registration ordinance (1991), there were no incidents of the category S. Incidents of this category would have to be reported immediately.

According to the seven-stage International Nuclear Event Scale, (INES), 35 of the 36 events mentioned above fell into category 0 (no or very minor safety significance). The event that was defined as belonging to German category E, also fell within this category. Only one of the 36 events fell into INES category 1 (incident). Similar to the previous years since the introduction of the INES scale (1991), there were no incidents of categories 2 to 6.

### Distribution Network Design and Maintenance of Pathways

The extensive network of overhead lines of RWE Energie, with a total length of more than 47,000 kilometres, is used for long-distance transportation as well as for regional distribution of electric energy. For the surfaces they occupy, RWE Energie holds the corresponding usufructs. The use is done in an environmentally sensitive way, as far as this is feasible. For example only low growth is acceptable within forested corridors to ensure safe electricity transmission. This is the only way to exclude the risk caused by falling trees to the overhead lines.

In the past, this requirement often led to deforestation. However, in the past ten years the maintenance methods have been developed in such a way that valuable ecosystems have formed in the pathways. Jointly with conservation experts, RWE Energie was the first electricity supplier to develop methods of environmentally compatible pathway maintenance. For pathways of overhead lines which pass through forests, long-term ecological management plans are developed.



**Ecosystem management within overhead lines – 110kV line of RWE Energie.**

Where they pass through open landscape, as well as gardens and parks, the methods for maintenance have similarly been optimised in ecological terms. The principles and methods have been made compulsory and have been compiled in a guideline that was issued by RWE Energie in October 1995. In this way, the company made an important contribution to the creation of valuable habitats for animals and plants.

During the planning process for new pathways, RWE Energie also co-operates closely with conservation and ornithological experts. One of the aims is to avoid any impact to the routes of migratory birds or important rest areas. Together with ornithological societies, certain ways of marking the power lines have also successfully been developed which nearly exclude any impact on the birds through the presence of the power lines altogether.

## **Promotion of the Rational Use of Energy and of the Use of Renewable Energie**

Since many years, RWE Energie has been offering individual advice on the issue of the rational use of energy. This is done within its 75 customer forums, as well as through the launching of relevant programmes and projects. Some of these programmes are the following:

### **Customer Energy Saving Service (termed 'KesS')**

With this programme RWE Energie helps its residential customers to purchase domestic appliances which save energy, by making a contribution of 100 DM. The first 100 Million DM were already spent after three years, therefore RWE Energie invested another 20 Million DM into the programme. Since July 1997, the premium for the purchase of a modern heat-pump tumble drier is as high as 250 DM.

### **ProKom**

This programme which was established in 1990 is directed towards the municipal partners of RWE Energie. It offers advice and financial support for the rational use of energy in municipal properties. To date approximately 7,200 projects were supported with around 120 Million DM. This initiated a further investment by the partners of more than 470 Million DM.



Photo voltaic plant, financed by the green tariff programme on the roof of the Emmy-Noeter-Campus of the Siegen University.

### KesS INDUSTRIE

Apart from providing advice, this programme also offers financial support for innovative ways of saving energy, particularly in heat using processes. 13 Million DM out of the 20 Million DM that have been reserved for this programme have already been paid to subsidise industrial and commercial customers.

### KesS SOLAR

Since 1996, 20 Million DM have been made available to promote the use of renewable energy sources by customers. RWE Energie subsidises the acquisition of solar collectors, heat pumps and photovoltaic installations connected to the distribution net. To date a total of around 10 Million DM were spent on approximately 5,000 subsidised projects.

### Green Tariff

The green tariff of RWE Energie enables the customers to influence the type of electricity generation. If they pay an additional 20 Pfennig per kilowatt hour for a chosen amount of electricity, RWE Energie adds the same amount and uses these financial means to cover the additional costs of plants using renewable energy. To the extend the clients order "green" kilo watt-hours in that way, RWE Energie constructs new plants which use renewable energy sources, such as wind, water and solar energy. In 1997, 1.1 Megawatts of wind power and about 1.0 Megawatt solar power could be financed in this way.

### Civil Engineering Manual and Competition for Architects

RWE Energie has issued a Civil Engineering Manual which contains all the principles, as well as a examples and advice related to energy saving construction and renovation methods. It has become a standard reference for inventors, house owners, and architects and has now been issued in its 12th edition, as well as being available on CD-ROM. Within the context of energy-saving architecture, RWE Energie also organised the ÖKOTOP competition, jointly with two producers of construction materials, which was geared towards students of architecture. A total of ten prizes were awarded in the categories detached houses, terraced houses, and semi-detached houses.



# Environmental Programme Energy.

## Reduction of Annual CO<sub>2</sub>-Emissions by 2.5 Million Tons (assuming unchanged electricity generation from lignite)

- Construction and commissioning of the 950 Megawatt lignite unit with optimised plant technology (BoA) and decommissioning of equivalent capacities of old lignite units.

## Further Increase of the Efficiency of Electricity Production from Lignite by approx. 5%

- R & D Programme: Testing of processes for lignite-drying and development of dry-coal-combustion technology to commercial scale – construction and commissioning of demonstration plants (subsequent combination with BoA to BoA-Plus).

## Reduction of Annual CO<sub>2</sub>-Emissions by 9-10 Million Tons

- Trying hard to attain the permit and re-commissioning of the nuclear power station Mülheim-Kärlich.

## Reduction of Specific CO<sub>2</sub>-Emissions from the Electricity Production from Lignite by at least 27%

- Staged substitution of our existing lignite units with new plants using best available technology.

## Reduction of Specific Consumption of Fossil Fuels, as well as Emissions

- Staged expansion of the supply of district heat and process heat from existing power plants.
- Staged substitution of customers' existing co-generation plants with plants using state-of-the-art technology, e.g. combined cycle power plants.
- Testing of new materials and techniques to improve efficiency of boilers for new power plants.
- Testing of fuel cells for decentralised use within the context of co-generation on the basis of natural gas.

## Reduction of Nuclear Fuel Consumption and of Spent Fuel Assemblies Arising

- Use of nuclear fuel with higher enrichment, optimisation of fuelling strategies and operation.

## Increase of Electricity Generation from Renewable Sources

- Step-by-step improvement of the efficiency of existing hydro-electric plants.
- Construction of new, small hydro-electric plants.
- Promotion of the development of wind-power-technology, particularly through the construction and testing of demonstration plants.
- Promotion of the development and use of photovoltaic energy generation, mainly through trials in demonstration plants and the construction of new plants within the green tariff programme.

## Reduction of the Consumption of Fuels and of Emissions

- Introduction of a computerised transport planning system for the entire network area.

## Reduction of the Consumption of Drinking Water in the Network Area by 5%

- Increased use of rain- and groundwater for irrigation purposes and sanitary installations.

## Relief of Municipal Wastewater System in the Network Area

- Local infiltration of rain waters and greening of roof surfaces.

## Further Reduction of Noise Emissions from Switching and Transformer Stations

- Procurement of transformers and circuit breakers with the lowest noise emissions.

### Timeframe

by 2002/3

by 2000

by 2030

by 2003

by 2010

starting 2002

by 2002

by 2000

by 2003/4

	Timeframe
<b>Environmentally Sensitive Maintenance of the High Voltage Network</b> <ul style="list-style-type: none"> <li>● Development of maintenance plans, defining the type, extent and chronological sequence of maintenance measures, introduction of the new concepts in the entire high voltage network.</li> </ul>	by 2002/3
<b>Optimisation of Bird Protection within the Transmission Network</b> <ul style="list-style-type: none"> <li>● Employment of bird deterrence markings on overhead high voltage lines in exposed areas used by birds.</li> <li>● Use of construction methods that do not impact on birds in the overhead medium-voltage network.</li> </ul>	by 2003/4 by 1999/2000
<b>Further Reduction of Waste Generation</b> <ul style="list-style-type: none"> <li>● Increased use of re-usable wastes at the respective plants (power stations).</li> <li>● Step-by-step increase of the recycling rates of unavoidable wastes, e.g. by means of appropriate collection and storage.</li> <li>● Step-by-step increase in the re-use of excavation and demolition wastes, especially through separation and conditioning.</li> <li>● Increase in the re-use of lignite fly ash within the construction and construction material sector.</li> </ul>	by 2003
<b>Use of Substances and Materials which are Environmentally more Compatible</b> <ul style="list-style-type: none"> <li>● Investigation of options for the substitution and standardisation of materials, definition of a substitution and saving programme.</li> </ul>	by 2000/1
<b>Reduction of the Emissions of Solvents and the Use of Zinc for Corrosion Protective Coatings</b> <ul style="list-style-type: none"> <li>● Introduction of water-based coating systems for steel constructions overhead line pylons, transformers, steel construction); continuation of the suitability tests and the development of applied technology (Large scale test, 36 months).</li> <li>● Large scale application.</li> </ul>	by 1998 by 2003
<b>Reduction of Use and Emissions of Chromium</b> <ul style="list-style-type: none"> <li>● Future exclusive use of chrome-free firebricks and tamping clay for fire-proof linings.</li> </ul>	immediately
<b>Protection of Soil and Groundwater</b> <ul style="list-style-type: none"> <li>● Development and introduction of organisational measures and education for the purpose of pro-active soil protection.</li> <li>● Step-by-step up-grading of oil leakage collection devices at distribution stations.</li> <li>● Development of a data base for contaminated sites.</li> <li>● Review of remediated contaminated sites on the basis of the requirements of the new Soil Protection Act.</li> </ul>	by 1999/2000 by 2010 by 2000/1 2000/1
<b>Improvement of the Environmental Management System</b> <ul style="list-style-type: none"> <li>● Introduction of a comprehensive environmental protection manual for the network area, completion of the system of framework instructions.</li> <li>● Completing the environmental reporting system.</li> <li>● Extension of the environmental reporting system to the main affiliated companies.</li> <li>● Extension of the education and training programme, improvement of education methods and materials.</li> <li>● Completion of the data base system 'Substances Subject to Surveillance' (ISUS) designed to assist strict compliance with all regulations, as well as the efficient management and documentation of all processes within the areas of 'Hazardous Substances' (occupational health and safety), 'Hazardous Goods' and 'Waste Management'.</li> </ul>	by 2000/1 by 1999 by 1999/2000 by 2001 by 1999

## Balance of Inputs and Outputs

		Reporting Period				
	Dimension	1992/93	1993/94	1994/95	1995/96	1996/97
<b>INPUT</b>						
<b>Energy</b>						
Lignite	t	87,045,447	86,631,151	86,313,630	86,073,637	88,316,995
Hard Coal	t	1,532,437	1,405,153	1,269,051	1,322,892	1,132,927
Nuclear Fuels	t	126	81	116	62	139
Petroleum	t	17,068	23,157	23,531	19,757	18,163
Natural Gas	1,000 m <sup>3</sup>	642,000	616,000	638,000	680,000	639,000
Other Gases	1,000 m <sup>3</sup>	2,412,000	2,964,000	3,366,000	3,067,000	3,228,000
Fuels	1,000 l	5,056	4,657	4,510	4,262	3,446
Wastes	t	555,604	749,146	651,674	650,754	655,171
<b>Water</b>	1,000 m <sup>3</sup>	3,792,587	3,569,271	3,634,726	2,062,579	4,114,979
<b>Raw Materials and Consumables</b>						
Natural Gas	1,000 m <sup>3</sup>	533,000	630,000	646,000	756,000	758,000
Electricity (external sources)	MWh	27,981,503	27,329,658	30,267,708	29,561,150	22,786,043
Lime	t	649,927	598,575	570,384	507,311	505,256
<b>OUTPUT</b>						
<b>Products</b>						
Electricity	MWh	121,503,802	123,569,517	125,582,254	124,308,075	129,747,122
District Heat	MWh	1,716,000	1,570,000	1,506,000	2,914,000	4,442,000
Natural Gas	1,000 m <sup>3</sup>	533,000	630,000	646,000	756,000	758,000
Water	1,000 m <sup>3</sup>	33,614	35,507	35,132	37,913	36,835
<b>Emissions</b>						
CO <sub>2</sub>	t	89,135,760	87,386,090	88,583,020	91,050,925	90,177,363
CO <sub>2</sub> from electricity from external source *	t	18,773,000	16,699,000	18,461,000	19,771,000	16,947,000
CO	t	34,759	32,556	32,442	29,291	28,109
SO <sub>2</sub>	t	37,085	36,930	34,624	29,219	31,038
NO <sub>x</sub>	t	62,368	58,008	58,553	51,787	51,392
Particulates	t	1,564	1,523	1,622	1,646	1,643
Heavy Metals	t	6.5	6.3	6.2	5.6	5.5
<b>Wastes</b>						
for Re-use	t	7,280,659	6,939,321	6,626,484	6,289,674	6,499,239
Gypsum for Re-use	t	1,436,579	1,314,760	1,220,021	1,095,018	1,059,284
Ash for Re-use	t	5,725,392	5,469,328	5,177,855	5,013,764	5,293,020
for Disposal	t	91,938	62,355	37,776	48,447	32,193
Spent Nuclear Fuel Assemblies	t	55	101	97	76	54
Radioactive Waste **	t	254	268	367	310	175
Effluent	1,000 m <sup>3</sup>	69,198	69,410	70,949	66,248	62,789
Effluent Load COD ***	t O <sub>2</sub>	1,079	1,076	1,073	1,005	941
Cooling Water to Receiving Water Course ****	1,000 m <sup>3</sup>	3,529,114	3,294,771	3,365,411	1,787,346	3,846,506
Water Loss at Cooling Towers	1,000 m <sup>3</sup>	154,387	161,635	159,686	167,939	172,738

\* Emission coefficients according to supplied mix

\*\* unconditioned

\*\*\* Chemical Oxygen Demand

\*\*\*\* 1995/96 shut-down of Biblis Unit A

The INPUT of 'electricity' within the table represents the electricity obtained from other suppliers. Most of the cooling water is used by Biblis power station, which normally uses water from the Rhine for cooling purposes. The large fluctuation in 1995/96 was due to one of the power units being inoperative.



Mining and Raw Materials.

# Chain of Responsibility – with no Missing Links.

The group division Mining and Raw Materials includes national as well as international subsidiaries and associated businesses. Its core business is the extraction and refining of lignite coal. The main operators are the coal-mining companies Rheinbraun AG and Lausitzer Braunkohle AG (LAUBAG), in which the RWE Group has a 45% holding. Approx. one quarter of the public electricity supply in Germany is based on lignite from the Rhineland and Lusatia. Rhenish open-cast mines deliver approx. 100 Million tons and those of the Lusatian area about 50 Million tons every year.

Apart from open-cast mining of coal and mineral raw materials, clay and gravel, Rheinbraun and LAUBAG are also involved in refining some of the lignite to pulverised lignite, briquettes and fluidised-bed coal. They are also involved in the treatment of groundwater to make drinking and process water. In addition, Rheinbraun produces lignite coke and operates lignite-fired power stations to generate electricity and steam for the coal refineries. Together, the firms have a total workforce of some 20,000.

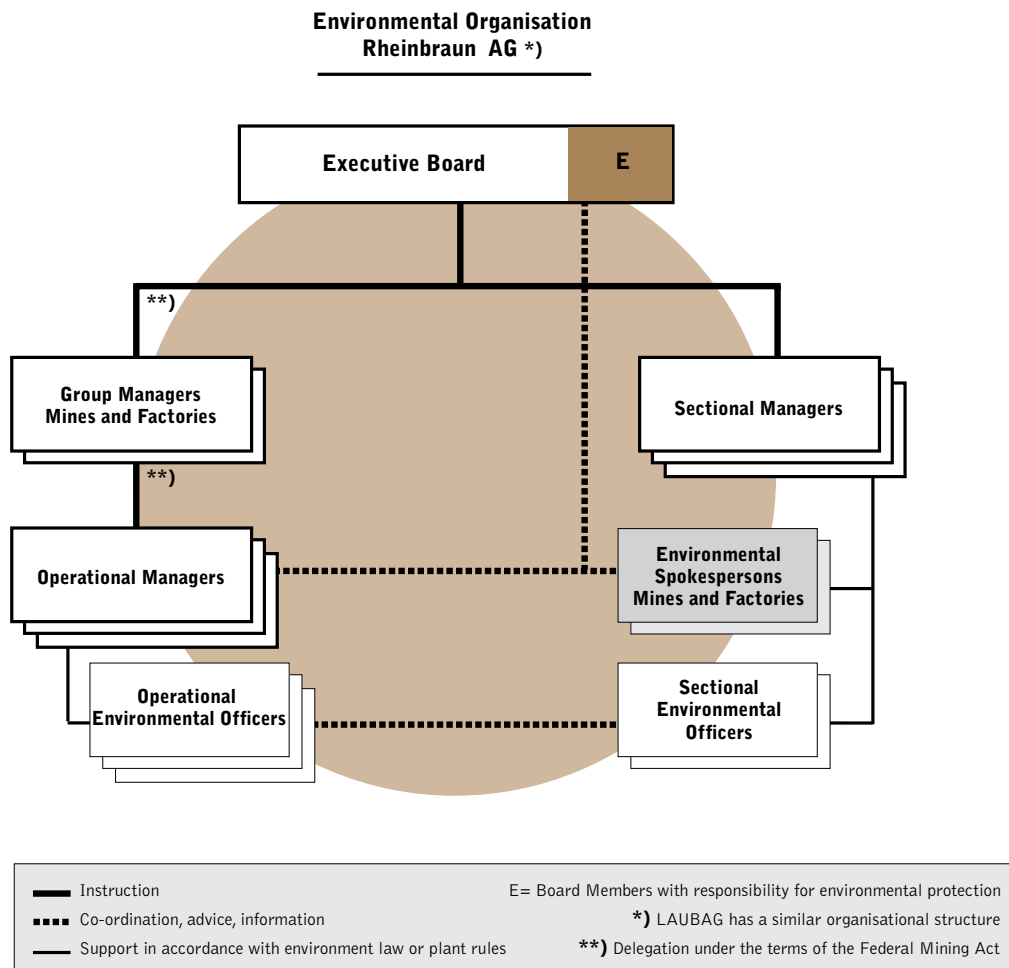
The most relevant activities in environmental terms are the mining of coal, its refining in briquette factories, and its combustion in power plants. The main sources of environmental impact in mining operations are the temporary landtake, the pumping and extraction of groundwater, and the generation of dust and noise. The use of coal in the pit power plants leads to emissions of sulphur dioxide (SO<sub>2</sub>), nitric oxides (NO<sub>x</sub>), carbon dioxide (CO<sub>2</sub>) and particulates. Ash is produced by the combustion process.

