



**VGB**  
POWERTECH



Competence  
Service  
Responsibility



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Dr. G. Jäger  
Chairman



Dr. K. A. Theis  
Executive Managing Director

## Preface

Secure, environmentally-compatible and economic electricity and heat generation – the aims of VGB PowerTech e.V. – are current issues of interest that are more up-to-date than ever.

Fierce competition among the utilities as well as growing demands to protect the environment and the climate require technical and economic solutions, based on concentrated, objective know-how.

Today it is essential

- to bundle resources, e.g. to pursue projects aiming at efficiency increases,
- to keep pace with the changing political and legal requirements, and
- to make electricity and heat generation even more efficient by the development of processes in the sense of the "best practice".

VGB is offering the proper frame to meet all these requirements. For the international power industry, authority institutions and other associations of the industry, VGB is the competence center for economic and ecological electricity and

heat supply from

- fossil,
- nuclear, and
- renewable power sources

in centralised and distributed generation facilities.

Due to the willingness of the VGB members to exchange technical and economic experience directly on the expert level and to jointly develop solutions, VGB is the neutral platform for securing and objectively assessing generation-related problems.

The membership is international with the focus on Europe. Based on a tradition of more than 80 years, VGB disposes of a particularly deep and simultaneously broad wealth of knowledge and experience. The permanent updating of this know-how enables VGB to define references and the state of the art. As a result, our members have recourse to efficient support with respect to their core competences. In addition, decision-makers in the economy and political areas are provided with the necessary support to cope with the challenges of safe and environmentally-compatible electricity and heat generation in a growing global economy.

Chairman  
Dr. G. Jäger

Executive Managing Director  
Dr. K. A. Theis

# VGB POWERTECH



VGB Office, Essen



## Welcome to VGB



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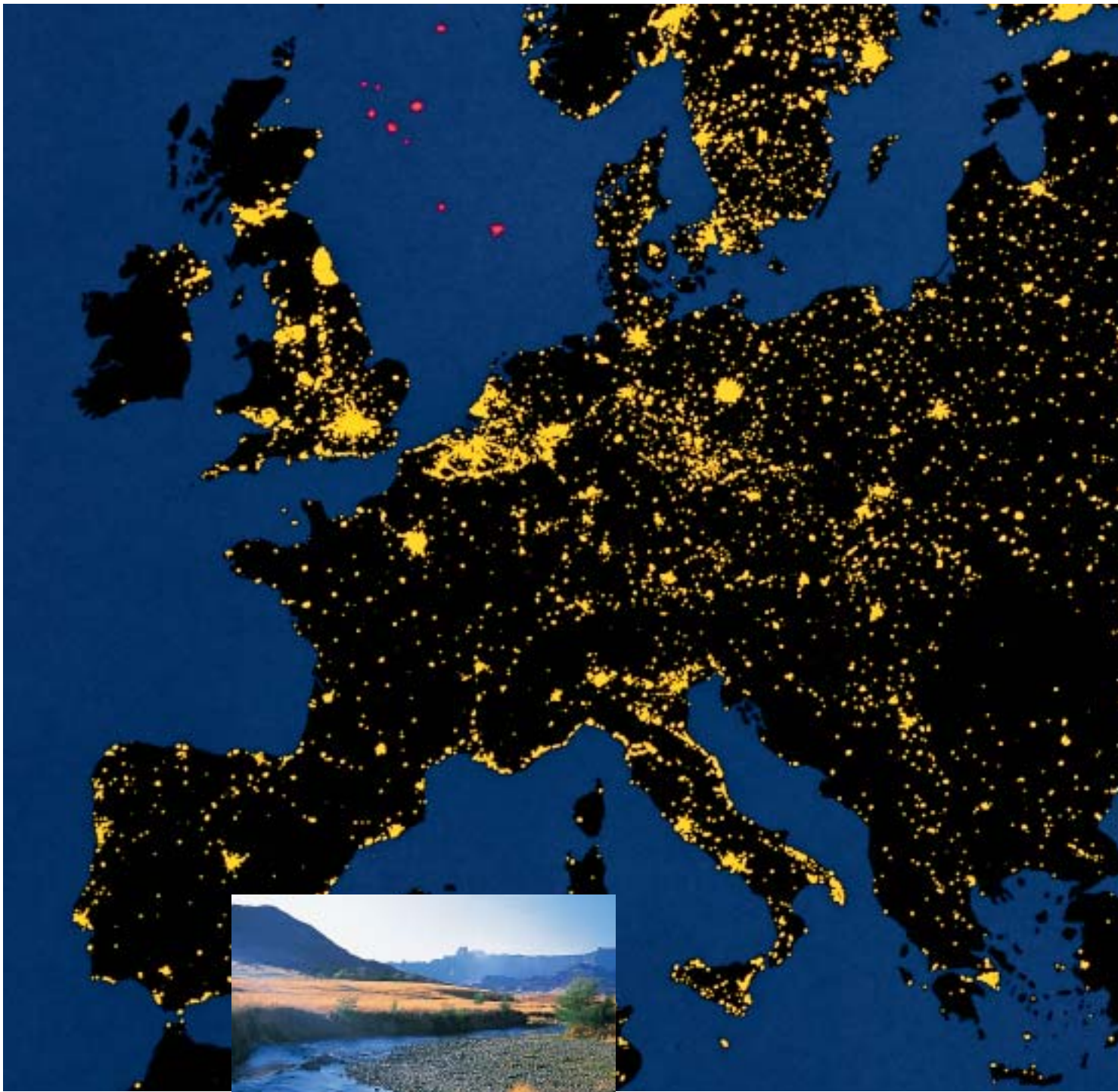
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*Our Aims - Our Members - Our Mission*

### Our Aims:

VGB PowerTech e. V. is a voluntary association of companies for which the operation of power stations and heating plants and the associated technology form an important basis of their corporate activity. The common aim of all the members – and therefore of VGB – is to promote and improve

- the operational safety and environmental compatibility and
- the availability and economic efficiency of both existing and new power plants.