Even though lignite mining inevitably entails interference with the landscape, both companies stand for an environmentally aware approach to Nature. The design of the post-mining landscape and the measures taken – securing the groundwater in particular – to preserve wetlands worth protecting are considered exemplary world-wide.

## Environmental Management

RWE AG environmental guidelines apply to all companies in this group division. To complement them, specific mining guidelines have been developed as well. The main environmental goals and protection measures are described in the lignite mining plans for the various open-cast mines and defined in more detail in framework and master operation plans and in water law approval procedures. Implementation of these measures at the various locations occurs as part of the operational and investment programmes, which are regularly reviewed and updated.

One special feature of mining companies is the appointment under mining law of certain responsible persons. These people are chosen for all levels, from the Executive Board via all line staff down to the operational staff on site. The aim is to form a chain of responsibility with no missing links. This system is also used for implementing environmental protection and safety as well, since these are firmly embedded in each organisational level. Those responsible at all levels are supported and monitored by the Environmental Officer. A total of 64 Environmental Officers are appointed at Rheinbraun and 10 at LAUBAG. Their remit includes the protection of the aquatic environment, pollution control, incident prevention, operational safety, transport of hazardous goods, and waste management. Process and work instructions control the environmentally relevant measures that need to be taken on a day-to-day basis. These measures relate to the start-up and shutdown of refinery plants, the operation of sprinklers to reduce dust in the open-cast mines, the compliance of power plant emissions with license conditions, and adherence to the discharge conditions for sump and waste water. Rheinbraun is currently busy preparing an Environment Manual. The aim is to further improve the information for staff at all managerial levels in each operational area on responsibilities, work sequences and structures in operational environmental protection.



Current environmental issues are discussed and cross-departmental know-how and experience exchanged in various committees and task force meetings. At both Rheinbraun and LAUBAG, environmental protection is an important element in the company suggestion schemes and a key component in our vocational and further training programmes to include as many staff as possible.

Safety assessments, as well as emergency and risk management strategies, and the stipulations contained in a health and safety document ensure that the workforce acts in a co-ordinated and systematic manner in any emergency to prevent risks to people and their environment. All hazardous substances in use are labelled according to their danger potential and are strictly controlled.



## Procurement and Logistics

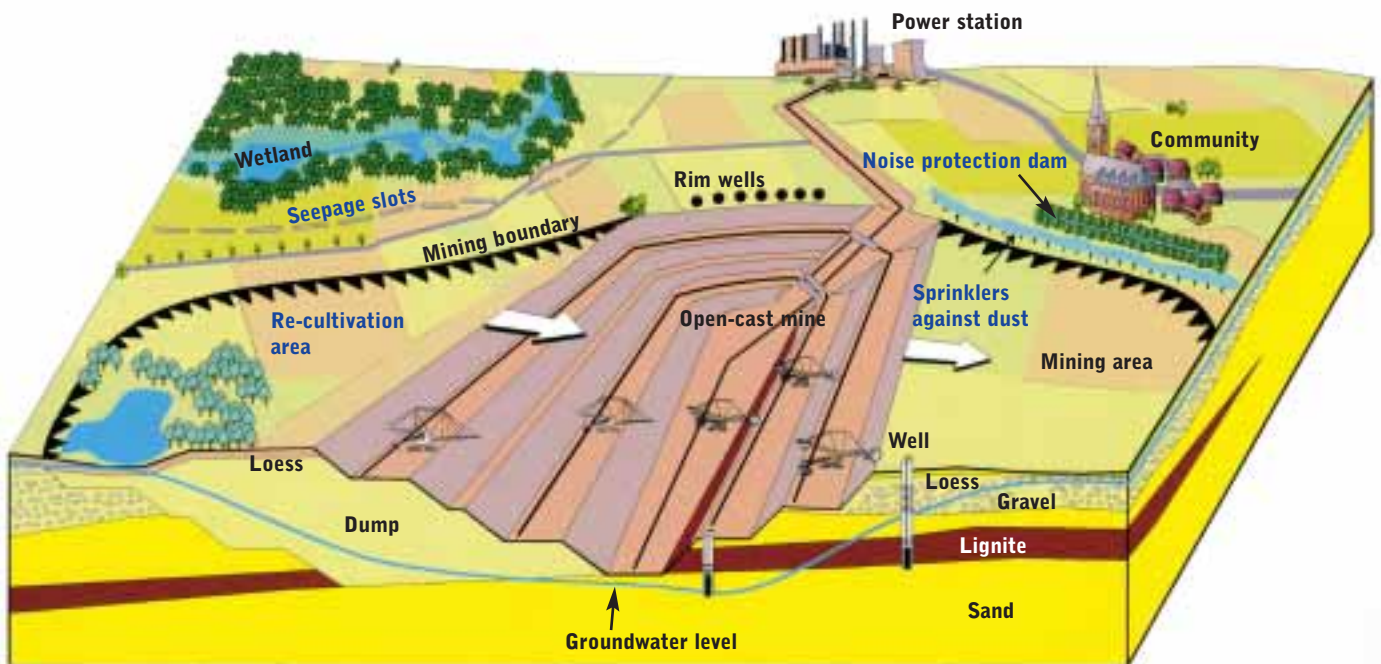
To promote the conservation of resources at all levels, the companies ensure that the materials procured are recyclable. LAUBAG has compiled a manual for staff containing procurement guidelines and checklists addressing ecological criteria. Where vehicles are procured, one important condition is that they be low in noise and pollution. Currently Rheinbraun is undertaking long-term tests on vehicles which use rape seed oil as fuel.

To reduce the need for packaging materials, Rheinbraun and LAUBAG mainly use returnable pallets and containers. Industrial customers are supplied entirely free of packaging by silo vehicle with pulverised lignite and fluidised-bed lignite, preferably by rail. The transport of lignite from open-cast mine to refinery and to the power plants of RWE Energie AG or Vereinigte Energiewerke AG (VEAG) is entirely by rail or conveyor belt system.

## Processes and Products

The range of environmental measures in lignite mining is wide and includes planning, technical and organisational measures. The most important are those that avoid or minimise emissions at source. They include the minimising of groundwater extraction during mine dewatering; the irrigation, greening or covering of longer-term open areas; the sprinkling of bucket wheels, conveyor belt transfer locations and bunkers; the use of equipment, drives or belt pulleys with noise reduction devices; and the encasing of plant units. Such action can be effectively supplemented by the downstream construction of protective dams and by providing protective vegetation.

**Diagram of a lignite open-cast mine**



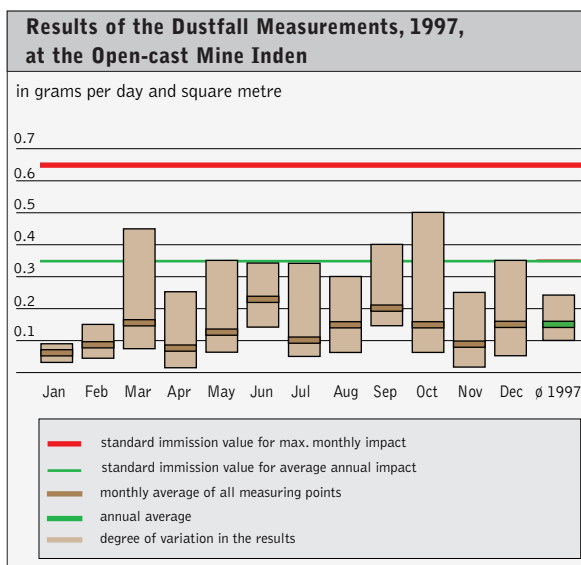
## Mining and Raw Materials.

The use of high-performance filters to minimise dust emissions is a priority measure in the processing of lignite at refineries. The coal-containing effluents from the refineries are thoroughly treated and returned to the plant as part of a closed loop system. The coal extracted during the effluent treatment process is used as fuel in power stations.

The pit power plants, which use lignite to produce energy for the refineries, have high efficiency rates – indicating the max. possible energy from the input fuel. So they help conserve resources. The efficiency rate, which typically lies at 85%, is achieved by the co-generation principle used by Rheinbraun. Flue-gas desulphurisation processes using lime reduce sulphur concentrations in power plant emissions. The power plants lower their nitrogen oxide levels using special techniques, such as fluidised-bed combustion.

Waste management concepts for all operational areas ensure that unavoidable waste is separated for collection and then either re-used wherever possible or else appropriately disposed of. The ash produced in power plants is used for refilling exploited sections of the mine.

At the product development stage as well, ecological aspects are already considered. Only coal low in sulphur and ash is refined, so that use of the sold products entails the lowest possible emission levels. To ensure this, both companies have quality management systems in place. LAUBAG supplies its customers with pulverised lignite mixed with lime so as to reduce the sulphur dioxide emissions in the furnaces using the dry additive process (TAV).





Coal bunkers of the open-cast mine Hambach.

## Communications

Rheinbraun and LAUBAG have launched several initiatives to encourage staff involvement. Newsletters and internal information bulletins discuss environmental topics, complemented by internal further training courses. Brochures dealing with products and environmental issues keep customers informed, and advice is given, for example in connection with the return of lignite ash. Also, to give the public an insight into their environmental activities, the companies organise guided tours, presentations, public discussions and open days.

Close co-operation with experts, universities, institutions and associations is maintained for the purpose of continuously improving our environmental efforts. The issues studied include the development of energy-efficient drying processes or the recultivation of open-cast mines. Representatives of Rheinbraun and LAUBAG are members of various sectoral bodies and sit on a number of public and municipal committees.

### In Focus.

#### Compensation Measures of Lignite Mining

Lignite mining requires total landtake. Agricultural areas, forests, streets and towns need to make way to the open-cast mine and its excavators. So one fundamental aim of Rheinbraun and LAUBAG is to offset as far as possible the unavoidable impact on the cultivated landscape and the living conditions of local residents.

#### Recultivation

The impact on the landscape is temporary. As soon as the first sections of the lignite deposit have been excavated, recultivation and reforestation commences in the exploited areas. During the run-up to mining activity – at the regional planning and approval stage – account is taken of the different opinions and expectations of the various stakeholders, such as farmers, foresters and other interests, as regards later recultivation. In the past, until the 1970s, the main issues were on the future agricultural, recreational and forestry uses of the new landscape. More recently, the focus has switched to conservation and bio-diversity. So recultivation does not aim at reconstructing the old landscape. That would be presumptuous. People can set the ball rolling, but it is Nature herself that returns the flora and fauna. Large areas are now protected. Recultivation as practised in the Rhineland is considered best practice by the experts.

#### Groundwater Extraction and Ecological Measures

Open-cast operations depend on stable embankments and solid work surfaces for the heavy machinery. Also, groundwater levels must be lowered in the mine area. Most of the vegetation is not adversely affected by this lowering of the groundwater table. This is because vegetation in the Rhineland has always relied upon loess soils for its supply of moisture and has no contact with the groundwater.



**"My job in the recultivation process is to replace the soil as carefully as possible with our spreader, so that plants have optimum growth conditions."**

Franz Joseph Faust, Foreman with spreader 737 at the open-cast mine Inden (Rheinbraun AG)



It is only in the valleys of rivers and streams, where the groundwater table comes close to the surface, that adverse effects might occur if no counter-measures were taken. Every year, Rheinbraun delivers a volume of several million cubic metres of treated water to these wetlands to counter the effects of lowering groundwater and protect these wetlands. The water is infiltrated via seepage wells and slots to maintain the natural cycle and safeguard the character and the ecological value of the wetlands.

## Garzweiler II

Mining in the Garzweiler open-cast mine in the northern section of the mining area will reach its western limits around the year 2006. Thereafter, mining is due to continue without a break in the new Garzweiler II mine. From the outset, it was the environmental aspects that were to the fore in public debate surrounding the planning and approval procedures. As early as 1984, the Minister for Regional and Town Planning of North Rhine/Westphalia issued a catalogue of criteria in the form of an ecological requirement schedule, which Rheinbraun completed and submitted in 1987.

Between 1987 and 1994, in the course of the state planning procedure for the Garzweiler II mine, the first comprehensive Environmental Impact Assessment for a European mining project was undertaken in line with the requirements of mining law. Rheinbraun prepared an extensive evaluation of the project's environmental compatibility, with the focus on people, flora and fauna, soil, water, air, climate, landscape and cultural values. Technical and geographical options for the Garzweiler II project were reviewed and assessed. Following ten years of scrutiny, the findings were that the project was necessary for energy policy, economically feasible, capable of socially compatible and ecologically responsible implementation. This conclusion was supported by a parliamentary majority in North Rhine/Westphalia.



Wetlands in the vicinity of open-cast mines are conserved by the infiltration of groundwater.

## Environment Programme Mining and Raw Materials.

### Conservation of Valuable Wetlands

- 15% increase in the seepage and discharge quantities from the present annual 47 Million cubic metres to protect the wetlands in the northern section of the Rhenish mining area, by extending the seepage, discharge and piping systems.
- Extension of a 7,500 m long and 75 m deep vertical sealing wall to 9,200 m along the Lusatian Neiße to prevent the lowering of the groundwater table.
- Construction of a pilot plant for groundwater enrichment and retrofitting of a trench system for 3 Million cubic metres of infiltration water per year in the area of the Jänschwalder Laßzinswiesen in the Lusatian area.

### Reduction of Emissions

- Construction of a stationary dust exhaust and optimisation of existing wet scrubbers in the refining process.
- Reduction of heavy metals, dioxins and furans within the off-gas of metallurgical processes and refuse incinerators by developing a process that injects pulverised lignite coke into the exhaust stream and removes it through a downstream electrostatic precipitator.

### Reduction in Energy Consumption

- 2% reduction in the specific energy consumption of conveyor systems by lowering the resistance caused by individual movements, adjusting the drive performance and equalising material flows at Rheinbraun.

### Reduction of Noise from Mining Operations

- Construction of a dam of 1,100 m length and 7 m height on the north-eastern rim of the open-cast mine Hambach.

### Waste Reduction

- Thermal re-use of demolition timber at the Berrenrath power station and use of delivery and production technology, as well as the construction of installations for adsorptive flue-gas cleaning.

### Improvement of the Environmental Management Systems

- Establishment of an environmental data reporting system and continuous improvement of the documentation for organisation structures and the structuring of operations by optimising the existing data management reporting.
- Completion of a unitary environment manual as a basic module for an environmental management system at Rheinbraun.

Timeframe
by 2001
by 2000
by 2000
by 2001
by 2001
by 2001
by 1999
by 1999
by 1999
by 1999

## Balance of Inputs and Outputs

		Reporting Period				
		Unit	1992/93 *	1993/94 *	1994/95	1995/96
INPUT						
Energy						
Electricity Consumption	MWh	3,906,840	4,027,580	4,834,543	4,806,477	4,673,817
– own generation	MWh	2,012,435	2,064,521	1,928,175	2,126,807	2,201,156
Fuels **	1,000 l				20,200	29,548
Heat	MWh			2,004,722	2,091,944	1,571,667
Steam	t	81,375	24,983	97,764	39,257	14,692
Sewage Sludge	t		15,720	79,596	133,485	130,090
Used Plastics for gasification	t			6,295	3,850	7,674
Water	1,000 m³	629,667	600,714	999,759	1,007,280	980,066
Raw Materials						
Raw Lignite	t	104,201,844	103,304,900	168,307,623	167,797,096	157,513,302
Sand	t	302,046	297,184	289,170	276,500	284,567
Gravel	t	3,753,940	3,566,594	4,084,388	3,499,082	3,133,952
Clay	t	203,420	214,576	369,475	395,529	293,296
Lime (for Power Stations)	t	14,020	16,209	15,037	12,509	14,146
Residues from Power Plant Operation for Refilling	t	5,444,483	6,687,725	5,583,116	5,637,329	6,432,005
OUTPUT						
Products						
Raw Lignite	t	88,331,904	87,855,998	145,523,930	143,905,534	136,644,932
Refined Products	t	5,202,293	4,877,001	7,072,727	7,241,514	6,504,106
Steam	t	2,259	2,779	2,628	2,903	1,342
Synthesis Gas	1,000 m³	233,393	170,733	190,420	120,810	165,576
Mineral Raw Materials	t	4,273,011	4,087,995	4,762,972	4,190,408	3,711,815
Lime Fertiliser	t	13,605	9,641	19,939	19,297	19,675
Supply of Water	1,000 m³	598,870	567,753	929,432	927,521	898,037
Supply of Water to Third Parties	1,000 m³	187,556	190,277	206,718	211,111	201,980
Introduction to Surface Waters	1,000 m³	411,314	377,477	722,714	716,410	696,058
Emissions ***						
Direct CO <sub>2</sub>	t	4,596,436	4,516,526	4,114,323	4,391,036	4,403,894
CO <sub>2</sub> from Electricity Generation	t	1,193,475	1,236,727	1,831,012	1,688,192	1,557,776
CO	t	609	613	490	597	549
SO <sub>2</sub>	t	2,709	2,590	2,614	2,702	2,954
NO <sub>x</sub>	t	3,894	3,508	3,048	3,077	3,277
Particulates	t	1,182	1,022	1,452	1,386	1,149
Wastes						
For Re-use	t				104,451	93,779
For Disposal	t				18,513	16,552
Effluent	1,000 m³	3,677	3,494	11,745	9,863	10,460
LOCATION						
Total Landtake incl. Mining Area	1,000 m²	89,167	90,757	157,661	160,848	163,413

\* 1992-94 without LAUBAG, \*\* 1996/97 with LAUBAG, \*\*\* Emissions in terms of calendar year.