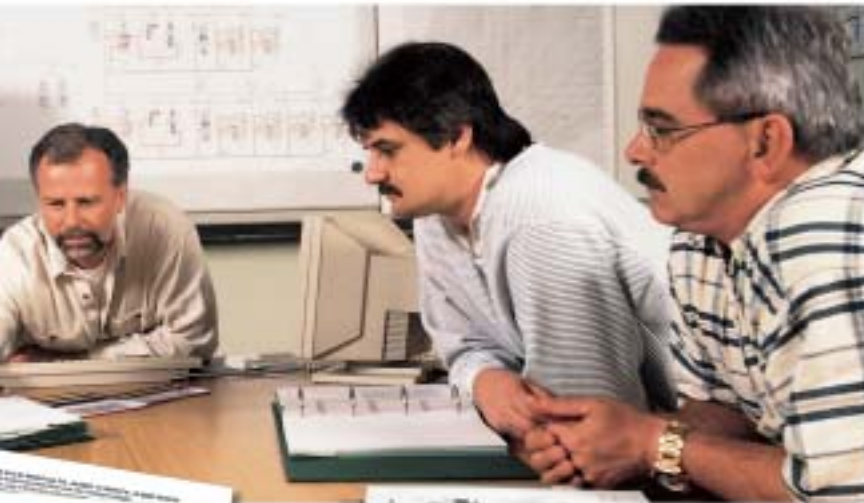
### Our Members – European and International

VGB was founded in Germany, in 1920. Today, approximately 420 utilities and industrial companies as well as institutions operating or manufacturing power and heating plants or dealing with related issues are members of VGB.

Approximately 150 of VGB's member companies are located in 29 countries worldwide. The majority are in Europe and represent more than 440.000 MW installed capacity of nuclear, fossil, hydro and other renewable power plants. About 1400 experts are active on more than 70 committees and working panels to exchange operating experience. The expertise is drawn from several countries throughout Europe. There is hardly another technical association that combines such a concentrated wealth of experience. It is this variety of opinions and commitment which is the driving force behind VGB's consistent forward thinking and its activities on an international level.



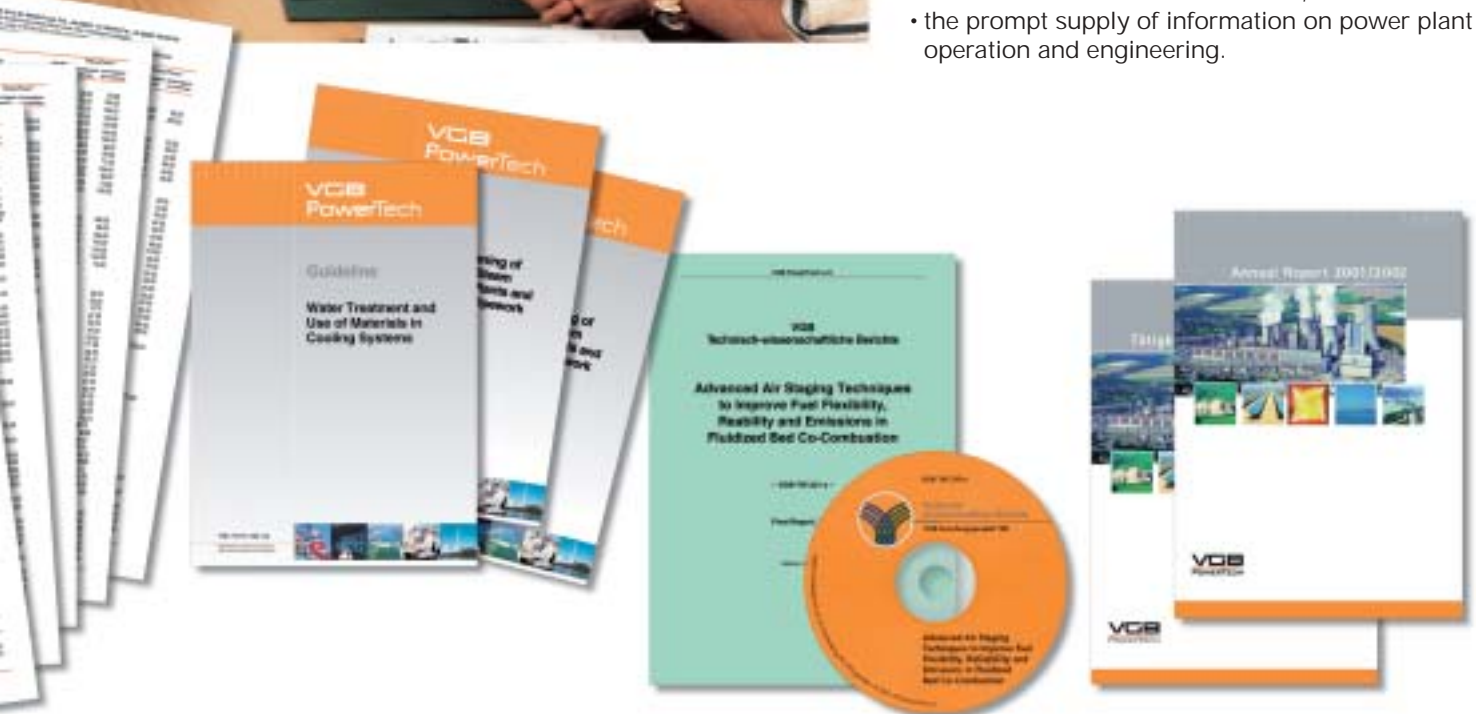
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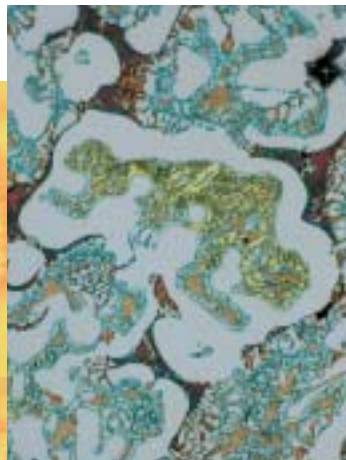


## Our Mission: To pool international experience

World-wide, data and facts from power plants are collected and analysed. As the result of the institutionalised exchange of experience between VGB members on VGB technical committees and working panels, these data are used for:

- the preparation of VGB's own guidelines and instruction sheets for promoting safety, availability, environmental compatibility and economic efficiency and also for the further development of power plants,
- the promotion of training related to power plant operation, updating technical knowledge and skills, professional education and training of power plant personnel,
- the initiation and management of research and development projects,
- tests and investigations in connection with plant failures, operating events and inspection findings
- advice on the planning, construction and operation of power plants,
- the preparation of technical terms and conditions of supply, and rules for power plants in co-operation with manufacturer associations, supervisory authorities and also research institutions,
- the continuous flow of information among members regarding new experience and knowledge through reports, papers as well as lectures, conferences and technical events and,
- the prompt supply of information on power plant operation and engineering.





# 2

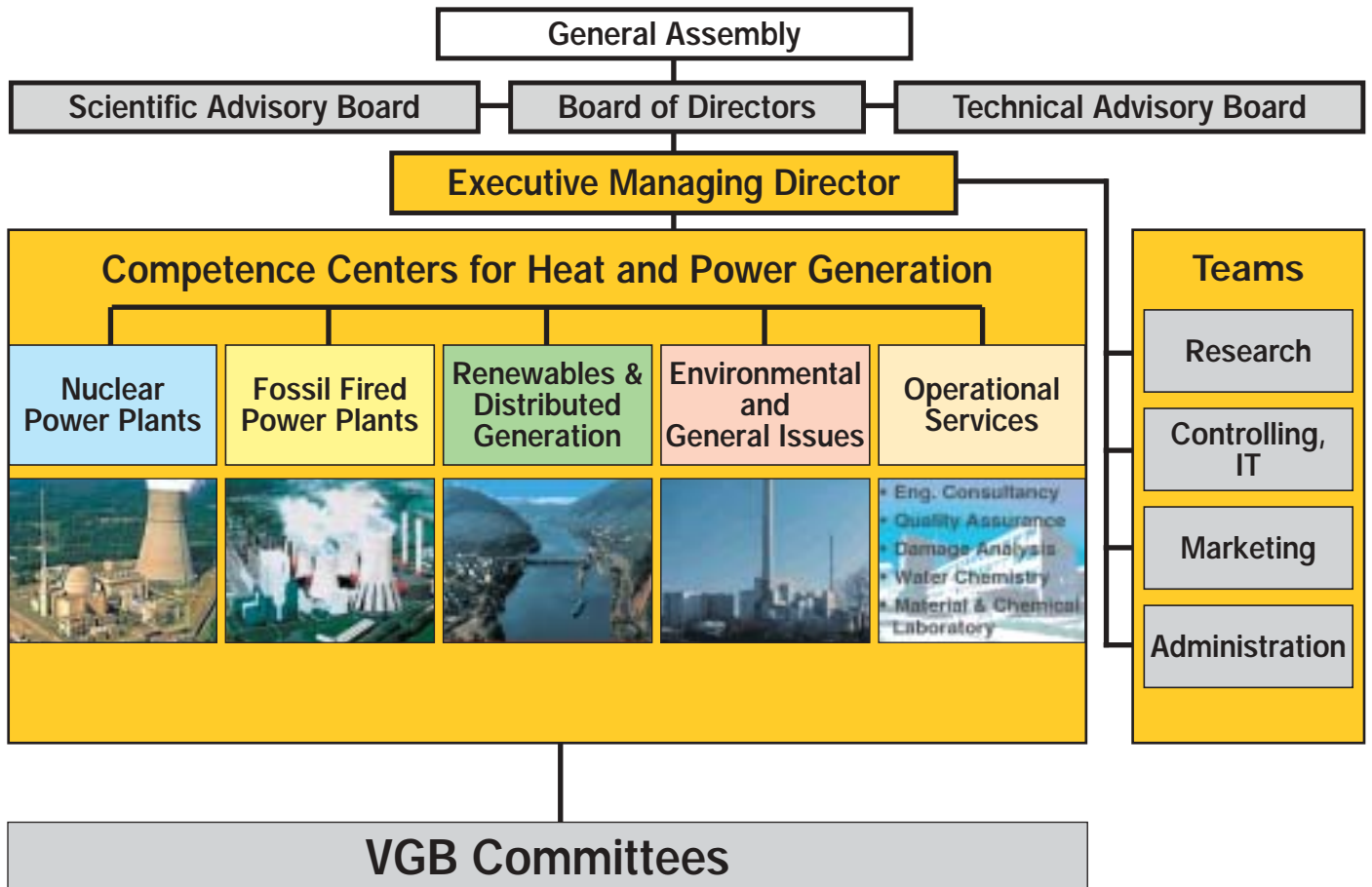
## The Responsibility of VGB

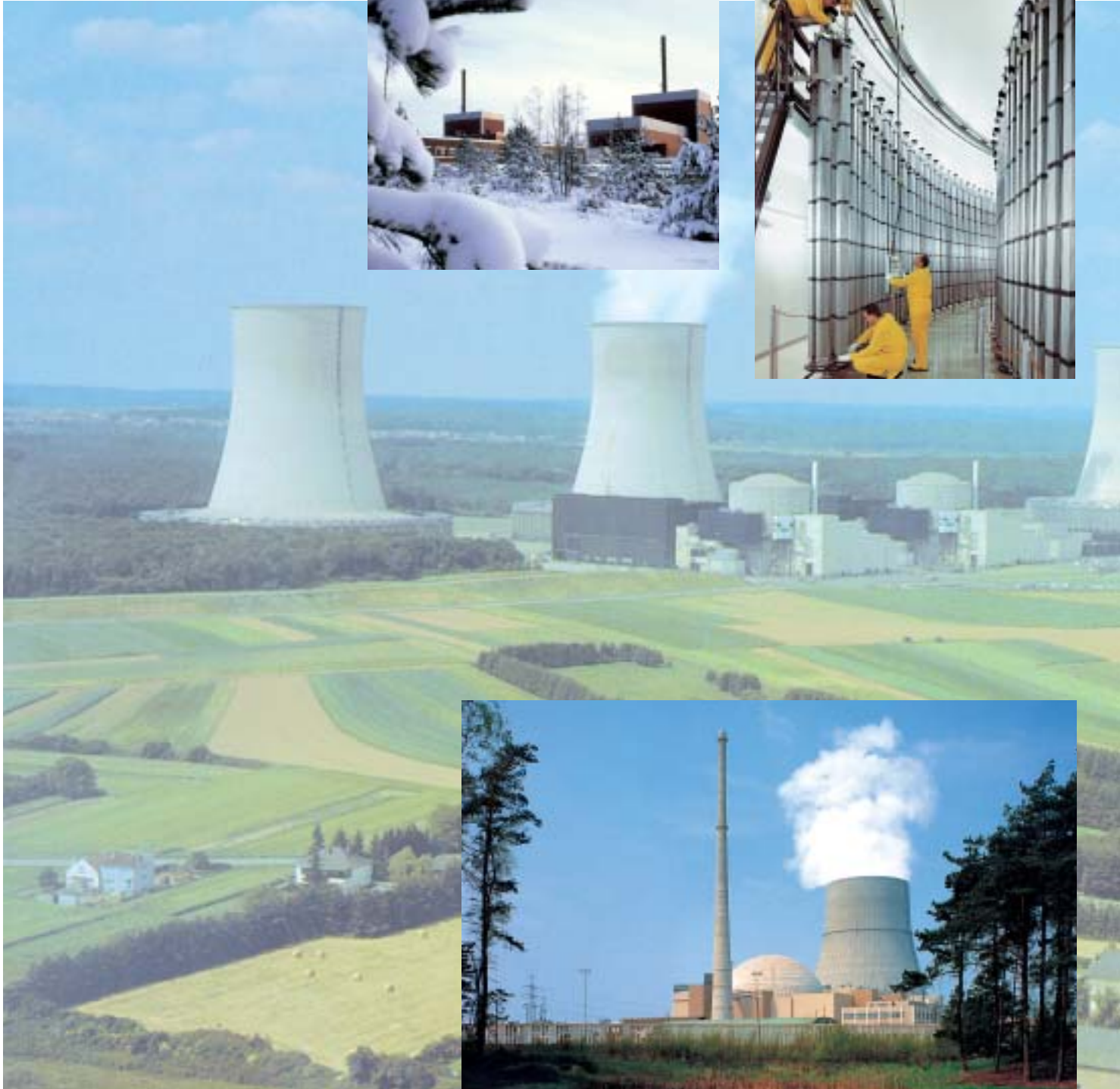
### Professional organisation: For the current tasks and future challenges

VGB is organised as an operative system of expert bodies which can deal professionally with all aspects of the exchange of experience.

The necessary scientific and technical back-up for management, research and administration is

garanted by the advisory boards and VGB Competence Centers and Teams. Thus, VGB is able to satisfy its members' demands by performing the existing specific tasks in the various areas of power plant engineering and operation.







## Generation, technology and efficiency – The responsibility of VGB

### I. Nuclear Power Plants

Nuclear power has become an essential backbone of the power generation industry. Approximately 450 nuclear power plants produce about 17 % of the power generated worldwide.

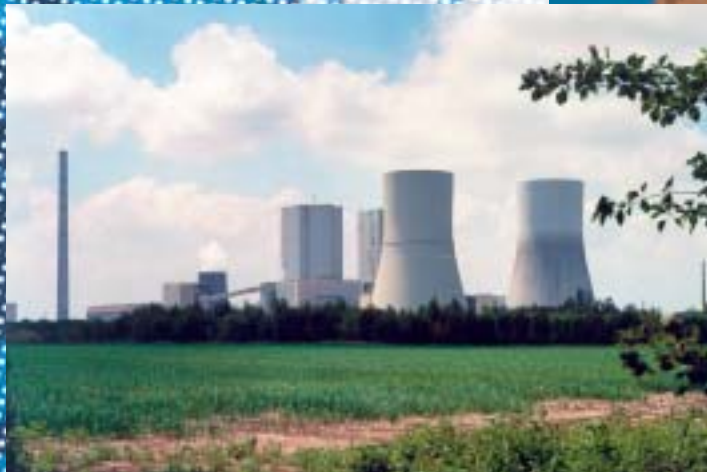
The nuclear activities of VGB are pooled in its general committee “Nuclear Power Plants”, heading a system of three technical committees, about 20 working panels and a varying number of working groups.

Their principal tasks are

- exchange of operating experience,
  - joint research and development,
  - common representation, and
  - development and maintenance of databases.
- The exchange of experience, which takes place in the committees, is also backed by the “VGB Central Incident Reporting and Evaluation Office”. It evaluates and distributes all event reports on a worldwide basis (e.g. from WANO, the World Association of Nuclear Power Operators) and checks their relevance for the VGB member plants and vice versa.

VGB organises about 40 to 50 joint R&D projects per year, thus saving considerable amounts of expenditures for its project partners.

VGB also co-ordinates the technical interests of nuclear power plant operators against third parties such as licensing authorities, the European Union (with EURELECTRIC), consultants and manufacturers. It also provides valuable information from the German Reactor Safety Commission meetings and acts as an interface to the German Radiation Protection Commission.





## II. Fossil Fired Power Plants

Fossil fired power plants are the pillar of the electric power supply in Europe. More than 50% of the electricity generated comes from fossil primary resources, i.e. coal, gas and oil. A wide range of technology options is the basis for competitiveness, sustainable environmental protection and security of supply.

The technology employed by fossil power plants has become ever more complex and has brought with it a variety of technological and operative aspects, which are essential to ensure reliable operation and optimum production. In order to comply with these challenges there is a need today - and more so in the future - for a communication platform and a fast flow of information between all areas of the power plant organized by VGB and its committees.

Both generation and technology are the central focus of the committee work.