Data from LAUBAG are included from 1994/95 onwards. Since LAUBAG has shut down all pit power plants step-by-step, its effluent streams were not taken into consideration any more.



Petroleum and Chemicals.

# Integrated Management System.

RWE-DEA Aktiengesellschaft für Mineralöl und Chemie is a German enterprise with international activities, and numerous national and international subsidiaries and affiliates. The operations of the Group, which has a workforce of approximately 10,250 (as of June 1998), include the exploration and production of crude oil and natural gas, nationally as well as internationally, the refining of petroleum, the sale of petroleum products, as well as chemical production and sales.



DEA's Wesseling refinery processes crude oil into petroleum products and petrochemical feedstocks.

In Germany RWE-DEA for example operates the drilling and production facilities Mittelplate and Schwedeneck-See, crude oil and natural gas production facilities focusing on North Germany, as well as gas storages in Bavaria. At the DEA refineries in Heide and Wesseling crude oil is refined into petroleum products and petrochemical feedstocks. At the Grasbrook Lube Plant in Hamburg, and at the Kiel Grease Plant, over 600 high-quality lubricants are produced. The company operates tank terminals at several locations. In Germany petroleum products are marketed through approximately 1,600 service stations operated by DEA and its partners. The CONDEA plants in Brunsbüttel and Meerbeck produce a variety of feedstocks, mainly for the chemical industry. These include fatty alcohols, alumina, and solvents. The chemical products are marketed internationally under the name CONDEA.

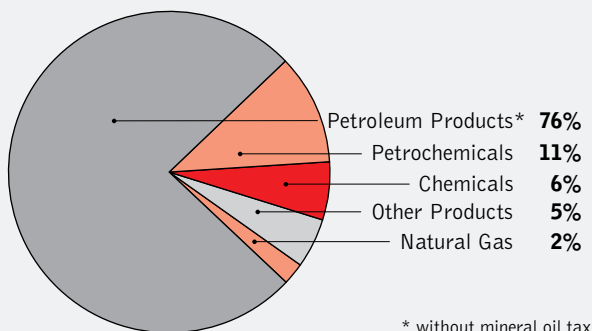


**Employees of the RWE-DEA Group.**

The RWE-DEA Group's main operations of environmental relevance are the production, processing, storage, transportation and distribution of water endangering and inflammable products. Numerous plants, therefore, are subject to stringent environmental legislation.

The emission of gases, such as sulphur dioxide ( $\text{SO}_2$ ), nitric oxides ( $\text{NO}_x$ ) and hydrocarbons, effluents, noise, the unavoidable generation of wastes, and the use of non-renewable resources are the environmental aspects of the organization's activities. They are a constant challenge for RWE-DEA corporate policy.

**External Turnover-related Shares of Product Groups Manufactured in Germany – 1996/97 Fiscal Year**



## Environmental Management

The environmental policies of the RWE-DEA Group are an important element of corporate policy. They are laid down in the 'Environmental Policy Statement' and aim at the continuous improvement of environmental performance. Each employee has personally received a copy of the statement with a covering letter. The public can obtain information through brochures, inquiries, or via the Internet.

The RWE-DEA Group contributes toward global environmental protection not only by defining special objectives for its operations and production sites, but also by e.g. sharing the commitment of German industry to reducing CO<sub>2</sub> emissions. The CONDEA plants in Brunsbüttel and Meerbeck are committed to according priority to the protection of the environment and to health and safety in their operations as part of the global Responsible Care initiative of the chemical industry.

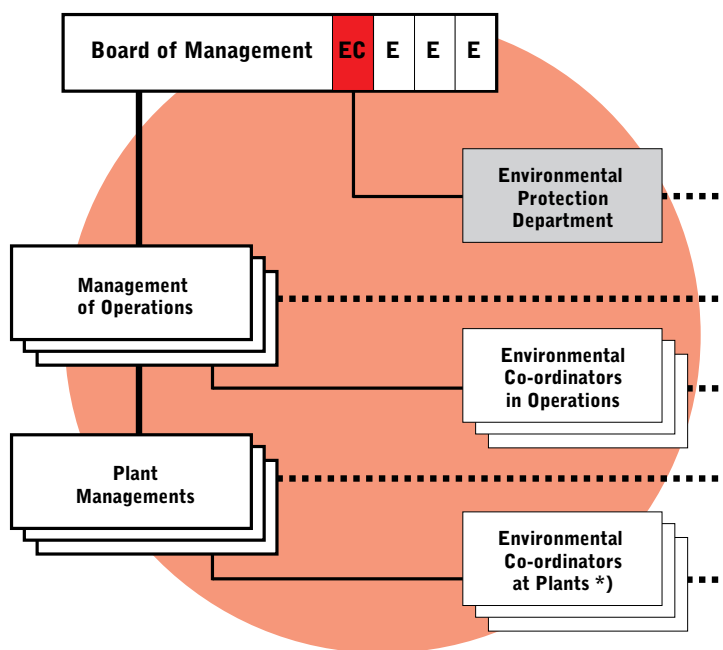
### Responsible Care



CONDEA supports the chemical industry's global Responsible Care<sup>®</sup> initiative.

The ultimate responsibility for environmental protection rests with the Board of Management which has delegated the individual tasks to the management of the operations. The Environmental Protection Department, which reports directly to the Board of Management, addresses and co-ordinates the essential environmental issues. It provides advice to the responsible personnel in the operations and plants, and to the environmental co-ordinators. The co-ordinators at plants provide environmental advice and support to management.

### Environmental Protection Organisation RWE-DEA AG



— Delegation  
 - - - Co-ordination, consultation, information  
 ..... Support pursuant to environmental legislation and operating procedures

E = Board of Management Member for environmental affairs  
 EC = Board of Management Member for environmental affairs with co-ordinating functions  
 \*) = required under environmental legislation



**DEA and its partners operate approximately 1,600 service stations in Germany.**

On the basis of the certified quality management system the existing environmental protection organisation is currently being documented for certification under ISO 14001 as an additional module of the integrated management system. A special working group is co-ordinating the incorporation of environmental protection into the integrated management system.

To minimise operational risks to humans and the environment, the technical installations are regularly monitored, maintained and adapted to technological progress. All substances used in operations are registered and clearly labelled according to their hazard potential. RWE-DEA has a detailed emergency organisation in place, including alert and risk management plans for all production sites, to enable rapid response in the case of an emergency.

Environmental protection is an important component of RWE-DEA training. The employees receive training according to the tasks of environmental relevance in which they work. In addition to regular meetings to discuss environmental protection in the operations, the people directly involved in environmental protection organise regular seminars and workshops. These provide an opportunity for the in-depth sharing of experience from all operations of RWE-DEA.

## Purchasing and Transportation

A Purchasing Manual and checklists are available to ensure the due consideration of environmental issues. The environmental performance of contractors and suppliers is one of the selection criteria.

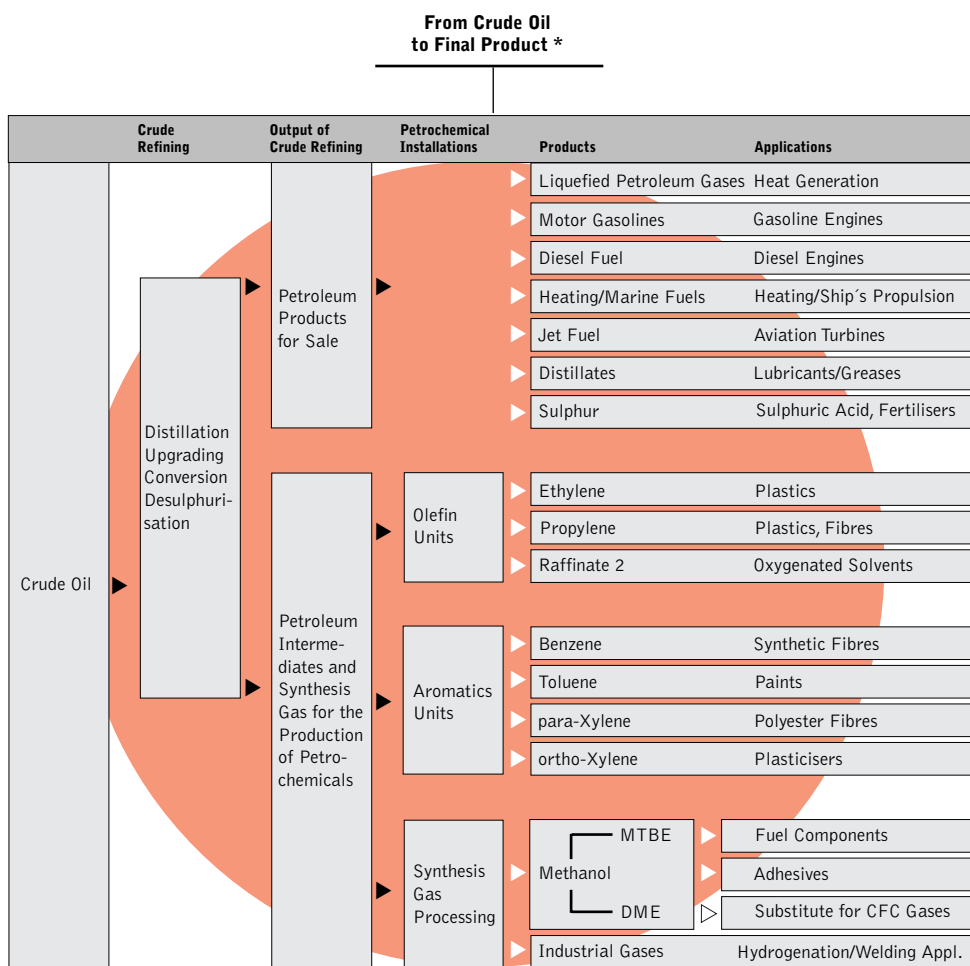
The environmentally compatible distribution of products takes place for example at refineries, terminals and service stations. At these locations, protective installations are in place to ensure that water contaminants cannot enter soil or groundwater, even if a spill occurs. Preventive measures also include the safe storage of raw materials and products.

Transportation takes place in an environmentally compatible manner through pipelines, on inland waterways, or by rail or road. In the supply of lubricants vehicles are used which can simultaneously transport more product groups than in the past. They are also equipped with improved dispensing technique, so that the number of vehicle movements could be reduced. In addition, pool vehicles are increasingly used to transport identical products, for example solvents. As a result, they need not be cleaned so often. To save packaging materials, bulk lubricants are supplied to customers in small returnable containers, rail tank cars, tank trucks, or barges.

## Manufacturing

In the past few years RWE-DEA has effectively implemented a number of process improvements to protect the environment. In addition to the reduction of sulphur dioxide emissions by more than 74% since the beginning of the 80s, emissions of nitric oxides and particulates were also substantially reduced. The cut-back of nitric oxide emissions is a result of the installation of denitrification units, particulate emissions were reduced by the use of state-of-the-art filter technology. Prior to discharge

all effluents are treated in wastewater treatment plants using a multi-stage process, including mechanical, chemical and biological purification. Highly contaminated process water is pre-treated before it goes to wastewater treatment plants. For instance, the installation of an ammonia stripper at the DEA refinery in Wesseling reduced the total nitrogen load in the discharge to the Rhine by 30%.



\* DEA Wesseling refinery



Wherever possible, water is repeatedly used in a closed cycle. Although, for example, production has clearly increased at the CONDEA Meerbeck Plant, the volume of effluents could be reduced by 70% in the past 20 years by means of recycling and the modernisation of processes. The conservation of resources is also improved by the consistent use of the co-generation of electricity and heat, and of residual gases, derived for example from the exhaust collection systems. The residual gases are no longer burnt off, but used as fuel. At the CONDEA Meerbeck Plant an annual reduction of CO<sub>2</sub>-emissions by 50,000 mt was achieved by co-generation. At the CONDEA Brunsbüttel Plant the energy use was substantially reduced by using exhaust gases from the furnace installation directly for drying alumina products. Additional innovative technologies are the closed-cycle, emission-free cleaning processes for gas drying, and the vapour recovery installations in the refineries and terminals which also contribute to the reduction of hydrocarbon emissions.

At the production sites waste management concepts are in place or under preparation. RWE-DEA has adopted waste reduction as a guiding principle in product packing and process optimisation. DEA was the first petroleum company at the beginning of the 90s to introduce returnable bottles for dispensing motor oils through the 'Oil Vendor'. At the Grasbrook Lube Plant, waste volumes were cut 50% in the past six years by the more efficient use of materials and supplies. All production sites increased the proportion of waste recycling by continually improving their waste separation systems. DEA's Wesseling refinery, for instance, achieved an increase to about 50%.



**"It is our aim to reduce water contamination as far as possible. In the early 90s, we started to plan the expansion of our wastewater treatment plant. We managed the expansion ourselves, to make sure that the project could be implemented during normal operations. The new plant was on line in the first half of 1997, together with a process control system, increased capacity and improved effluent quality. A proportion of the treated water is recycled back into the process plants."**

Niels Holbeck, Manager of Wastewater Treatment Plant (CONDEA Brunsbüttel Plant)

## Products

Both production processes and products should affect the environment as little as possible. In 1996, therefore, the marketing of leaded gasoline was discontinued. As early as 1995, the sulphur content of diesel was reduced from 0.2 to a maximum of 0.05 percent by weight. This led to the reduction of sulphur dioxide and particulate emissions from diesel vehicles. An additional aspect of environmentally compatible products is their longevity. In the development of engine oils for commercial vehicles DEA aims at a product life of 100,000 km. On the other hand, biodegradability is important, particularly for hydraulic oils used mainly in construction. For instance, synthetic esters are used in the production of lubricants for mobile hydraulic systems. These esters consist of readily degradable alcohol and fatty acids. For some time DEA Mineraloel has been marketing lubricating oils consisting of components produced from rapeseed oil.

## Petroleum and Chemicals.

Similarly, the production of fatty acids and its derivatives is based on petrochemical or renewable raw materials. These compounds are used in the production of personal care products, cosmetics, pharmaceuticals, detergents and fragrances. The fatty alcohols from either of the two production processes have an identical chemical structure, are entirely biodegradable and non-toxic. As a specialist for high-purity alumina, CONDEA makes an important contribution to environmental protection also with this product group. Aluminas with defined physical characteristics are used in high-performance catalysts for oil refining, vehicle exhaust cleaning, and chemical processes.



Natural fatty alcohol unit at the CONDEA Brunsbüttel Plant.

## Communication

Environmental protection is an integral subject of the corporate employee suggestion scheme, to ensure that suggestions for improvement receive appropriate consideration. The members of the RWE-DEA Group receive regular environmental information through circulars, the 'Panorama' magazine and other publications, like 'CONDEA Info'. DEA's marketing partners are kept informed through 'DEA Partner Magazin'. Service stations are advised on environmental activities by the 'DEA Zündschlüssel' publication. Product information to customers is contained in material safety data sheets, product bulletins and brochures. The public has access to a variety of information sources, too. These include environmental brochures, information on safety measures, environmental hotlines and leaflets. RWE-DEA has also been co-operating closely with industry associations for many years. In addition, RWE-DEA has Open House events and provides information to visitor groups at its plants.



## In Focus.

### Crude Oil Production in the North Sea

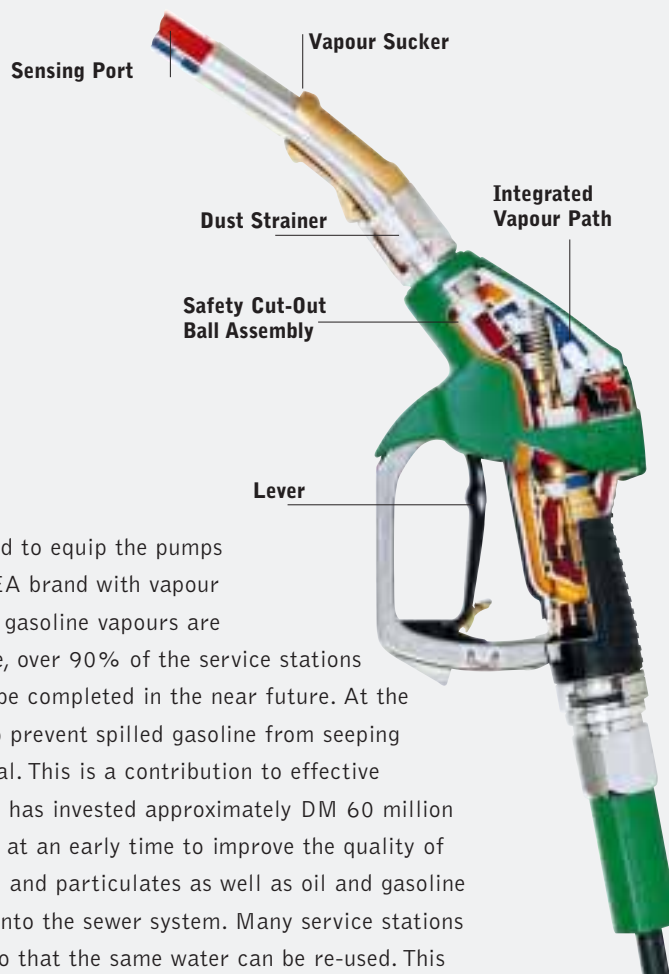
With an annual production volume of 800,000 mt Mittelplate is Germany's most productive oil field. RWE-DEA has given close attention to environmental considerations when installing the drilling and production island. The Mittelplate artificial island was built in the North Sea tidelands in 1985 as a compact system with separate living quarters, drilling and process areas, carefully sealed off from the environment. It rests on the sandy flats of the Mittelplate, like a big steel and concrete basin. A sophisticated waste management system which is permanently monitored by the authorities ensures that the North Sea ecosystem is not affected, not even by the drilling operations. Double-hull transport barges developed especially for the purpose take the oil ashore. Ten years of troublefree operation demonstrate the efficiency of the system. Environmental studies have been accompanying the project from the start. These studies regularly investigate the condition of the seabed, as well as the presence of fish, birds and benthos. So far, no negative impacts have been found.