VGB processes and answers both general and detailed questions concerning the main areas, such as fuel, steam generator and pipe systems, mechanical and electrical engineering and control and instrumentation, material engineering with respect to material strength and test methods and plant operation and maintenance management, respectively.

### Boiler technology

VGB is involved in matters relating to combustion technology, including

- safety and monitoring aspects,
- corrosion in the combustion chamber,
- waste incineration,
- fuel characterisation,
- coal mills and grinding, and
- burner design.

### Material problems

Material problems were one of the reasons why VGB was initially founded. This particular area is still of prime importance in the eyes of the association.

### Turbines - steam and gas

Turbines are key components of power plants. Therefore operational performance and maintenance optimization as well as design features with component efficiency and material issues are in the central focus of VGB activities.







### Civil engineering

In civil engineering, investigations are carried out on building materials, components and support structures. Advice on tendering, surveillance, construction work and surveying are mainly in the interest of safety and economic efficiency. Protection measures against wind impact and temperature and dynamic effects (earthquake) on stacks, hydraulic engineering structures, reactor buildings and machine foundations, are all matters that VGB is committed to.

### Instrumentation & control

In view of the fact that in modern power plants, mechanical engineering and electrical engineering are connected by highly sensitive, control and instrumentation diagnostic systems, the entire range of electrical engineering, including the primary voltage terminal of the main transformer is also part of the VGB activities.

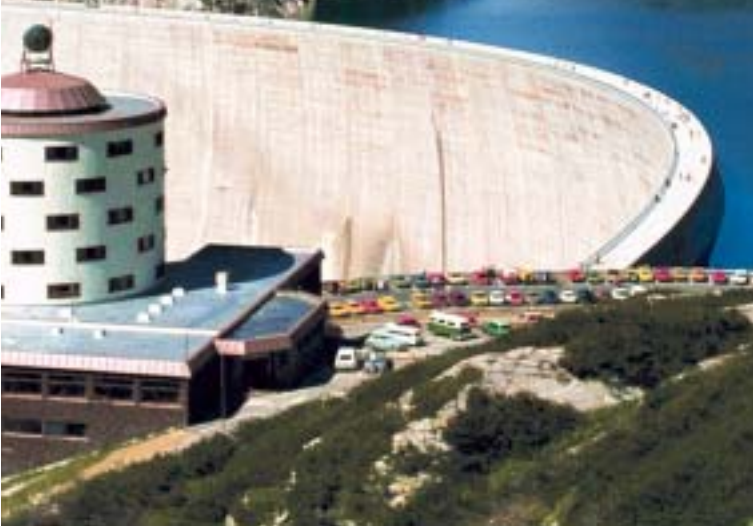
These are all areas where important facts and figures can be obtained from the up-to-date know-how and experience of our members.

### Power plant concepts and R&D activities

As a result of the further development of process engineering and the use of new materials in power plant engineering, the VGB  $E_{max}$ -Initiative ( $E_{max}$  = efficiency, economy, and environment) has been launched to open up the highly-efficient power plant technology for coal. VGB has already been co-operating since the early 1990ies with its European partners in the AD 700 project aiming at a power plant process with steam temperatures of 700 °C and pressure around 350 bar by using high-grade materials so that efficiency levels well above 50 % can be achieved.

### Operation and maintenance

The liberalisation of the power markets resulted in fierce competition and price pressure. It forced plant operators to save costs. Consequently, cuts in maintenance personnel were unavoidable. This has to be compensated for by innovative maintenance strategies like condition-based maintenance, which are also supported and optimized by VGB and through its related activities.



### III. Renewables and Distributed Generation

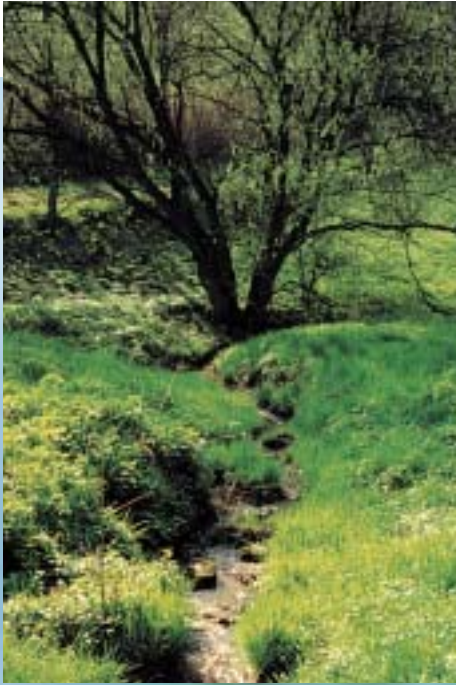
In the directive of the European Parliament concerning the promotion of electricity based on renewables of 27th September 2001, all member states agreed on the challenging goals, i.e. renewables have to contribute 22,1 % to the electricity supply in 2010. Since distributed generation also increases continuously, new requirements have to be met by electricity and heat generation. In order to integrate these systems into the existing power plant portfolio and the grid system, VGB is actively supporting its members in their responsibilities. In the near future hydro power will keep its leading role in the use of renewables. The main tasks are the planning of new power plants and the maintenance and efficiency optimisation of existing installations. Innovative flow machines, material development as well as effective maintenance strategies are to be dealt with, and damage cases have to be analysed. Especially the availability of pumped-storage plants will gain in importance because higher requirements have to be met in terms of grid regulation and covering peak load demand.

The planned extension of wind power places high demands on operators and service companies. It requires new strategies for the grid connection of large offshore wind parks. These not only have to meet the requirements for maintaining reliable system operation, but also future grid-supporting functions. Biomass is expected to make a major contribution to the long-term production of energy from renewable energy sources. For quality assurance purposes it is compulsory to monitor the composition of the biomass fuel.

On the basis of fossil fuels, fuel cells are among the most promising future technologies which can contribute considerably to environmentally friendly energy supply. This does not only apply to household applications but also to decentralised combined heat and power (CHP) applications. One important prerequisite is a drastic reduction of the system cost in order to guarantee economic operation.

The VGB committees related to "Renewables and Distributed Generation" deal with all technical and economic issues. The exchange of knowledge and operating experience are important activities in this area. In addition to the technical issues, the committees evaluate the framework and the legal conditions for the energy industry. This includes reports and position papers on the relevant topics. VGB represents the operator interests towards government authorities. The committees organise specialist conferences, meetings and joint research projects.





## IV. Environmental and General Issues

### Environment

Today, environmental protection is in the centre of attention. VGB activities are concentrating on:

- air pollution and noise control,
- water and soil conservation,
- waste management, and
- utilization of by-products.

These activities include consulting to and representation of the members with respect to licensing and operation of power plants, development of guidelines and instruction sheets, exchange of knowledge and preparation of comments on ongoing legislation. VGB organises research projects on behalf of the members.

VGB represents the operators of coal-fired power plants in their responsibility as producers of raw and building materials from by-products to the construction industry and operates as a consultant regarding protection of established utilisation channels and development of new applications for by-products.

### Chemistry

Water chemistry is a key issue in power plant operation. VGB offers technical expertise in all areas of water chemistry in power plants including the water-steam-cycle in fossil-fired and nuclear power plants, cooling water systems, treatment of waste water from flue gas desulphurisation plants and other auxiliary circuits. Round-robin tests to improve the quality and reliability of chemical laboratories of member companies are organised. Guidelines and instruction sheets covering all aspects of water chemistry in power plants have been published and are being revised on a regular basis.

### Labour safety/health protection/ fire protection

Labour safety and health protection as well as fire protection are additional VGB activities.

VGB's main activities in this area include

- the exchange of knowledge and expertise in technical committees,
- the elaboration of guidelines and instruction sheets and
- representation of the operators' interests when specific authorities are involved.







## V. Operational Services

The communication platform for the exchange of experience and the setting of standards is best performed and managed by the VGB staff, because the VGB experts are also integrated into the operational services of our member companies.

These services comprise engineering consultancy, quality assurance, material analysis and investigation, and support in water chemistry treatment, fire protection in power plants, labour safety and health protection. In the chemistry sector, VGB's main activities include water and waste water treatment, conditioning and monitoring of the water-steam- and cooling-cycles and consultancy related to problems of chemical analysis.

As a part of damage analysis, metallurgical investigations are performed by the materials' laboratory based on representative samples taken from components, using scanning electron microscopy in combination with energy dispersion analysis as well as x-ray diffraction for identifying the root cause. This is relevant in power plant operation as well as availability analysis and development of performance indicators.

The reduction of personnel among power plant operators and the supply industry and the lack of young engineers has increased the demand for expertise in power generation/technology issues. The VGB Operational Services are part of this expertise.

Highly-qualified engineers with a large spectrum of skills are available for consultancy. These experts support the process of solving problems, root cause analysis in connection with events, damage, failures, etc. VGB is also acting as a mediator by bringing together experts to provide remedies and solutions.





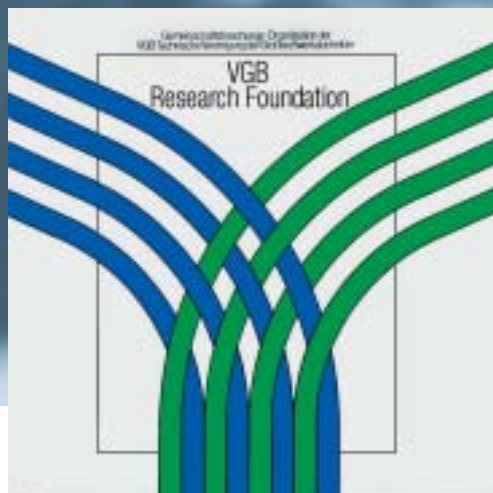
# 3

## *Thinking Ahead*

Co-operative research to plan the future:

### The VGB RESEARCH FOUNDATION

In liberalised markets for power, heat and gas, research and innovation are prime movers to bring company businesses ahead of competitors. Apart from that, there will always be co-operative research that can be organized and managed by VGB. This may concern topics of general importance, like plant safety or environmental protection requirements. Another common goal may be the co-operation with university research institutions to improve their readiness for industrially-oriented basic research and short-term investigations. In addition, VGB offers competent and neutral co-ordination of research and demonstration projects for members' consortia, thus matching both industrial and political perspectives.





- Outstanding examples are new material developments or high efficiency and low emission technologies. The joint research programme of VGB is
- tailored to the needs of VGB committees or groups of member companies,
  - cost-efficient through joint funding,
  - merging interests by industrial steering and public funding,
  - truly European, as all VGB member companies may join the steering committees and use the project results, and
  - sustainable by engaging and strengthening university research capacities.

In this way, from nuclear plant to fuel cell, technical developments for an economical and sustainable energy future are backed by VGB's co-operative research activities.

## Initial and advanced training – Training for beginners and experts

VGB has been actively encouraging education and training at KRAFTWERKSSCHULE E.V. (KWS, PowerTech Training Center) for more than 45 years.