Ecology has high priority in the operation of the Mittelplate island.

### Diagram of a pump nozzle

During fuelling, the nozzle sucks in gasoline vapours through the vapour sucker. These vapours are returned to the underground tank through an internal hose.



### Retrofitting of Service Stations

A long time ago, DEA and its partners started to equip the pumps at the service stations operating under the DEA brand with vapour recovery systems. These systems prevent that gasoline vapours are released to the air during fuelling. Meanwhile, over 90% of the service stations have such recovery systems. The project will be completed in the near future. At the same time, sealed driveways were installed to prevent spilled gasoline from seeping into the ground, and to enable its safe removal. This is a contribution to effective water pollution control, for which DEA alone has invested approximately DM 60 million so far. Appropriate measures were also taken at an early time to improve the quality of effluents. A two-stage process separates sand and particulates as well as oil and gasoline from the wastewater, before it is discharged into the sewer system. Many service stations treat the water from the car wash facilities so that the same water can be re-used. This contributes to drinking water economy. Moreover, all detergents used at service stations are environmentally compatible.



The vapour recovery system from refinery/tank truck to the car operates on the same principle: the displaced gasoline vapours are returned to the upstream container.

## Implementation of ISO 14001

Management systems define the responsibilities, procedures and work processes of relevance in the compliance with defined requirements. These requirements may relate to quality, environmental protection, or industrial health and safety.

The RWE-DEA Group resolved to develop an integrated management system including all of its locations. The Quality Management System is in place and certified under ISO 9000 ff. On this basis, an environmental management system will be established at all production sites as an additional module to be certified under the international ISO 14001 standard. In future, additional management systems may be integrated into the system as appropriate.

The environmental management system is based on the Environmental Policy Statement of the RWE-DEA Group. RWE-DEA has undertaken to act responsibly toward humans and the environment. Organisation, processes and accountabilities within the environmental management system are documented in integrated management manuals, work and process instructions, to ensure that all employees and all processes comply with defined environmental policies and nothing is left to chance.



## Environmental Programme Petroleum and Chemicals.

### Environmental Management

- RWE-DEA plans to develop an integrated management system for all of its locations. It will include the certified quality management system and the environmental management system currently under preparation. Certification of the environmental management systems under ISO 14001 is an ongoing project at the CONDEA plants in Brunsbüttel and Meerbeck.

### Reduction of Emissions

- Annual reduction of SO<sub>2</sub> emissions by 100 mt by the processing of lower sulphur products and the shutdown of the SO<sub>2</sub> extraction plant (Grasbrook Lube Plant).
- Reduction of chlorinated hydrocarbon emissions by about 10% through capacity adjustments (Grasbrook Lube Plant).
- Reduction of hydrocarbon emissions from gasoline by means of vapour recovery systems at service stations.
- Production of motor gasoline with max. 1% benzene.

### Energy Conservation

- 5% reduction of energy consumption through running time optimisation of cooling water pumps (Grasbrook Lube Plant).
- 10% efficiency improvement of DEA's Heide refinery power plant by installation of a gas turbine.
- Use of process heat of the maleic anhydride (MA) unit to generate heat and steam at the CONDEA Meerbeck Plant.

### Reduction of Water Consumption

- Reduction of water consumption by 150,000 cubic metres annually by recycling of condensates at DEA's Heide refinery.
- 50% reduction of water consumption by closing cycles at the CONDEA Meerbeck Plant.
- Reduction of groundwater production by 10 million cubic metres annually due to the use of closed cycles (DEA Wesseling refinery).

### Reduction of Effluents

- 20% reduction of effluent volumes at the CONDEA Brunsbüttel Plant by effluent recycling.
- Re-use of 20 cubic metres of effluent per hour (DEA Wesseling refinery).

### Reduction of Noise

- CONDEA Brunsbüttel Plant enhances noise reduction.

### Reduction of Waste

- Multiple use of oil packages at service stations.

Timeframe
2000
end of 1999
end of 1999
end of 1998
end of 1999
end of 1999
beginning of 1999
2000
2000
end of 1999
2000
mid-1999
2000
ongoing

## Balance of Inputs and Outputs – Petroleum

		Reporting Period				
		1992/93	1993/94	1994/95	1995/96	1996/97
Unit						
INPUT						
Energy						
Natural Gas	mt	80,045	154,131	146,868	151,377	166,582
Electricity	MWh	571,037	567,773	498,644	437,176	410,123
Water						
Own Supply	1,000 m³	32,929	33,930	39,393	38,700	32,004
External Supply	1,000 m³	822	913	814	711	623
Raw Materials						
Crude Oil	mt	10,238,000	10,463,000	10,452,000	10,070,000	10,855,000
Naphtha	mt	575,000	573,000	733,000	582,000	526,000
Gasoline Components	mt	86,000	106,000	76,000	114,000	77,000
Flash Distillate	mt	45,000	45,000	45,000	45,000	45,000
Additives	mt	11,000	11,000	11,000	11,000	11,000
Others	mt	218,328	260,951	285,580	239,531	282,858
OUTPUT						
Products						
Liquefied Petroleum Gas	mt	105,000	129,000	118,000	104,000	112,000
Motor Gasolins	mt	1,915,000	2,058,000	1,933,000	1,917,000	2,026,000
Middle Distillates	mt	4,592,000	4,770,000	4,853,000	4,721,000	5,172,000
Heavy Fuel Oil and Asphalt	mt	925,000	851,000	955,000	887,000	837,000
Aromatics	mt	576,000	641,000	633,000	643,000	698,000
Olefins	mt	953,000	957,000	1,029,000	966,000	981,000
Base Oils	mt	74,000	94,000	107,000	106,000	126,000
Refined Products	mt	141,000	137,000	143,000	137,000	140,000
Extracts	mt	92,000	88,000	92,000	101,000	86,000
Others	mt	684,000	945,000	905,000	759,000	801,000
Electricity	MWh	6,162	36,252	29,361	30,331	41,252
Emissions						
CO <sub>2</sub>	mt	3,475,052	3,567,171	3,591,459	3,489,762	3,670,027
CO <sub>2</sub> for Input Electricity	mt	359,753	357,697	314,146	275,421	258,377
CO	mt	160	145	143	133	137
SO <sub>2</sub>	mt	12,216	11,314	11,300	10,664	11,221
NO <sub>x</sub>	mt	4,132	4,400	4,275	4,058	3,880
Particulates	mt	355	338	322	303	320
Hydrocarbons	mt	1,245	1,004	806	773	799
Chlorinated Hydrocarbons	mt	581	494	264	228	264
Heavy Metals	mt	10	8	7	4	5
Wastes						
For Utilisation	mt	18,259	23,032	25,572	30,132	27,910
For Disposal	mt	15,362	14,530	12,396	10,899	9,444
Effluents						
Wastewater	1,000 m³	4,360	4,382	4,586	4,348	4,017
COD *	mt	265	207	226	219	206
Cooling Water	1,000 m³	51,609	53,103	54,183	53,579	51,821
TERMINALS						
Turnover	mt	4,529,000	4,565,000	4,491,000	4,435,000	4,467,000

\* COD (Chemical Oxygen Demand). The COD value determines the amount of oxygen that is required to degrade the organic compounds in the effluent.

Due to the closely integrated flows between petroleum, chemical, exploration and production, three tables were developed to avoid counting individual flows twice.

## Balance of Inputs and Outputs – Chemicals

		Reporting Period				
		Unit	1992/93	1993/94	1994/95	1995/96
INPUT						
Energy						
Natural Gas (NG + NG equivalents)	mt	89,750	92,942	99,875	107,362	116,761
Electricity	MWh	76,279	75,440	90,677	58,006	40,924
Heating Fuels	mt	31,300	30,700	32,600	32,300	32,900
Motor Fuels	mt	150	150	150	150	150
Water						
Own Supply	1,000 m³	12,459	12,060	12,753	13,322	13,180
External Supply	1,000 m³	681	754	926	1,054	1,012
Raw Materials						
Specific	mt	290,700	276,200	326,000	304,800	284,100
OUTPUT						
Products						
Specific	mt	428,000	352,500	399,100	379,100	384,700
Electricity	MWh	0	0	0	37,500	39,000
Emissions						
CO <sub>2</sub>	mt	299,500	310,100	322,200	336,700	363,420
CO <sub>2</sub> for Input Electricity	mt	48,056	47,527	57,127	36,544	25,782
CO	mt	32	43	48	56	69
SO <sub>2</sub>	mt	537	553	561	556	567
NO <sub>x</sub>	mt	357	338	357	368	390
Particulates	mt	57	65	69	66	70
Hydrocarbons	mt	167	150	128	125	105
Wastes						
For Utilisation	mt	2,650	1,374	2,030	3,547	7,058
For Disposal	mt	4,123	4,182	4,930	6,216	6,029
Effluents						
Waste Water	1,000 m³	1,165	1,144	1,191	1,159	1,122
COD *	mt	77	53	88	101	63
Cooling Water	1,000 m³	11,859	11,460	12,153	12,822	12,680

\* COD (Chemical Oxygen Demand). The COD value determines the amount of oxygen that is required to degrade the organic compounds in the effluent.

## Balance of Inputs and Outputs – Exploration and Production

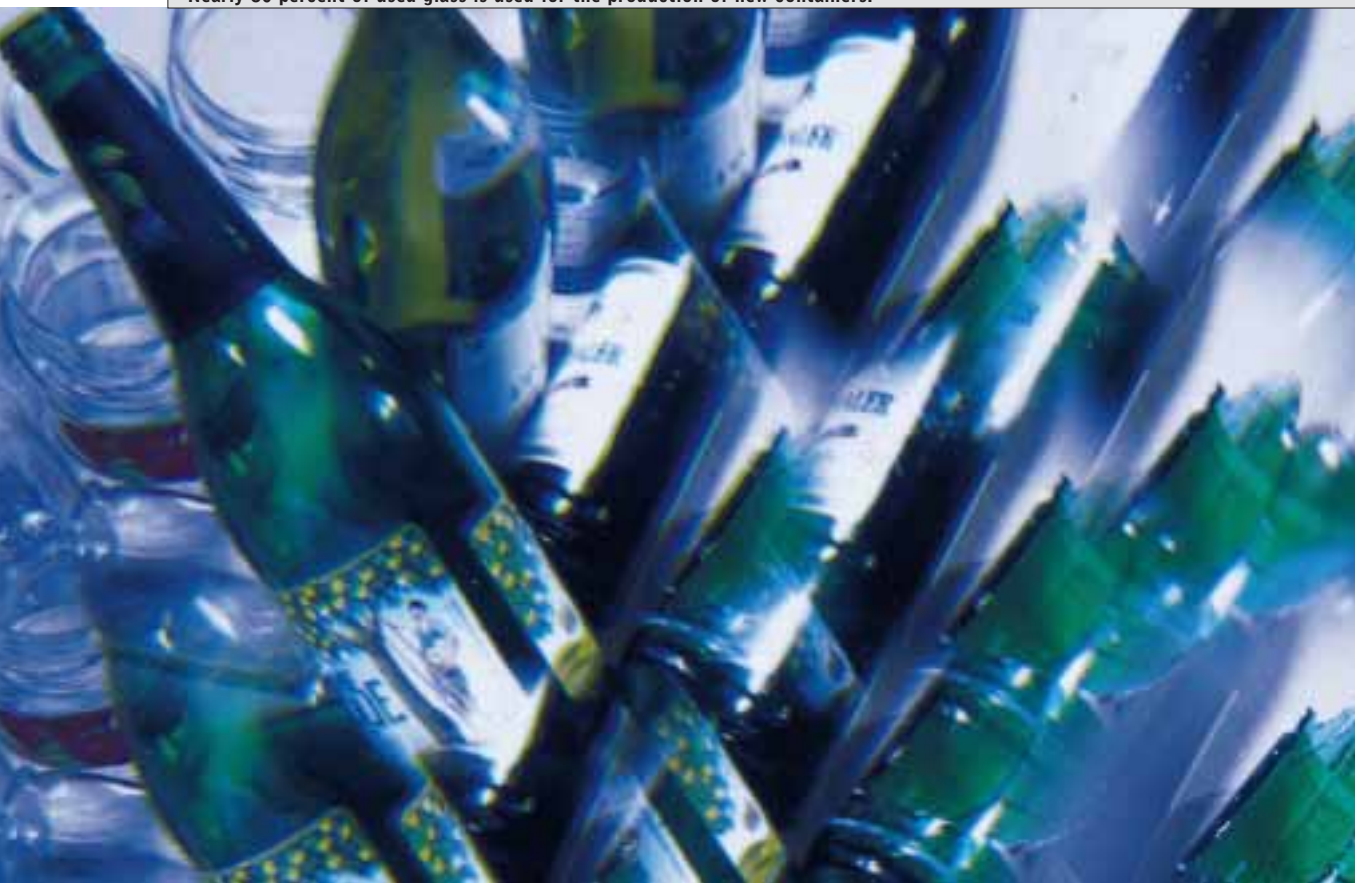
		Reporting Period				
		Unit	1993	1994	1995	1996
INPUT						
Natural Gas						
Natural Gas	mt	7,543	6,129	10,824	13,236	11,644
Electricity	MWh					31,485
Motor Fuels	mt					4,900
Water						
Own Supply	1,000 m³	1,380	1,332	1,192	1,230	1,146
External Supply	1,000 m³					28
Raw Materials						
Crude Oil	mt	679,932	586,848	742,044	741,612	772,648
Natural Gas and Associated Gas	mt	1,179,196	1,309,967	1,384,736	1,989,761	2,046,852
OUTPUT						
Products						
Crude Oil	mt	679,932	586,848	742,044	741,612	772,648
Natural Gas and Associated Gas	mt	1,179,196	1,309,967	1,384,736	1,989,761	2,046,852
Emissions						
CO₂	mt	16,671	13,545	23,921	29,252	41,217
CO₂ for Input Electricity	mt					19,835
CO	mt	1	1	2	2	4
SO₂	mt					18
NOₓ	mt	13	10	18	23	31
Wastes						
For Utilisation	mt	19,634	37,242	18,180	27,158	18,461
For Disposal	mt	17,444	22,400	13,447	20,744	33,722
Effluents						
Wastewater	1,000 m³	8.4	19.0	30.1	11.7	7.5
Cooling Water	1,000 m³	294	314	340	347	417

Figures relate to RWE-DEA's exploration and production activities in Germany, either direct or as operator.

The data for Input Natural Gas represent the proportion of produced gas that is used in captive consumption.



Nearly 80 percent of used glass is used for the production of new containers.



Environmental Services.

## Closing the Cycle.

The activities of RWE Umwelt AG, leading company of Environmental Services, are grouped in four divisions: Waste Management and Recycling Germany, Waste Management and Recycling International, Environmental Consultancy, and Water Resources Engineering/Sewage Disposal. Worldwide round about 20,000 people are on the staff of RWE AG.

The division 'Waste Management and Recycling Germany' undertakes the collection, transport, separation, sorting, processing, utilisation and disposal of all types of wastes. Its operations range from glass collection to the intermediate storage of hazardous wastes. The businesses of R+T Umwelt GmbH, which is the management company for operations beyond North Rhine Westphalia, treat and dispose of an annual volume of more than four million tons of waste. Nearly one million tons of this volume is made up of domestic waste. Within North Rhine Westphalia, the business division Waste Management and Recycling Germany is managed by Trienekens AG.

Within the business division 'Waste Management and Recycling International', the new management company RWE Umwelt International GmbH, together with its subsidiaries, is mainly represented in Austria, Spain, as well as in several eastern European countries. They manage the domestic waste of several million people – including that of the more than two million residents of Bukarest. They collect and sort out usable wastes and operate recycling plants.

The business division 'Environmental Consultancy' is led by the management company ENSR International Consulting GmbH. This division offers a variety of services, including the global provision of advice with respect to environmental technology, as well as services relating to waste and effluent management, emission control, infrastructure, restoration of industrial land and contaminated land

remediation. Consultancy services for issues of quality and environmental management are provided, Eco- and Occupational Health and Safety Audits are undertaken, as well as other types of studies, such as environmental impact assessments and risk and safety management analyses.

Services provided by the division 'Water Resources Engineering/ Sewage Disposal' include the planning, construction and operation of plants for drinking water supply and waste water disposal. Apart from that, the management company RWE AQUA GmbH provides support to municipal partners in implementing financing schemes and privatisation concepts and offers services in the areas of project management, sewage sludge disposal and maintenance of sewerage systems.



**"We developed a special waste management concept for the construction project TREP-TOWERS in Berlin. In Spring 1998, the Federal Association of German Industry awarded us with an Environment Prize for it. It was the first time that 12 different types of waste were separated. Apart from the usual construction rubble, wood and scrap metal, we also separated out foils, cable rests, mineral fibres, asphalted cardboard and other wastes. This led to cost savings of 44%, compared with the usual waste management methods at construction sites. We are now applying this recycling concept together with HOCHTIEF to another large construction project in Berlin."**

Hans-Jürgen Noack, Manager of R+T Umwelt GmbH in Berlin/Brandenburg

## Environmental Services.

A total of approximately 10,000 staff are employed by the main national operating companies and Trienekens AG (status at 30.6.1998).

Within the framework of the services that the business group RWE Umwelt provides, a large proportion of the collected wastes are fed back into the material use and thus contributes towards the conservation of resources. The main task is to utilise the wastes according to set requirements and to expand waste utilisation where it makes ecological sense and is economically justifiable.

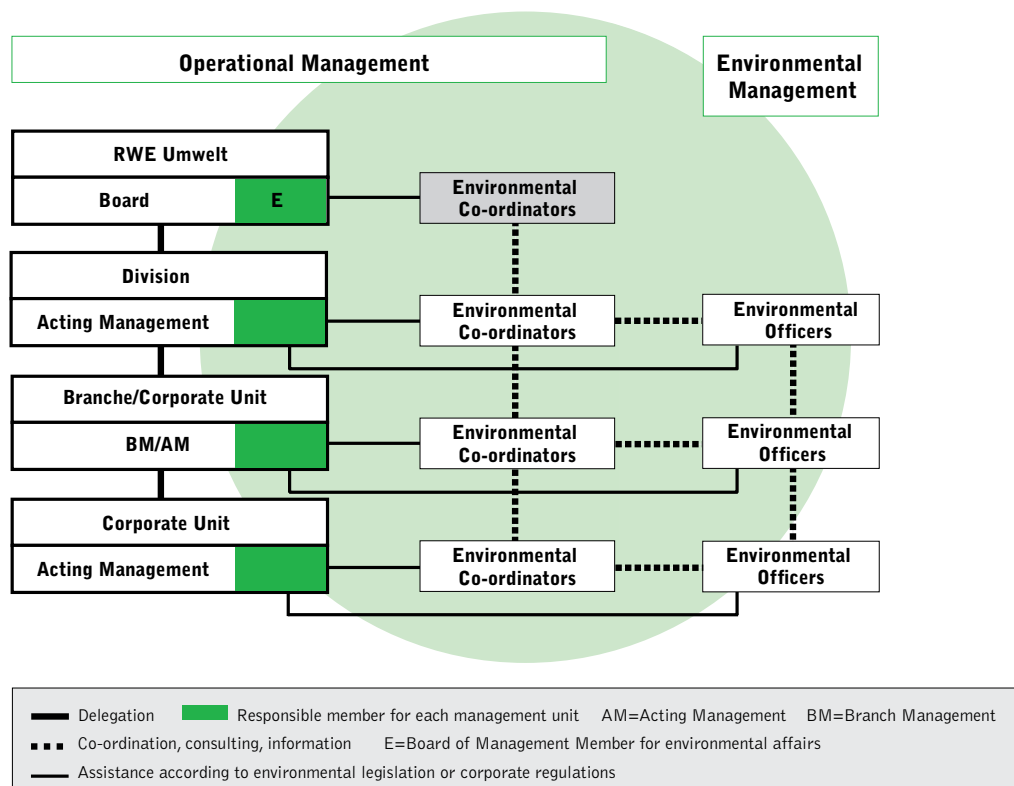
The main operations which are of environmental relevance are concentrated within the area of 'Waste Management and Recycling'. The main sources of environmental impact are the following:

- energy consumption of the recycling plants
- emissions during waste transport and
- disposal of non-reusable wastes.

## Environmental Management

Overall responsibility for environmental protection lies with the Board of RWE Umwelt which has nominated one of its members to be responsible for environmental issues. The responsibility is delegated to the operational levels by organisational instructions and is embedded in management manuals. These manuals define, amongst others, responsibilities for environmental tasks, the organisational framework for environmental officers, as well as processes and work sequences. To meet the special environmental requirements in the field of waste management, the majority of operational businesses are certified under the Ordinance Waste Management Operations and have approved quality management systems, according to the international standard DIN EN ISO 9001/9002, in place, which specifically deal with environmental issues.

### Environmental Protection Organisation RWE Umwelt AG



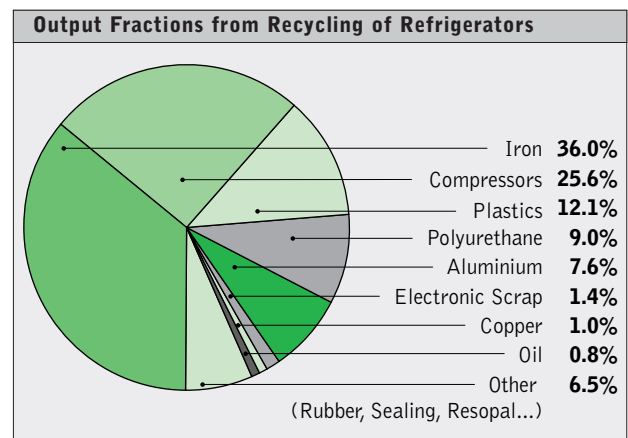
Corporate environmental protection will be effective only if staff are included in its implementation. For this reason, regional working groups have been established to exchange experience on pertinent environmental issues. Further, environmental protection is an important part of the education and training programmes of the businesses of the RWE Umwelt group. In addition to those courses that are required by legislation, seminars on waste management and recycling and on other current issues are held.

For each business, processes and reporting systems for the case of emergencies are integrated within the regulations of the quality management system, or within internal guidelines. Measures for the case of fires or accidents involving hazardous substances are agreed with local authorities, before they are put in place. The relevant management company, as well as RWE Umwelt is immediately informed of any incidents.

## Processing and Utilisation

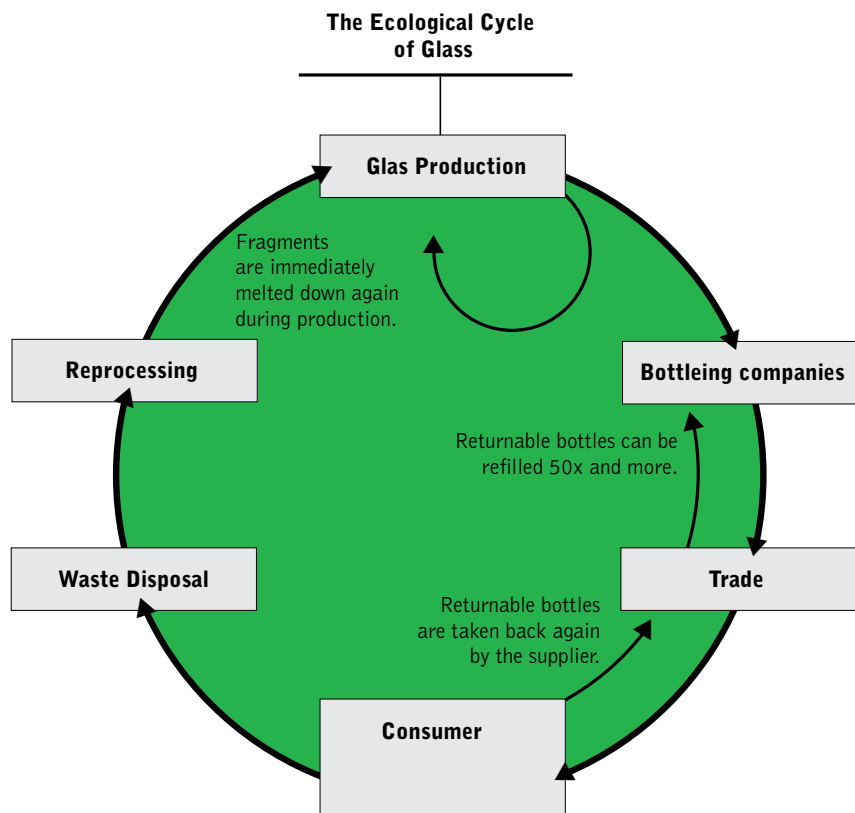
The subsidiary Trienkens operates a dry-mechanical processing plant for large white goods. This plant achieves the recovery of 98.5% of the metal components (iron, copper and aluminium) with a high degree of purity. The treatment process is particularly environmentally compatible, since it has a low energy consumption. There are no effluents and off-gases.

Today only refrigerators with environmentally compatible cooling agents are offered on the market. However, the recycling of old appliances of the last generation, which contain chloro-fluoro-hydro-carbons (CFC) which damage the ozone layer, still continues. Each year approximately 600,000 refrigerators are recycled by R+T Umwelt at various locations.



RWE Umwelt is the only business group in Germany to process refrigerators according to the BRESCH process. This involves sucking out the refrigerants and refrigerating oils from the refrigerating cycle, to recover the halogenated foaming agents from the insulation materials, to liquefy them in special tanks and to dispose of them in an environmentally responsible manner. Around 95% of all refrigerators can be recycled using this innovative technology.

The business group RWE Umwelt supplies an annual volume of over 600,000 tonnes of recycled glass for the production of new goods. Four processing plants manufacture glass granulate from white, green and brown glass. Thus, RWE Umwelt belongs to the largest raw material suppliers of the German glass container industry.



According to data from the Gesellschaft für Glasrecycling und Abfallvermeidung mbH (GGA), a recycling quota of 78.9% was achieved for container glass in 1997. Thus, an equivalent volume of primary raw materials (sand, soda, lime) and particularly energy were saved at the same time.

The same applies to the recycling of waste paper. Measures by the annual volume of over a million tons of collected, recycled and marketed paper and cardboard, RWE Umwelt is one of the largest suppliers of the paper factories.

Nationally RWE Umwelt collects over 260,000 tons of light packaging each year. It is separated into recyclable and residual waste fractions at 21 sorting plants. The fractions foils, mugs and hollow elements from the Duales System Deutschland and commercial areas are broken down into single material granulates, which are used in the plastics industry. 86% of the process water, which is needed for the separation of the mixed plastics using the float-sink

process, has been taken from own supplies since the beginning of 1997. In one of the most modern processing and recycling plants in Europe, a fully automatic sorting module is being operated. With a programmable sensor the increasing proportion of PET-containers can be separated from the other packaging materials. Briquettes and pellets are manufactured out of a mix of plastics. These are used as raw material for methanol (production) and as a reducing agent in the steel industry.

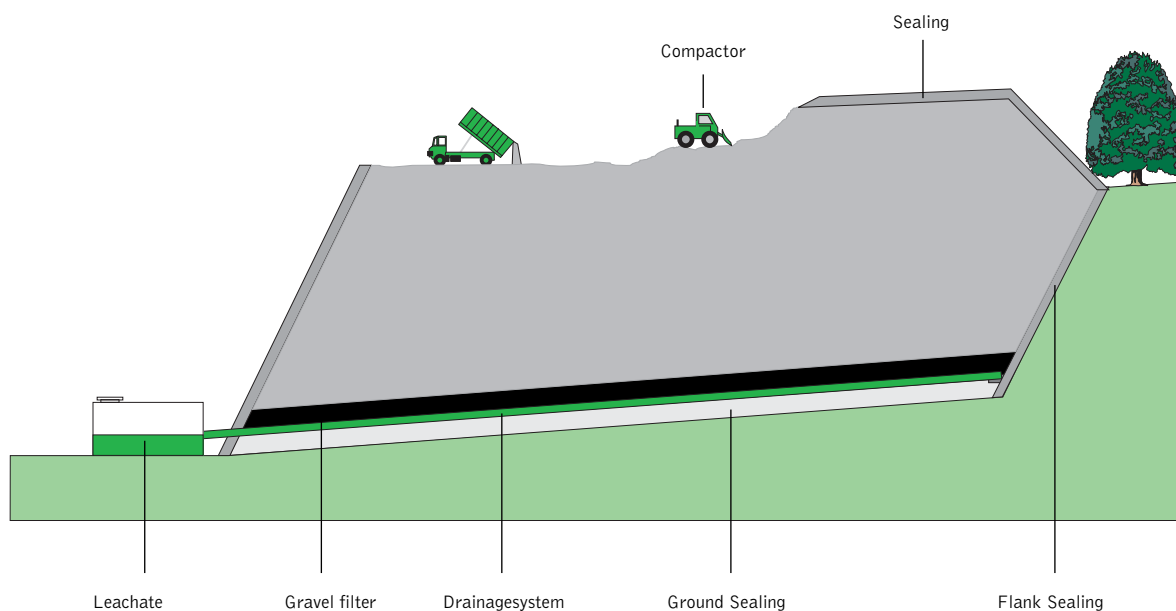
Further, the business group collects an annual volume of 400,000 tons of compostable wastes. These are processed to compost in compliance with strict quality criteria and are marketed with a quality label.

The area of car and textile recycling is being expanded as well. Car recycling focuses mainly on the disassembly of cars from relatively recent accidents to obtain spare parts for repair works. All businesses in this area are certified under the scrap car ordinance, which came into effect in April 1998. In 1997, RWE Umwelt commenced construction of one of the most modern recycling works in Europe

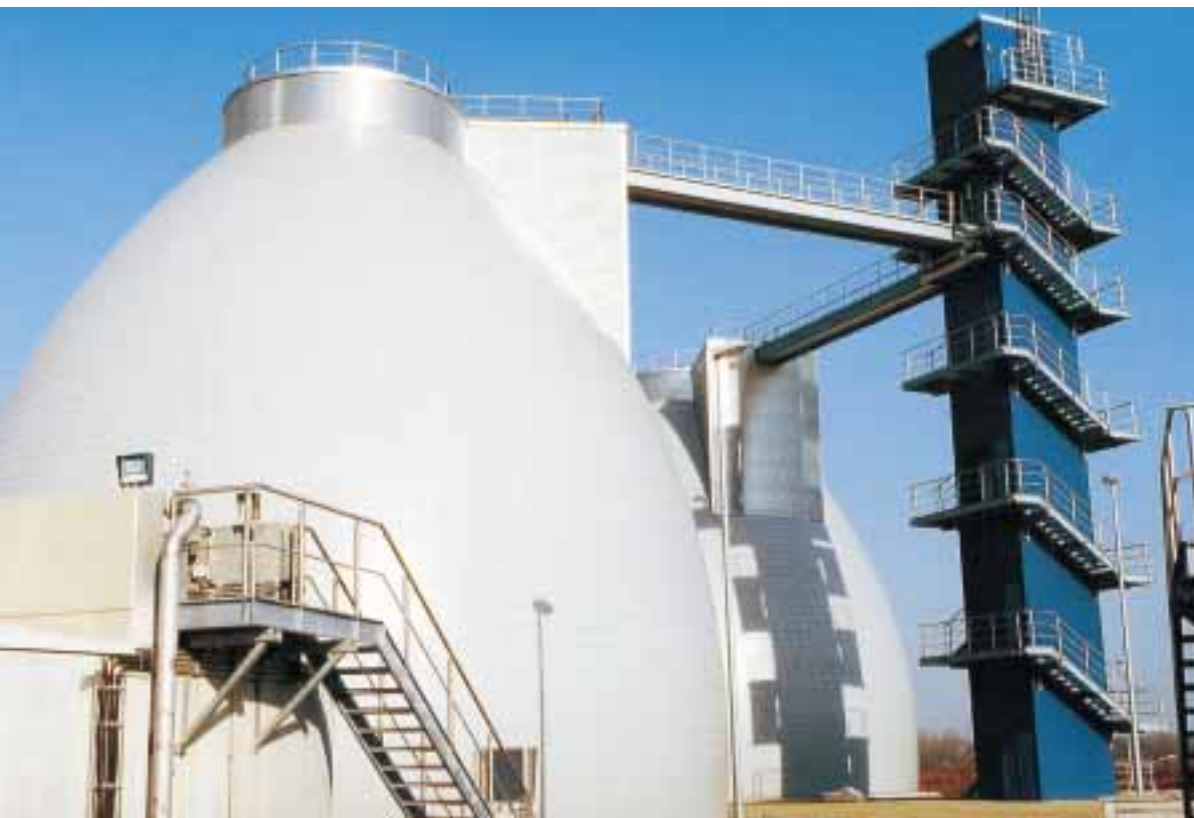
for the sorting and recycling of textiles. It has a capacity of 58,000 tons. A large proportion of this volume is recycled to produce commodities, such as blankets, fleeces and insulation materials for industry.

The operation of sanitary landfills requires particular responsibility, as escaping leachate and gases can represent a significant source of environmental impact. All landfills are therefore equipped with a ground sealing system, which consists of several layers. This system protects soil and groundwater from contamination. The leachate from the entire site is collected by a network of drainage systems and is treated in effluent treatment plants. It is treated to the stage of being acceptable for discharge to public water resources.

### Sanitary Landfill = Compacted Disposal







Fermentation tanks of the sewage treatment plant in Halle on the Saale.

The gas from the landfill sites, which consists mainly of combustible methane, is also used for the generation of electricity and heat in small co-generation heating plants.

## Communication

Staff papers and magazines contain information on current environmental topics. Open days, as well as so called 'Recycling Days', which are regularly organised, offer insight into the environmental activities of the businesses for the public, as well as for customers and suppliers. Other means of providing information on business activities to the public are

guided tours through the works, press conferences, as well as discussions with political representatives, bodies responsible for waste management and environmental organisations. Further, many businesses of RWE Umwelt co-operate with local universities. By supporting academic theses on issues of waste management and recycling, for example, they obtain external know-how and therefore contribute towards an improvement of their own environmental performance.





Pollutants are completely decomposed in the rotary kiln which generates temperatures of 1,200°C.

## In Focus.

### Incineration of Hazardous Wastes

Although industry and commerce have been successfully reducing their volumes of waste, as well as recycling it increasingly, a substantial volume of hazardous waste is still generated within Germany. The safest way of permanently removing most of the organic hazardous wastes in an environmentally acceptable manner is by means of thermal treatment. Since June 1998, RWE Umwelt has been operating one of the most modern plants in Europe in Brunsbüttel. The plant is operated via its subsidiary company SAVA Sonderabfallverbrennungsanlagen GmbH. A large proportion of the hazardous waste that is collected by the business group is delivered to this plant.