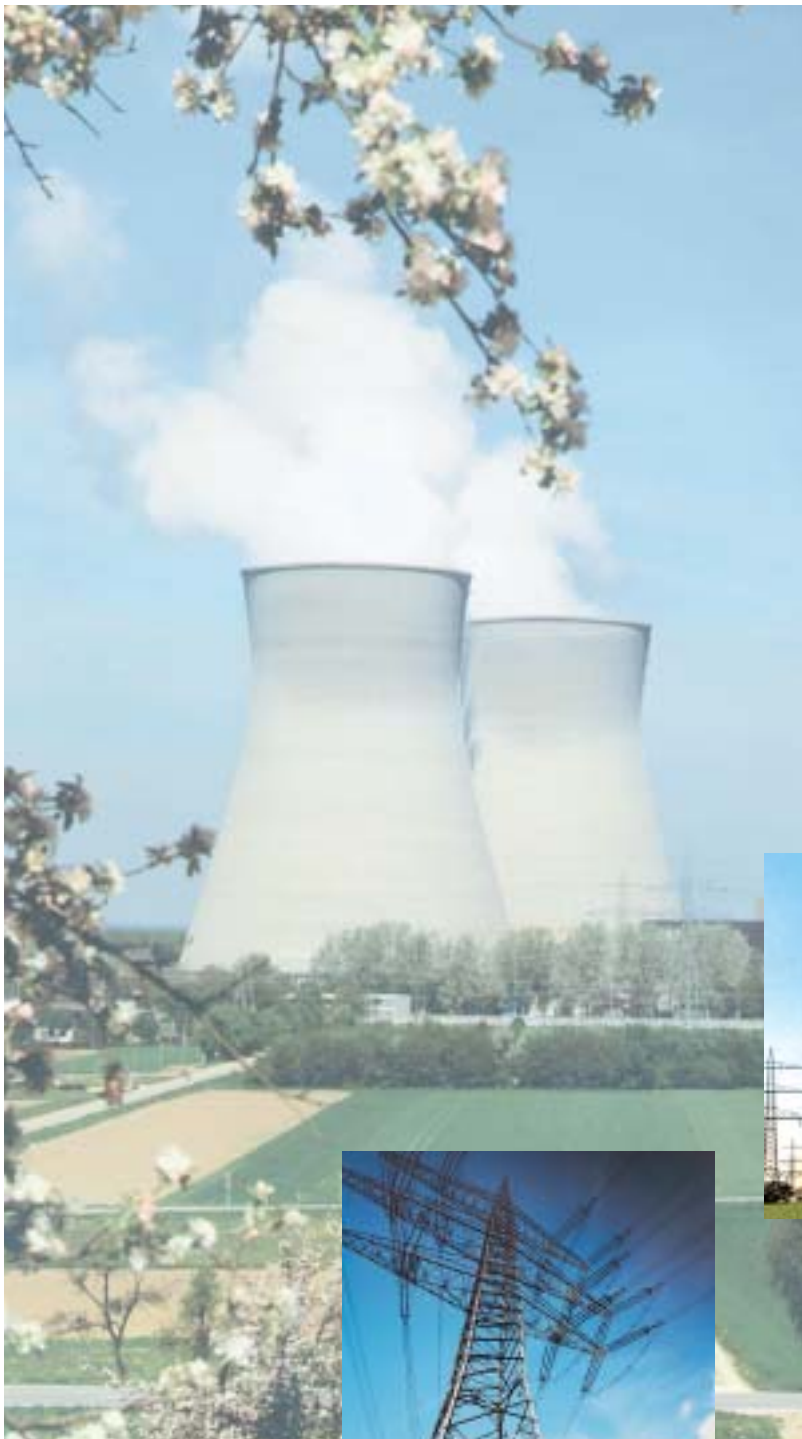
Advanced education and training for plant operators and shift supervisors is provided on the basis of VGB guidelines including learning objectives and qualification standards. A series of textbooks is available for the training at different levels of power plant personnel.

In addition to theoretical training in modern lecture rooms and laboratories, several full-scope simulators are available for practical training under normal and abnormal operation scenarios. The simulators represent steam power plants with different fossil fuels and combined cycle gas turbine power plants.

Besides an ample programme of standard courses for initial and advanced training, KWS provides special courses tailored to the individual needs of power plants in Europe and worldwide. Mobile simulators can easily be set-up and operated in any power plant.

Nuclear power plant personnel are trained in the KSG/GfS Simulator center for Nuclear Power Plants in Essen-Kupferdreh. Simulator training for reactor operators commenced in 1977. In 1987 eleven German and two foreign utilities set up KSG (Kraftwerks-Simulator-Gesellschaft mbH) and GfS (Gesellschaft für Simulatorschulung mbH). KSG provides the simulators and the relevant infrastructure at the new simulator centre, which GfS uses to provide its training courses.





## VGB as your partner – International co-operation

VGB is integrated in a co-operative international network with many organisations and institutions for example KEMA (The Netherlands), IEA (International Energy Agency, France), VDEW (Germany), ETSU (UK), ASME and EPRI (USA), etc. and of course with EURELECTRIC, the leading organization of the European electricity industry.

VGB is a well-accepted institution which, in addition to its technical committees made up of international experts, also has worldwide access to extensive technical information relating to power plant operation. This information is carefully analysed and fed into the international experience exchange network.

Furthermore VGB represents its members actively in various international bodies:

**WANO – World Association  
of Nuclear Power Operators**

WANO's mission is to maximise the safety reliability of nuclear power plant operations by exchanging information and encouraging communications, comparison and emulation amongst its members. VGB represents the German nuclear power plant operators in this association.



**ECOBA – European Coal Combustion Products  
Association**

This organisation takes care of the interests of the European power plant operators in the field of utilisation of the mineral products from coal-fired power stations. ECOBA is administered and managed by VGB.

**CEN and CENELEC**

VGB is working with these EU bodies to contribute to the pan-European standardization.

## Strict organisation to do a professional job

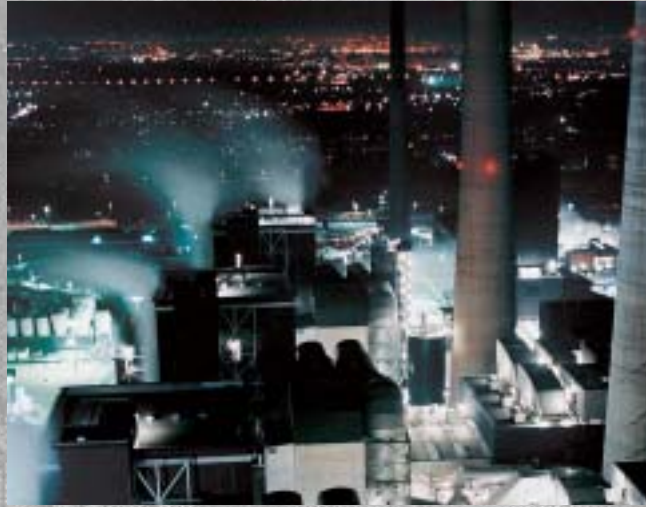
VGB is a performance-driven organisation and is specifically structured so that the tasks prescribed by its statutes can be performed efficiently.

VGB is supported by VGB PowerTech Service GmbH (the publishing house of VGB) in the realisation of its technical and scientific activities.

VGB PowerTech Service GmbH produces a number of publications on a regular basis to inform VGB members about VGB activities. Most of these are bilingual (German and English), and are also available to non-members and include:

- instruction sheets, guidelines and recommendations. Conference reports reflecting the state of the art and also available to non-members through VGB PowerTech Service GmbH,
- the monthly newsletter, VGB PowerTech News, containing e.g. minutes of the committee meetings to inform members about the exchange of experience,
- the monthly journal, VGB PowerTech, containing basically papers on power plant technology and operation, and
- the VGB Annual Report (German and English)





## VGB – Association for the future

In view of the importance of electricity as a universal source of energy, as evidenced by the enormous increase in power consumption throughout the world, the priority of energy technology in the future has to be guaranteed. Social compatibility, reliability and environmental acceptability rank on equal basis.

In view of this challenge in terms of environmental compatibility, the sparing use of resources and increasing competition, power plant engineering will have to develop in the direction of using a balanced primary energy mix and increased plant efficiency.

In order to be able to maintain a high level of operational safety, power plant staff will also need to be highly-trained in the future. However, manning levels will be reduced as the result of continuing automation of the power plant process. Quality assurance measures for power plant components made all over the world and also qualified supervision of the construction and assembly work, from the planning stage up to and beyond commissioning, will become increasingly important for the safe operation of power plants.

VGB, as an association of the operators and manufacturers of all types of power plants, will continue to face up to the changes brought about in the European and global context by the relentless advance of technology and changing conditions with its usual application and dedication.

[www.vgb.org](http://www.vgb.org)

- your connection to VGB at any time, any place,
- details about the VGB structure, tasks and services,
- contact to VGB experts via our subject catalogue,
- reports on damage, statistics,
- working group reports (members only) e.g. information about the committee and panel meetings (minutes),
- topics of interest from the industry,
- exchange of experience, and
- current events, reports etc.



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Competence.  
Service.  
Responsibility.

**VGB**  
POWERTECH

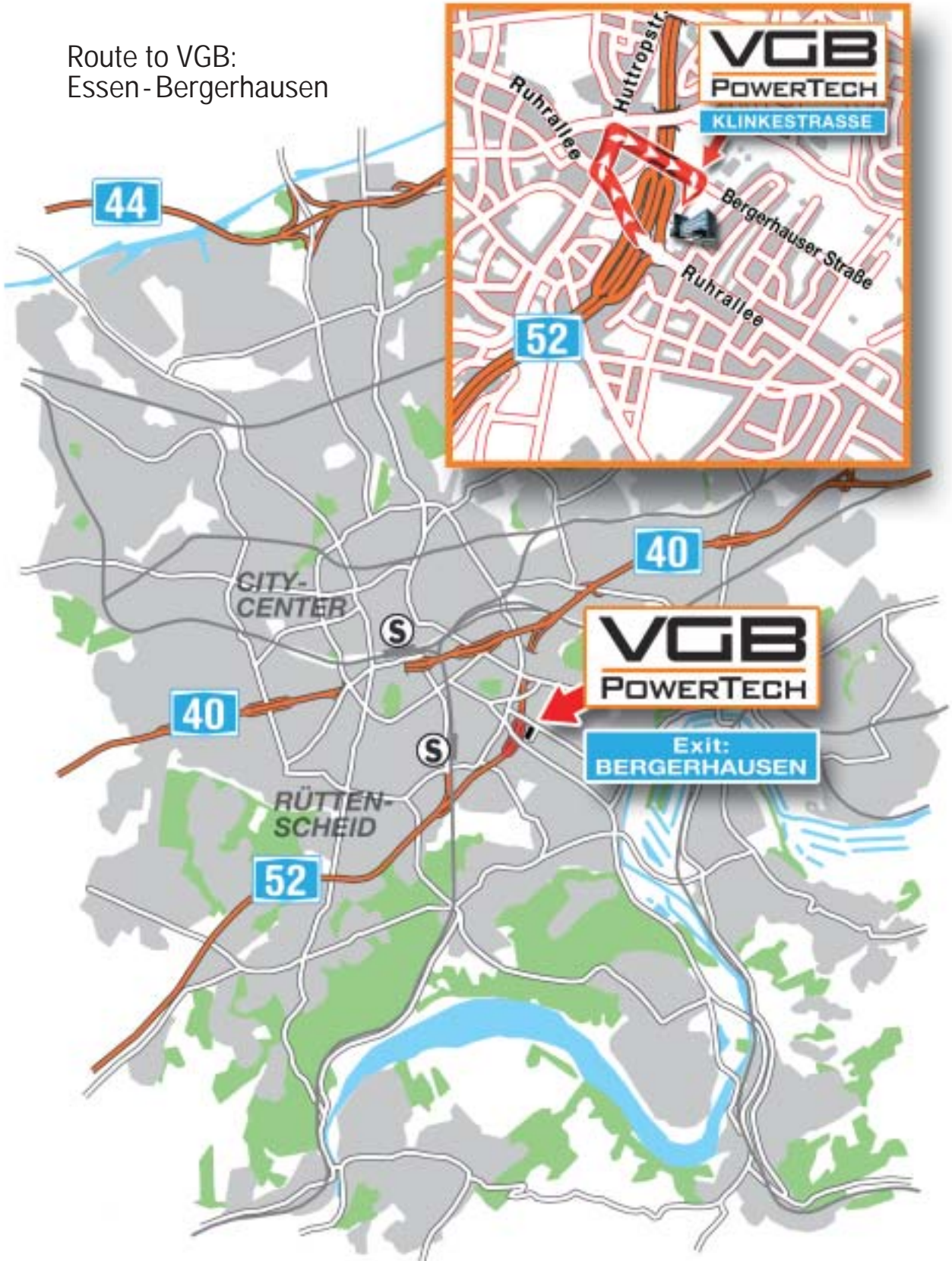


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