The pre-processed waste and the generated flue gases are treated thermally with very high temperatures (1,200°C). Within this process, the various pollutants are decomposed or converted to environmentally neutral substances. The flue gas cleaning process, which employs state-of-the-art filters, removes all particles and does not allow gaseous components to reform to toxic compounds.

Additional process stages ensure that the final residues that are formed during thermal treatment are of high quality and can be channelled back into the cycle as usable products, such as slags, hydrochloric acid or gypsum. Another environmental protection measure of SAVA Brunsbüttel is the use of waste heat and rainwater.

The Environmental Impact Assessment that was prepared during the planning process of this plant, came to the conclusion that the plant provides a net benefit for the environment and does not cause additional pollution. The Report stated that the proposal therefore serves public well-being. Nevertheless, the planning process for the plant originally led to wide-spread concern amongst local residents and created a long-term legal battle between a local interest group and the permitting authority. SAVA Sonderabfallverbrennungsanlagen GmbH proposed the delay of the legal proceedings for the period of one year, so that it could use the experiences that were made during the first operational year to consider a further reduction of the emission threshold values, in discussion with the permitting authority.

## Environmental Programme – Environmental Services.

### Logistics: Reduction of Specific Consumption of Fuels

- Collection and review of indicators on the basis of 'The performance Record Vehicle Fleet' and the preparation of an overview of consumption and transport services.
- Route optimisation and increase of vehicle utilisation.
- Avoidance of unnecessary empty trips and transports.
- Increased use of vehicles that are low in fuel consumption and emissions, procurement of new trucks complying with Euronorm III).
- Continuous review of potential use of alternative modes of transport (rail, ships).

### Sorting and Processing: Reduction of Specific Uses of Energy, Water and Auxiliary Materials

- Installation of monitoring equipment (electricity and water metres) in the plants for the collection of environmentally relevant data.
- Collection of data on consumption and systematic comparison amongst plants (Benchmarking).
- Measures to increase efficiency.

### Recycling: Increase and Expansion of Recycling of Wastes, where Economically Feasible

- Development and extension of recycling processes, such as additional installations for the production of 50,000 tons of substitute fuels annually.

### Operation of Sanitary Landfills: Protection of Soil, Groundwater and Air

- Continuous installation of gas collection and leachate treatment systems, where necessary (e.g. leachate treatment on disposal site Haus Forst).

### Operation of Sanitary Landfills: Conservation of Resources through the Use of Landfill Gas

- Use of landfill gas for energy and heat generation in co-generation heating-plants.

### Organisation: Adaptation of Environmental Management to Changed Organisational Structure

- Finalisation of the guideline 'Environmental Management System of RWE Umwelt'.
- Expansion and documentation of the environmental management systems of the management companies, subsidiaries and operational businesses.

### Procurement: Consideration of Environmental Performance of Contractors and Suppliers

- Introduction of selection criteria during preparation of procurement guidelines.

### Communication: Improvement of Communication about Environmental Issues

- Regular provision of environmental information to staff.
- Intensification of the internal environmental education and training programmes.
- Expansion of dialog with the public.
- Establishment of working groups at various business levels.

#### Timeframe

by Juli 1999

continuously

continuously

continuously

by end 1999

by end 1999

by December 1998

by July 2000

by July 1999

continuously

continuously

continuously

continuously

## Balance of Inputs and Outputs

		Reporting Period		
		1995/96	1996/97	
Unit				
INPUT				
Energy				
Electricity	MWh	23,290	30,155	
Refrigerator Processing *	MWh	1,267	1,448	
Glass Processing	MWh	6,692	7,178	
Processing of Electronic Scrap *	MWh	2,44	2,40	
Plastics Recycling *	MWh	11,707	15,740	
Plastics Processing	MWh	3,621	5,787	
Water **				
Plastics Recycling	1,000 m³	420	303	
Own Supply	1,000 m³	0	262	
External Supply	1,000 m³	420	42	
Raw Materials		t	752,709	806,975
Refrigerator Processing	t	8,978	10,438	
Glass Processing ***	t	682,701	705,583	
Processing of Electronic Scrap	t	8,645	10,479	
Plastics Recycling	t	16,469	23,085	
Plastics Processing ***	t	35,916	57,390	
OUTPUT				
Products		t	673,329	707,258
Refrigerator Processing	t	8,544	9,933	
Glass Processing ***	t	617,303	627,593	
Processing of Electronic Scrap	t	6,688	7,834	
Plastics Recycling	t	11,572	15,894	
Plastics Processing ***	t	29,222	46,004	
Emissions				
CO2 from Electricity from External Sources	t	14,673	18,998	
Wastes				
For Disposal	t	28,470	36,683	
Refrigerator Processing	t	434	505	
Glass Processing ***	t	17,330	21,091	
Processing of Electronic Scrap	t	1,859	2,578	
Plastics Recycling	t	4,897	7,191	
Plastics Processing ***	t	3,950	5,318	
For Recycling				
Glass Processing	t	34,659	42,182	
Effluents **		1,000 m³	420	303
Plastics Recycling	1,000 m³	420	303	

\* Projected Figure

\*\* Related to calendar year

\*\*\* Data on inventories was not collected.

Due to restructuring within the Group Division, a systematic compilation of all material and energy streams was not possible. To nevertheless enable a consistent presentation, only the streams from the waste processing businesses were considered and not those from the transport businesses. The consumption of energy for the areas refrigerators, electronic scrap and plastics has been projected.

Mechanical, Plant and Equipment Engineering.

# Environmental Protection as Common Responsibility.

The group division Mechanical, Plant and Equipment Engineering embraces several business areas and business groups. As a management holding, LAHMEYER AG leads this group division. Heidelberger Druckmaschinen AG, as well as companies involved in equipment engineering, medical technology, energy supply, building service systems and the provision of environmental and engineering consulting services, belong to the LAHMEYER group. Apart from NUKEM GmbH, the NUKEM group includes other engineering companies, as well as ASE GmbH, which produces solar technology.



Environmental aspects become increasingly important during engineering consulting and project development.

LAHMEYER AG has issued environmental guidelines for its business area in May 1998. Within the next two years, measures for implementing these guidelines will be developed. These measures will include all shareholding businesses of the LAHMEYER group.

## Environmental Guidelines of the LAHMEYER AG

Environmental protection safeguards the basis of our existence, in the sense of representing a dominant facet of sustainable development. We accept our common responsibility and use the following guidelines in the course of all our operations:

- We consider environmental protection an important business goal and practice it as an integral part of our business policy.
- We see environmental protection on the one hand as a responsibility towards staff and the public and on the other hand as a challenge and chance for the continuous improvement of our ecological efficiency.
- We comply with all legislative requirements, relating to environmental protection, and aim at continually improving our environmental performance even more, as far as it is economically feasible.
- We minimise the environmental impacts of our operations by using state-of-the-art technology.
- Wherever possible, we use processes which are more efficient with respect to the use of raw materials and energy.
- The protection of health and safety of our staff represents a continuous responsibility for us and is an important part of our environmental protection initiatives.
- We practice an open dialog with staff, business partners, authorities and the public, as a basis for finding efficient solutions for environmental issues, in mutual agreement.

Mechanical, Plant  
and Equipment Engineering.

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## Mechanical Engineering

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Within this group division, which is represented by Heidelberger Druckmaschinen, mechanical engineering is of particular importance. In Germany alone, the company employs more than 12,000 staff at its works in Heidelberg, Wiesloch, Amstetten, Brandenburg and Kiel. The main products of the German subsidiaries are the offset printing machines for sheets which are internationally renown. The works in Kiel produces equipment for the pre-press stage, including scanners and imaging devices for films and printing plates.

The main activities that are environmentally relevant are the casting of metal parts of all sizes, the use of cooling lubricants during metal machining, as well as, to a lesser degree, electroplating and lacquering of surfaces. The production of electronic parts also needs to be mentioned here. The consumption of raw materials is considerable, although mainly high quality steel scrap, as a secondary raw material, is used during the manufacture of cast iron parts. Further, emissions are generated through the use of oil and gas for heating the works areas and the offices. Contaminated process effluents are not discharged to sewer without appropriate treatment.



**Top quality printing requires precision in mechanical engineering.**

## Environmental Management

Operational principles, such as the conservation of resources and the minimisation of wastes are established at highest managerial levels. Environmental aims and corresponding programmes to achieve them are documented in all operational areas. In 1996, the foundry location Amstetten already took part in the EC Eco-Management and Audit Scheme (EMAS). All other works will follow suite and implement the EC Regulation and develop environmental management systems as well.

The Board of Technology at Heidelberger Druckmaschinen AG carries the responsibility for environmental protection. The Corporate Unit Environment reports directly to this Board and is responsible for the co-ordination of corporate environmental protection measures, nationally, as well as at the eight international sites. All operational sites have nominated representatives for environmental management, or officers for the area of waste management. Some also have nominated officers for emission control, the protection of water resources, hazardous goods and radiation control. Throughout the group division, safety and emergency plans have been prepared to avoid risks to the environment and to humans in the case of potential incidents.



## Environmental Compatibility of Processes and Products

The continuous evolution of corporate environmental protection is represented by numerous measures, which in total lead to a considerable reduction of environmental impacts. For example, the extended periods of use of the cutting fluids that are needed to cool the tools, as well as their recycling, help to reduce their consumption. Heidelberg has chosen an innovative approach by dry machining of metal parts, so that the use of cutting fluids and cooling emulsions is hardly required any longer. The recycling of compressor condensate, containing oil, is achieved with the help of an ultra-filtration installation. This has led to considerable savings.

Since then only three cubic metres of condensate, compared to the previously approximately 120, need to be disposed of, return on investment for the plant will be less than four years. The moulding sand can now also be recycled through appropriate processing in a regeneration installation, equipped with flue gas cleaning. Approximately 98% of the moulding sand can be recycled in this way. Several of the works have developed a waste management concept to try to avoid wastes, as far as possible, or to recycle them as valuables. Depending on the operation, the recycling rate currently lies between 68 and 99 percent.

Ecological criteria have also been considered within the context of the final use of products. Since 1995, printing equipment, which exclusively requires cleaning agents which are low in emissions for cleaning the cylinders and printing blankets, is on the market. Heidelberg is currently undertaking research to investigate, amongst others, how certain approaches towards construction can lead to a high recycling potential. This is an example of how ecological criteria play a role in the course of product development. New products on the market are Heidelberg's imaging device for films and plates which no longer require the previously necessary chemicals and fixing baths. The Studien- und Fördergesellschaft der Schleswig-Holsteinischen Wirtschaft awarded the certificate 'Environmentally Friendly Business 1997' to the works in Kiel, to acknowledge these innovative measures which lead to the conservation of resources.

## Communication

Since 1993, the business has been keeping its staff and customers, as well as the authorities and the public, informed through the issue of an annual environmental report. The subsidiary in Amstetten plant published the first environmental statement in 1996. Articles on environmental issues appear regularly in the staff paper 'Heidelberg Post' and additional information is pinned onto the staff pinboards to support environmental communication. On top of that, customers world-wide receive the publication 'Printing and the Environment' which is published in 13 different languages. Business representatives cooperate in numerous external initiatives. They are, amongst others, members of the working group 'Environment and Economics in the Rhine-Neckar Triangle', members of a sector initiative for the reduction of solvent emissions in offset printing, as well as of a municipal initiative for the implementation of the environment and development programme, Agenda 21, in Heidelberg.

## In Focus.

### Heidelberger Druckmaschinen applies EC Eco-Audit-Regulation

The EC Eco-Audit-Regulation, which came into effect in 1995, relies upon businesses' own sense of responsibility towards environmental protection. Businesses which have completed an environmental audit, have developed an environmental management system and have issued an environmental statement, which is validated by a certified environmental auditor, can use the EC Environment logo on their correspondence. They can thus publicly demonstrate that they operate in an environmentally responsible manner.

Heidelberger Druckmaschinen decided to implement the EMAS at all its German subsidiaries to create a fundamental basis for corporate environmental protection. In 1996, the plants in Amstetten, with the foundry and the manufacture of heavy parts, were the first to undertake an environmental audit. The local environmental team examined the areas of waste management, water resource management, emission control and energy management. On the basis of the data acquired, the team developed an ambitious environmental programme. Two of the aims of the works are the installation of further measures to reduce water consumption and the reduction of the volume of paint sludge that is generated. The reduction aimed for is 20% by March 1999.



In 1996, the Amstetten plant became the first foundry in Germany to obtain certification under the EU EMAS regulation.

# Environment Programme – Mechanical Engineering.

(Heidelberger Druckmaschinen)

## Environmental Management

Implementation of the EC Eco-Audit-Ordinance at all German plants.  
This will involve the following:

- Development of an environmental management system.
- Monitoring of material and energy flows.
- Development of an environmental programme.
- Drafting of an environmental statement.

### Timeframe

by 2000

## Balance of Inputs and Outputs

		Reporting Period				
	Unit	1993/94	1994/95	1995/96	1996/97	1997/98*
<b>INPUT</b>						
<b>Energy</b>	MWh	286,800	306,900	333,900	338,100	376,500
Natural Gas	MWh	105,000	107,000	110,000	114,000	139,900
Electricity	MWh	151,300	174,300	186,600	182,200	211,400
Oil	MWh	13,000	8,000	17,000	24,000	8,700
Water	MWh	17,500	17,600	20,300	17,900	16,500
<b>Water</b>	1,000 m <sup>3</sup>	390	337	287	287	339
<b>Raw Materials</b>						
Casting Materials/Metals	t	22,209	30,200	37,801	34,250	46,516
<b>OUTPUT</b>						
<b>Products</b>						
Printing Equipment, Pre-press Products	t	34,179	39,079	48,077	48,602	58,760
<b>Emissions</b>						
CO <sub>2</sub>	t	24,332	23,388	26,397	29,067	30,208
CO <sub>2</sub> from Electricity Supply	t	86,940	109,620	117,180	114,660	132,930
SO <sub>2</sub>	t	1	1	2	2	1
NO <sub>x</sub>	t			3	3	3
Particulates	t			7	6	6
Hydrocarbons**	t			46	44	26
<b>Wastes</b>						
For Re-use	t	11,307	15,427	27,167	24,495	33,666
For Disposal	t	10,747	11,573	5,300	4,580	4,671
Effluents	1,000 m <sup>3</sup>	304	257	210	217	253
Cooling Water	1,000 m <sup>3</sup>			28	26	33

\* Since 1997 including Kiel plants

\*\* Change-over to solvent-free lacquers

The most important material flows were listed as indicators, since the data on raw materials was presented in various units and are thus only of limited value. The Kiel plant is considered as of 1997.

### Equipment Engineering

The area of equipment engineering includes mainly the manufacture of electromechanical components, electricity supply systems, as well as medical technology. Although the products of the companies Piller, MAQUET and Starkstromgerätebau (SGB) are very different, the manufacturing processes and their environmental aspects are very similar: the main activity of all three companies is the manufacture of metal products.

The company MAQUET, vendor for integrated surgery workplaces, produces operating tables and hospital equipment at its site in Rastatt and employs approximately 1,000 staff. The most recent development is the first European surgical robot, the CASPAR (Computer Assisted Surgical Planning and Robotics). Surface treatment occurs at degreasing and lacquering installations, as well as at an electrical polishing installation, with its own effluent treatment. The environmental impacts of plastic manufacture could be substantially reduced during the last few years, particularly by substitution of fluoro-chloro hydrocarbons (CFCs).

At two sites, Osterode and Mechernich, Piller manufactures electricity supply installations, generators, electromechanical components and systems, as well as transformer stations. Piller employs approximately 930 members of staff. The metal surfaces are lacquered in an electrostatic powder coating plant.

The plant in Mechernich has switched its fuel to gas and has installed complex effluent treatment plants to reduce environmental impacts. The site in Mechernich is already certified according to the international environmental management standard ISO 14001. Osterode has a quality management system in place, which complies with ISO 9001.

The SGB in Regensburg produces oil and cast resin transformers, offers reconditioning services for transformers, as well as for rotating electrical machines and undertakes preparatory services for disposal and recycling of transformers and capacitors containing polychlorinated biphenyls (PCBs). At its six sites the company employs a total of 620 staff members. Activities of environmental relevance include the preparation of PCB-containing transformers for disposal, the treatment of surfaces in spraying and lacquering installations, the cleaning of machines prior to repair and the handling of oil.

Important environmental aspects of equipment engineering are the generation of wastes and paint sludge, effluents, as well as air emissions from the lacquering and heating plants. The potential risk to groundwater through the use of consumables, such as oil or trichloroethylene, which is still used as a cleaning agent by Piller, should be mentioned as well.



Produktverantwortung bei MAQUET: FCKW-freie Polster für Operationstische.

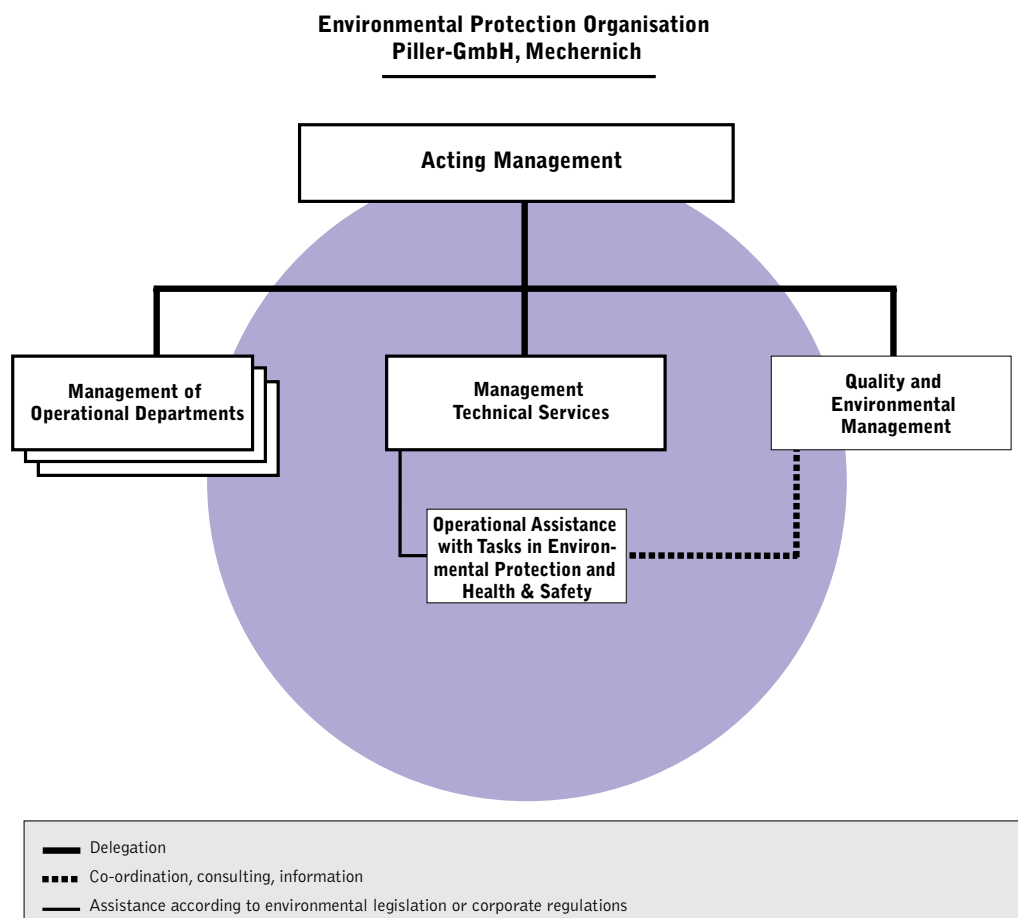
## Environmental Management

The environmental guidelines of LAHMEYER AG, which complement those of RWE, are valid for all businesses. A member of the Board of the LAHMEYER AG holding is overall responsible for environmental protection. Piller and SGB have adopted these environmental directives and have added to them by developing their own environmental operating principles, environmental goals, as well as environmental programmes. The businesses have firmly embedded the responsibility for environmental issues within their management. Responsibilities, processes and work sequences have also been defined. MAQUET documents the environmentally related operational organisation by means of operating directives. Within all businesses, environmental protection represents part of the operational suggestion system and is integrated into training. MAQUET has appointed an officer for waste. Further management officers are responsible for the areas of emission control, aquatic protection and hazardous substances at Piller and SGB. All businesses have measures for the avoidance of environmental impact during worst-case scenarios in place. These include emergency plans, firewater retention basins and/or an own fire-fighting team on-site.



**"Our Board has decided that, by 1999, we will have defined environmental guidelines, goals and an environmental programme, which will include firm recommendations for improvement. I am also looking forward to the adaptation of our environmental organisation to the restructuring of our business, which occurred during the past few years. The strong involvement of our Board in issues to do with environmental protection, is a fundamental basis for its continuous improvement. It also serves as a motivation for staff. This makes my job easier."**

Gerd Mörmann, Officer for Occupational Health and Safety and Environmental Protection (MAQUET AG)



### Procurement and Logistics

The companies SGB and Piller take ecological criteria into consideration during the selection of their suppliers, since consistent environmental protection starts with procurement. The SGB is in liaison with the producers of lacquers, with the aim of introducing water-based lacquers. MAQUET supports a research project to change-over to powder coating, which is environmentally more acceptable. To reduce the huge volumes of packaging waste, the businesses use recycling pallets and transportation racks for their national deliveries.

### Production and Products

To ensure environmentally compatible production, directives for environmentally relevant work sequences are available in all businesses. Innovative measures are employed, too, for the purpose of keeping environmental impact to a minimum. The SGB, for example, already managed to substantially reduce the losses that occur during spray lacquering, termed 'overspray', through the use of an electrostatic process. The increased use of water-based lacquers contributes to a decrease in the emission of solvents. To reduce water consumption, Piller recycles the wastewater from the cleaning of machinery and uses it again. MAQUET pursues the same aim by recycling water in the production process. A centrifuge, which separates the water from the residual lacquer, is used to treat the lacquer effluents. A similar installation is used by Piller. In future, waste management concepts in all the businesses will define measures for the reduction of waste that is generated.

Ecological issues are considered more and more during product development. Piller manufactures cables and dry transformers that are halogen-free. MAQUET, on the other hand, has switched to the use of FCHC-free alternatives. Foaming of the padding of the operation tables is now undertaken using n-pentane, a pure hydrocarbon. Recycled paper, instead of polyurethane foam, is now used as insulation material in wall elements.

### Communication

The businesses SGB and Piller issue instructions to inform staff of environmental issues. Special brochures are published to inform customers about the environmental impacts of the products. Piller also organises seminars to inform its customers and provides advice within the context of accepting lead and steel accumulators for recycling. SGB and Piller in Mechernich offer open days for the public. Within all businesses, representatives are actively engaged in external working groups.



## Environmental Programme – Equipment Engineering.

### Reduction of Energy Consumption

- Avoidance of power peaks in electricity consumption (Piller and MAQUET).
- Optimised curing (SGB).
- Reduction of the energy demand (Piller, MAQUET).

### Improvement of Environmental Management

- Finalisation of environmental guidelines and definition of aims (MAQUET).
- Development of an environmental protection organisation (MAQUET).
- Drafting of procurement guidelines containing environmental considerations (MAQUET).

### Reduction of Emissions

- Increased use of water-based lacquers (SGB).
- Avoidance of FCHC-emissions through substitution of the polyurethane insulations (MAQUET).

### Reduction of Water Consumption

- Introduction of water-saving cycles (MAQUET).

### Reduction of Raw and Auxiliary Materials and Consumables

- Reduction of the consumption of resin and curing agent through optimised coil design (SGB).
- Avoidance of pickling agents through the use of pyrolysis with off-gas cleaning (SGB).

### Waste Reduction

- Development of a waste management concept (MAQUET).

#### Timeframe

continuous

by 1999

by 1999

by 1999

continuous

continuous

by 2000

by end 1998

## Balance of Inputs and Outputs

		Reporting Period	
		1996*	1997*
Unit			
INPUT			
Energy			
Natural Gas	1,000 m <sup>3</sup>	2,655	3,011
Electricity	MWh	17,325	17,073
Oil	l	1,595,293	1,413,696
Fuels	l	262,736	86,825
Water			
Own Supply	1,000 m <sup>3</sup>	13.7	11.2
Foreign Supply	1,000 m <sup>3</sup>	39.5	55.9
Raw Materials			
Paints, Lacquers	t	54.7	66.8
Trichloroethen	t	3.4	2.0
Solvents	t	23.3	24.9
OUTPUT			
Emissions			
CO <sub>2</sub> from Electricity Supply	t	10,915	10,756
Trichloroethen	t	2.8	1.6
Solvents	t	23.3	11.8
Wastes			
For Re-use	t	5,306	5,110
For Disposal	t	988	877
Effluent	1,000 m <sup>3</sup>		45.0

\* The time scales are different: Piller used the calendar year as the basis of its data. Starkstrom-Gerätebau and MAQUET used the financial year as a basis (1 July to 30 June of the following year).

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## Plant Engineering and Consultancy Services

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The business areas consulting and technical services have relatively few environmental impact. Three companies within the LAHMEYER group are active in this area.

Lahmeyer International, Frankfurt, offers a wide spectrum of planning and consultancy services in the areas of energy, water, traffic, construction and project management. It employs 900 staff. The associated company ERM Lahmeyer International, with its 100 staff, offers a wide range of consultancy services in all areas of industrial environmental protection and environmental management. In international projects, newly industrialised and developing countries are supported in development of environmental protection.

The main focus of Rheinelektra Technik, Mannheim, is the technical equipment of buildings, as well as data and communication technology. It employs 2,000 staff within its five main branches in Germany. The company makes a significant contribution towards energy-efficient buildings through the development of integrated electrotechnical installations. The concept of 'Integrated Electro-technical Engineering' combines and co-ordinates the areas of energy and installation technology, communication technology, as well as data and automation technology. The manufacture of equipment and installations is deliberately not undertaken, so that the best individual components can be chosen, independent of the manufacturer.

The Starkstrom-Anlagen-Gesellschaft mbH (SAG), Frankfurt, employs approximately 5,500 staff within around 200 German branch offices, for the purpose of providing technical services.

Complete projects and system solutions are supplied nationally, as well as internationally. These include power station and industrial plant engineering (power supply, light and power installations, control and processing), high voltage grids (switchgear, cables, transmission lines, auxiliaries and controls), network services (distribution networks, lighting and traffic control systems), telecommunication (stationary, mobile and directional radio, data processing networks), as well as network information systems (geodesy, GIS and surveying).

The main aspects of environmental relevance are the wastes that are generated in the course of installation and maintenance works, such as cable residues and electronic components. The consumption of energy, water and paper in the offices should be mentioned here, too, as well as the emissions that are connected to the operation of the car park.

# Environmental Programme – Plant Engineering and Consultancy Services.

## Environmental Management

- Introduction of an integrated by end 1998 management system, in accordance with DIN ISO 9001 and DIN ISO 14001 (ERM Lahmeyer International).

Timeframe
by end 1998

## Environmental Activities

At SAG, which has defined its own environmental guidelines, the responsibility for environmental issues is firmly embedded into management. Operational directives and instructions are available for the handling of hazardous substances. It is one of the duties of the environmental officers at SAG to substitute these substances with more environmentally compatible alternatives, wherever possible.

At Lahmeyer International and Rheinelektra, environmental tasks are defined in the quality management manual, in the form of operational directives. These directives address the procurement of environmentally compatible products, the use of recycled paper, as well as waste separation.

Representatives of Lahmeyer International co-operate in the working group 'Environmental Protection' of the Chamber of Industry and Commerce. The staff of ERM Lahmeyer International are also active in numerous environmental working groups, within the framework of their consulting operations. One of these is the World Business Council for Sustainable Development.



Maintenance work also has environmental impacts.

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## NUKEM Group

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Next to NUKEM GmbH, the companies NUKEM Nuklear GmbH, Klöckner Industrie-Anlagen GmbH and EDELEANU also belong to the NUKEM group. The operations of these companies have relatively little environmental impact, as the main focus of their work is plant engineering and contracting. The services that are offered are widely spread and range from engineering services to the planning and construction of turn-key industrial plants within the sectors of nuclear technology, pulp and paper, chemicals and petroleum, as well as industry and infrastructure. A total of 800 staff are employed within this business group in Germany.

The NUKEM subsidiary company, ASE GmbH in Alzenau, produces solar cells and modules for use in industrial technology, domestic technology, telecommunication and space technology. It employs around 140 staff at three German sites. The use of solar energy for electricity generation is most promising in southern latitudes, but also nationally ASE contributes to the conservation of resources through systems which are integrated into building fronts and roofs. The most relevant environmental aspects of the production of solar cells are the etching and cleaning of the wafers, the application of coatings, as well as the cleaning of the installations. These activities mainly impact air and water, they also generate waste.



Pilot production of solar cells at ASE in Alzenau.

The operation of NUKEM Hanau GmbH with its 17 members of staff, is involved in the dismantling of the de-commissioned former factory for fuel rods, NUKEM-A. This operation shall be divided into four stages as follows:

- decontamination of buildings and removal of all equipment and installations,
- preparing one of the buildings for conventional use,
- demolition of the buildings that cannot be used,
- remediation of soil and sewer system.

The dismantling process occurs with public participation, in close cooperation with the authorities. Within the framework of the permitting procedure, which was undertaken according to the Atomic Energy Act and an environmental impact assessment, the environmental impact was examined, assessed and reduced, wherever possible.

## Environmental Management

NUKEM's environmental guidelines are documented as an important component of the corporate guidelines, with the aim of continuously improving corporate environmental performance. A member of the management is responsible for environmental performance. Apart from that, this responsibility is documented in the position descriptions of managerial staff. Various directives, such as residues and waste management directives, safeguard the orderly sequence of operations that are environmentally relevant. A safety engineer is appointed at NUKEM GmbH and all its subsidiary companies. For fire protection within all operational areas, fire alarm and sprinkler systems have been installed. The organisational emergency processes are regulated in emergency plans. To encourage staff co-operation, environmental protection is a part of the corporate suggestion system. ASE also trains staff, according to their environmentally relevant tasks. The individual training needs are established through discussions with staff.

## Environmental Activities

ASE, as the only business within the NUKEM group which generates considerable volumes of waste, is currently developing a waste management concept, containing concrete measures for waste reduction. ASE pursues this goal by using reusable containers, wherever possible. To include staff in the active implementation of environmental protection, there are appropriate directives for environmentally relevant production processes. The environmental aspects that need to be considered are described in these directives. ASE is also planning to include ecological criteria into the selection process of suppliers and contractors, as environmentally compatible production commences with procurement. Within the context of product and process development, ASE cooperates closely with the Fraunhofer Institute for Solar Energy Systems, ISE, in Freiburg.

## Environmental Programme – NUKEM Group.

### Environmental Management

- Development of ecological procurement criteria (all businesses).
- Integration of the topic of environmental protection into staff training (all businesses).
- Development of an environmental management system in accordance with ISO 14001 (ASE).
- Inclusion of contractors into environmental management (ASE).

Timeframe
by 1999
by 1999
by end 1999
by end 1999

## Balance of Inputs and Outputs – NUKEM

		Reporting Period		
	Unit	1995/96	1996/97	1997/98
INPUT				
Energy				
Natural Gas	1,000 m³	924	813	798
Electricity	MWh	9,591	9,845	9,553
Oil	t	250	250	250
Water	1,000 m³	54.8	56.7	60.8
Raw Materials				
Acid	t	40.3	44.3	47.3
OUTPUT				
Products				
Solar Cells (nominal power output)	MW	2.3	2.3	2.6
Emissions				
CO₂ from Electricity	t	6,042	6,202	6,018
SO₂	t	< 0.1	< 0.1	< 0.1
NOₓ	t	< 0.1	< 0.1	< 0.1
Hydrocarbons	t	0.1	0.1	0.1
Wastes				
For Re-use	t	103	122	102
For Disposal	t	42	44	47
Effluent	1,000 m³	49.8	51.9	54.6
Cooling Water	1,000 m³	3.6	3.4	4.2



# Environmental Principles.

RWE Telliance AG, which operates in the field of telecommunications, is the youngest member of the corporation. It has formed a venture with VEBA, called o.tel.o. communications GmbH & Co., which provides various telecommunication services. These include public telephony, the development and operation of a national telecommunication network, as well as services in the field of multi-media. RWE Telliance AG is a shareholder of the E-Plus Mobilfunk GmbH through o.tel.o.

Although the operational activities of RWE within the field of telecommunications have relatively insignificant environmental impacts, the issue of environmental protection was integrated into the corporate vision at the foundation of the company o.tel.o. Its operational principles include the promotion and use of environmentally compatible operational processes, the preference of environmentally compatible technology and products, as well as the economical use of resources. To enable the day-to-day implementation of these principles, o.tel.o has integrated environmental criteria into its procurement guidelines and into its supplier contracts. o.tel.o is also planning to nominate an environmental representative with responsibility for environmental issues.



Last training session before starting customer-service.

Construction and Civil Engineering.

# Environmental Impacts are Unavoidable.

The core competence of HOCHTIEF is construction. More than 16,000 employees are involved in realising construction and civil engineering projects, up to and including complex systems, in Germany. The company also offers design, financing and operation of such projects.



The worlds largest floating crane during construction of the Öresund bridge between Denmark and Sweden.

HOCHTIEF's projects include developments that have the potential to result in environmental impact, such as petrol stations, sewage treatment plants, landfill sites, canals, power stations and other installations which require approvals. The entire national construction and construction management business is served regionally by the Main Branches with its Sub-branches and Regional Offices. Specialised know-how is concentrated in the competence centres throughout the group. These centres undertake remediation of contaminated sites, rezoning and demolition of industrial plants.

Within HOCHTIEF, mainly the operations in contaminated areas, as well as in groundwater and radiation protection areas, the use of mechanical techniques in road construction and the remediation of disused landfills and hazardous waste disposal sites are relevant within the context of environmental protection. In addition, HOCHTIEF operates several environmentally relevant plants itself, such as cleaning and lacquering plants, several microbiological, as well as one thermal soil treatment plant, ready mixed concrete and pre-cast concrete element factories as well as timber-fuelled captive thermal power plants.

Every construction project has an environmental impact. The main sources of impact are land use, excavation, construction within the groundwater and, in some cases, the diversion of water courses. Other sources of environmental impact are the consumption of energy, water and raw materials, as well as the generation of noise, vibrations and waste. During all the tasks that HOCHTIEF performs, it tries to reduce these impacts to a minimum. An appropriate organisational structure ensures that this goal is continuously pursued.



**"By separating the wastes rigorously during construction, we protect the environment and save a lot of money. Within this context, it is vital that everyone on the construction site co-operates – from construction management to the subcontractor from the concrete builder to the carpet layer. Clear sign-posting and short distances to the collection containers help us in our aim."**

Wolfgang Paulik, Construction foreman  
HOCHTIEF

Within the Executive Board, environmental protection is allocated to the field of construction operation. Responsibilities and authorities for all environmental tasks are documented and are communicated to all employees. To ensure compliance with legislative requirements, work instructions regarding the following topics have been issued by the Corporate Units:

- environmental protection,
- organisation of environmental protection,
- handling of hazardous substances,
- transport of hazardous goods,
- operations in contaminated areas,
- waste management.





**The Katse dam: Heart of the Lesotho Highland Water Project.**

The Environmental Officer of the company reports directly to the Executive Board. The Corporate Units have nominated their own Environmental and Hazardous Goods Officers. In addition, a Waste Management Officer and one for emission control are employed by HOCHTIEF Umwelt GmbH. The main tasks of the Environmental Officers include the overall co-ordination of environmental tasks and the development of waste balances and quarterly environmental reports. Apart from that, employees involved in undertaking environmental tasks receive training. To actively include as many employees as possible in environmental protection, it is subject of the corporate suggestion scheme and also forms part of the corporate training programme. For the purpose of exchanging know-how and experiences, the Environmental Officers of both Headquarters and Corporate Units hold quarterly meetings.

## Risk Management

Instructions for the handling of hazardous substances, dangerous equipment and installations, as well as for working in plants that require approval under the Federal Clean Air Act are available. This is a precaution for operational incidents which could lead to environmental impact. In construction projects, measures for the protection of soil and groundwater are taken during the handling of potential contaminants. These measures include oil separators, oil basins and oil containers. Every Corporate Unit also has a Safety Engineer who controls the measures for health and safety at work and provides training courses.



## Procurement and Logistics

Some of the Corporate Units take ecological criteria into consideration during procurement. A list of environmentally compatible construction materials is available to them – the Main Branch South-West has even developed its own database. Although the choice of building materials is usually influenced by the investor, HOCHTIEF uses materials which do not have an environmental impact, wherever possible. For example, waste minimisation is the guiding principle during design and construction of formwork and falsework. The same applies to road construction, where the use of recycled additives is preferred.

Logistics are optimised by high utilisation during transports, the avoidance of empty trips and 'just in time' deliveries. Streif Baulogistik, which maintains the equipment pool, procures equipment which is as low in emissions as possible.

## Construction Projects

During its construction projects, HOCHTIEF uses construction methods which are environmentally more acceptable, and installs environmentally compatible technology, wherever possible. For example a complex water supply system was developed for the Messeturm office tower and the Commerzbank headquarters in Frankfurt/Main, which turned an economic concept for conservation of resources into reality. Cooling water, for example, is used again in sanitary installations before it is discharged to sewer.



Waste minimisation during construction can only succeed with all employees involved.



For some construction projects, alternative energy sources can be used, such as geothermal energy. Within this context, HOCHTIEF is currently undertaking an immense pilot project. – The office tower 'Main Tower' in Frankfurt taps into the temperature storage capacity of around 280,000 cubic metres of earth through so-called 'energy piles' that are driven deep into the ground.

For the purpose of resource conservation, HOCHTIEF also uses recycled construction materials from the demolition of buildings or road surfaces. Streif uses waste wood, which is generated during the construction of prefabricated houses, for the generation of energy. By these means, the company consistently implements the prime aim of waste management, namely to avoid wastes as far as possible, or at least to re-use them in a sensible manner. Various Corporate Units have already developed waste management concepts. Sometimes such concepts are developed for individual projects. The Main Branch Berlin-Brandenburg which undertook a pilot project for waste management concepts for the construction project Messe Süd, was awarded an environmental protection prize from the Federation of German Industry (BDI) in 1998.

## Communication

HOCHTIEF provides its employees with environmental information through various media. Regular information is distributed via circulars and notices. Training courses and workshops provide an opportunity for the exchange of information beyond the boundaries of the organisational units. Customers receive insight into the environmental activities in the course of negotiations and discussions, whilst subcontractors, who are involved in HOCHTIEF projects, are consistently included in the project-specific environmental concepts. To develop environmental protection further, the Main Branch South-West for example co-operates closely with the Technische Hochschule Darmstadt and the Bauverein Darmstadt within the project 'Concrete with Recycled Additives'. HOCHTIEF Umwelt is involved with the Federal Ministry of Education, Science, Research and Technology through research and development projects on construction materials recycling and concrete construction. Finally, the participation of HOCHTIEF employees in corporate workshops and various initiatives of the construction industry serves to deepen environmental know-how and to find new, common solutions.

## In Focus.

### Database for Environmentally Compatible Construction Materials

The choice of construction materials is a very important aspect for environmental and health conscious design and construction. Due to the large number of chemical products, decisions have to be made particularly critically. HOCHTIEF is therefore planning to develop a database which will be made available to all project managers and planners. As a first step, the construction materials of pilot construction sites are being itemised, systemised and documented, within the framework of two research projects. The project 'Health-friendly Construction Materials' is examining the construction site of the 'Wohnpark Frechen' near Cologne, a HOCHTIEF-constructed housing complex. Classes of products such as the ones that were used during the construction of the Commerzbank headquarters in Frankfurt are being registered within the project 'Environmentally Compatible Construction Materials for Office Buildings'

After the employed construction materials have been registered, a comparative assessment of their effects on the environment and human health is made. The main consideration is the extent of their effects on human health and therefore the suitability of using them in future. Other aspects that are reviewed are the emission of pollutants during use and in the case of fire. Possibilities for recycling as well as for waste disposal are also examined. On the basis of this collection of information, HOCHTIEF develops internal recommendations and compiles the data in a construction material database. After it has been finalised, this database will become part of the internal Technical Information System (TIS) and project managers and planners will be able to access it via the Intranet.



**HOCHTIEF develops recommendations for the use of environmentally sound construction materials.**

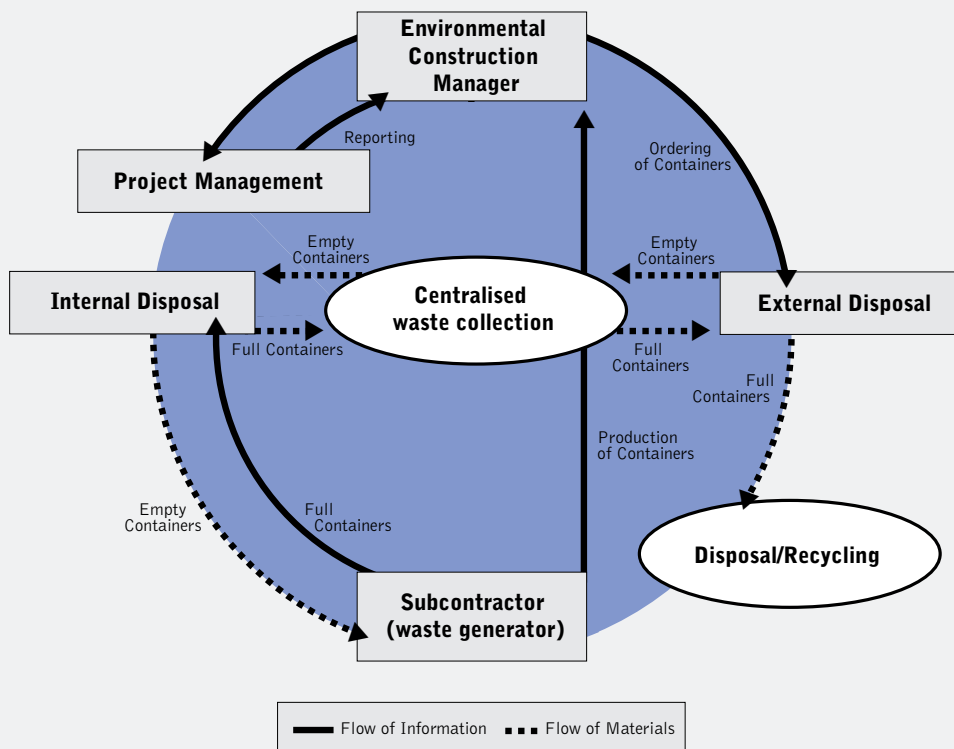
## Waste Management Concept

Last year the Main Branch Berlin-Brandenburg developed a waste management concept for the south extension to the trade fair complex in Berlin. This was done as a pilot project. The main aim was to avoid waste as far as possible. Construction wastes were separated and subsequently recycled to a high qualitative level.

This project also aimed at helping other Corporate Units to find ways of optimising their waste disposal processes. It was crucial, therefore, to compile the data. The result of the project was a significant reduction of waste disposal costs. This demonstrates that a waste management concept, that has been properly thought through, can also improve the economic result of a construction project.

HOCHTIEF used these positive experiences during waste disposal at the construction site Sony-Centre on the Potsdamer Square in Berlin. This was done in cooperation with RTB Umwelt GmbH. RTB Umwelt is a subsidiary of RWE Umwelt and, similar to HOCHTIEF, has been awarded a BDI Environmental Protection Prize for waste management at construction sites in 1988.

### **Material and Information Flow during Waste Management Logistics**



## Environmental Programme – Construction and Civil Engineering

### Integration of Environmental Protection into the Management System

- Baseline status for Corporate Units.
- Evaluation.
- Development of a structured environmental protection organisation.

#### Timeframe

by end 1998  
by end 1998  
by end 1998

### Transparency of Waste Streams

- Establishment of waste balances with the use of standardised software.

by end 1998

### Procurement and Use of Environmentally Compatible Construction Materials

- Implementation of the findings of the research and development project 'Environmentally Compatible Products in the Construction of Turnkey Office Buildings', which was finalised in 1997.

by end 2000

### Energy Efficiency and Reduction of CO<sub>2</sub>-Emissions

- Implementation of the findings of the following research and development projects:
  - Air circulation and energy conservation on industrial and production floors,
  - Energy supply via heat recovery in buildings,
  - Energy supply and storage.

by end 2000

### Conservation of Raw Materials

- Undertaking of a research and development project to optimise processes during demolition operations (construction material recycling):
  - environmental assessments of demolition methods,
  - data collection and review for the establishment of indicator values.
- Undertaking a research and development project on pre-stressed concrete hollow floors as a continuous improvement process.

by end 2000

### Transparency of Material Streams

- Continuous improvement of the compilation of environmentally relevant data in finance and accounting.

by end 2000

### Integration of Waste Management Systems into Corporate Construction Process

- Use of experiences gained from pilot projects for new projects.

by end 2000

### Avoidance of Noise Emissions

- Use of low-noise vibration technique to compact concrete HOCHTIEF-prefabrication.

by 2000

## Balance of Inputs and Outputs

	Unit	Reporting Period * 1997
<b>INPUT</b>		
<b>Energy</b>		
Electricity	MWh	60,650
Oil, Fuels, Gas **	1,000 l	11,154
<b>Water</b>	1,000 m <sup>3</sup>	1,511
<b>Raw Materials</b>		
Timber/Form-work Boards	m <sup>3</sup>	81,479
Concrete Steel	t	118,126
Reinforcement Steel	t	8,357
Concrete, Sand, Gravel	m <sup>3</sup>	1,521,567
<b>OUTPUT</b>		
<b>Emissions</b>		
CO <sub>2</sub> from Electricity	t	38,209
<b>Wastes</b>		
Structural and Old Timber	t	112,148
Construction Rubble	t	12,895
Road Demolition	t	52,095
Asbestos Cement	t	8,969
Iron Scrap	t	1,012
Slag from Concrete Production	t	2,869
Contaminated Soil	t	2,106
Commercial Wastes, similar to Domestic	t	586
Construction Site Wastes	t	5,941
		25,675

\* Due to SAP – introduction, data are only available for 1997

\*\* For the reporting period, no further details could be given.

Summary data can hardly be compiled, due to the various short-term projects that occur at various locations. Further, the different requirements of the various Federal States regarding waste balances renders the collection of data on waste volumes very difficult. The service area with the operation of airports and facility management, as well as residential construction was not taken into consideration.



Environmental Programme of the RWE Group.

# For Continuous Improvement.

The baseline assessment that was undertaken for this Environmental Report not only identified what has been achieved so far, but it also served to highlight gaps and weaknesses. These include the internal reporting system and the fact that environmental management has not yet been consistently extended to include product development. It should not be concealed either, that companies of the group division Mechanical, Plant and Equipment Engineering still partially use trichloroethylene or CFC's. Other environmental impacts, such as CO<sub>2</sub>-emissions and the use of resources, can not be avoided in future, but there is still potential for improvement in this areas.

Concrete plans for the improvement of operational environmental protection, from product development to the conservation of resources, are documented in the environmental programmes of the Group Divisions. They will be complemented by organisational measures, which we will introduce at a corporate level, in consistent pursuit of our environmental strategy. We have summarised the main points of the individual programmes within an overview. Regular reporting will help us establish what we have achieved and what still needs to be done in future.



# Environmental Programme – RWE Group.

## Improvement of Environmental Management

- Structuring and co-ordination of the environmental management systems:
  - development of framework requirements for the environmental management systems of the corporate companies.
  - implementation of the framework requirements within the corporate companies.
- Introduction of a group-wide system for reporting on environmental issues and on the status of environmental management:
  - definition of contents and implementation of the reporting system within existing systems.
  - regular reports to the Board of RWE AG.
- Extension of exchange in experiences regarding environmental management:
  - organisation of seminars on environmental management.
  - Realisation of the feature 'Environmental Protection' in the RWE-Intranet

## Consideration of Sustainability Criteria for Business Decisions

- Establishment of the main operational areas for sustainable management.
- Development and agreement of aims and criteria regarding sustainability.
- Complementation of environmental directives with requirements for sustainable management.

## Reduction of Environmental Impacts

- Increase in efficiency during energy generation.
- Reduction of the emission of greenhouse gases:
  - saving energy and fuel within in the works and logistics.
- Preservation of natural resources:
  - optimisation of use of materials and resources during processes and services.
  - increased recycling of wastes.
- Development of environmentally compatible products:
  - review and improvement of our products regarding their environmental impacts during use.

### Timeframe

30.06.1999

30.06.2000

30.06.1999

annually

30.06.1999

31.03.1999

30.06.2000

30.06.2000

continuous

continuous

continuous

continuous

continuous

RWE in Dialog.



# Speaking about Environmental Issues.

With this Environmental Report, we want to illustrate our environmental activities and promote the dialog with our target groups. Thus, the Report complements our corporate environment policy which includes the issue of news items and most importantly the publication of our business magazine 'agenda'. It is regularly published in German and English and represents the RWE Group, including its economic and social environment, using various examples.

Further information, including details on environmental protection, can be found on the Internet under [www.rwe.de](http://www.rwe.de). The holding, as well as the business areas, report regularly on most recent developments, using this medium. After the Environmental Report has been published, we want to make extracts of it publicly available in this way, too.

The companies of the Group Divisions co-operate with a number of different bodies, for the purpose of the exchange of experiences and the improvement of environmental protection. RWE AG itself is a member of the German National Committee of the World Energy Council, whose publications on issues of energy policy we strongly support. The main topic for 1998 is – characteristically – 'Sustainable Development'.

RWE's working group for energy management, which consists of members of the holding, and the Group divisions Energie, Rheinbraun and DEA, analysed 'Chances and Risks of Future Global Energy Supply' within a comprehensive study and, together with the underlying data, made it available to the public.

Regionally, we are mainly represented in the Initiative Group Ruhr region, which aims to promote the structural changes of the Ruhr region. With METEORIT, which is located in the RWE Park in Essen and which was created by André Heller as both a museum as well as an art object, we also try to promote the exchange of ideas with our social environment and initiate reflection on issues of the future. The RWE Summer Academy is another of our communication projects. It is an annual series of events for young people, involving experts from politics, science and the corporation itself.

Using our motto 'RWE, The Group That Knows How', we commit ourselves to transparency, openness and readiness for dialog. This is also illustrated by the book 'The Glass Giant. RWE – A Corporation Becoming Transparent', which was published at the occasion of our centenary. It contains reports on the various operational areas and includes information on the history and future of our corporation.

Since environmental protection is an issue involving our society, we consider the exchange with non-governmental organizations, authorities and science, but also with staff, important. We will be delighted to receive ideas and queries.

The same applies for our Group Divisions. Here more detailed information can be obtained with the reply card. Of course the contact persons that are listed in this Report, together with their addresses, are always available to answer further queries.

Contact Persons within the Group.

# Available for You to Speak to.

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\* contact person for the corporate companies Rheinelektra Technik GmbH AG, Starkstrom-Anlagen Gesellschaft mbH, Starkstrom-Gerätebau GmbH, Piller-GmbH, MAQUET AG, Lahmeyer International GmbH as well.

Companies included.

# RWE Aktiengesellschaft.

## RWE AG

### ● Energy

RWE Energie Aktiengesellschaft, Essen

### ● Mining and Raw Materials

Rheinbraun Aktiengesellschaft, Köln

Hürtherberg Stein und Erden GmbH, Köln

Lausitzer Braunkohle Aktiengesellschaft (LAUBAG),  
Senftenberg

Rheinbraun Brennstoff GmbH (RBB), Köln

### ● Petroleum and Chemicals

RWE-DEA Aktiengesellschaft für Mineraloel  
und Chemie, Hamburg

CONDEA Chemie GmbH, Hamburg

DEA Mineraloel AG, Hamburg

### ● Environmental Services

RWE Umwelt Aktiengesellschaft, Essen

R+T Umwelt GmbH, Essen

Trienekens AG, Viersen

### ● Mechanical, Plant and Equipment Engineering

LAHMEYER Aktiengesellschaft, Frankfurt/Main

Heidelberger Druckmaschinen AG, Heidelberg

MAQUET AG, Rastatt

Piller-GmbH, Osterode am Harz

Starkstrom-Gerätebau GmbH, Regensburg

Lahmeyer International GmbH, Frankfurt/Main

ERM Lahmeyer International GmbH, Neu Isenburg

Rheinelektra Technik GmbH, Mannheim

Starkstrom-Anlagen-Gesellschaft mbH, Frankfurt/Main

NUKEM GmbH, Alzenau

NUKEM Hanau GmbH, Hanau

Angewandte Solarenergie – ASE GmbH, Alzenau

Klöckner Industrie-Anlagen GmbH, Duisburg

EDELEANU Gesellschaft mbH, Alzenau

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