VGB PowerTech e. V. is the European technical association for electricity and heat generation. 

It is the prime target of VGB PowerTech e.V. to support its member companies upon the generation of electricity and heat and the related by-products.

This applies in particular to:
- Operational and plant safety
- Economic efficiency
- Environmental compatibility
- Application of new technology
- Competitiveness of different technologies
- Relevant legislation upon planning, construction, operation, and disassembly of plants

VGB PowerTech’s activities comprise:
- Offering of an international platform for the accumulation, exchange, and transfer of technical know-how
- Acting as “gate-keeper” and provider of technical know-how for the member companies and other associations of our industry
- Harmonisation of technical and operational standards between the companies involved and third parties
- Identification and organisation of joint R&D activities, supported by national and international budgets
- Exclusive member access to qualified expert knowledge

Dear ladies and gentlemen,

With this report at hand VGB PowerTech presents the result of its activities during the reporting period 2012/2013.

VGB PowerTech, the European technical association for electricity and heat generation, bundles the issues and tasks related to electricity and heat generation that are of joint interest to the entire power industry, i.e. operators, manufacturers, service companies as well as research and development institutes. VGB PowerTech also coordinates relevant activities of member companies with government institutions and additional partners in international cooperation worldwide.

The current issues and topics of the activities of VGB PowerTech e.V. and its associated institutions – Kraftwerksschule e.V. (Power Plant Training Centre), VGB Forschungsstiftung (VGB Research Foundation), and VGB PowerTech Service GmbH – are presented comprehensively in the report at hand.

Electricity supply: Technical solutions for current and future challenges

Europe’s energy policy is defined clearly: in 2007, the EU set the targets for the community known as “20-20-20” targets for the year 2020. These targets involve reduction of greenhouse gas emissions by 20%, share of renewables in final energy consumption to amount to 20% and energy efficiency is to be increased by 20% in order to decrease total energy consumption. Simultaneously, the single European market is to be implemented with free competition.

In the meantime, it has been demonstrated how ambitious these targets are and that the targets, at least partly, are at risk. Restructuring of electricity generation is particularly focused. Generation is changing towards the desired increase of renewable energies with wind power and photovoltaic plants being added. This also means a revolution concerning generation sites, i.e. not only the grid has to be extended to implement the European single market but it also must be enlarged to connect the remote centres of generation with the centres of consumption. In view of a growing share of fluctuating and not reliably predictable production of wind- and solar-based power, system stability is a growing challenge. Conventional power plants have to balance the system which means that the conventional generation portfolio needed will equal to the current power plant park. However, the technical requirements to be met by these conventional plants will also increase. In future they will be operated more flexibly with less utilisation hours than today. At the same time the European power plant park is ageing.

Since energy policies in the single European states are not sufficiently harmonised, the changes in these countries are differing, this in turn causes new problems.

This involves necessary integration of renewables, new construction of conventional power plants, and construction of storage solutions. Guaranteeing system stability requires enormous endeavours on the part of financing and engineering alike. VGB PowerTech is determined to support and accompany its members in meeting the targets related to the tasks described.

It is among the targets of VGB PowerTech to make a contribution to the creation of value and the permanent improvement of plants and plant operation.
The challenges our industry is facing and the trends on the European power market made VGB PowerTech to initiate the project «Further Development of VGB PowerTech e.V.» A staged process was started to identify and implement measures aiming at the optimisation of the range of services and bundling the activities of the association.

The following products and services are still in the focus of VGB PowerTech from the planning stage to the construction and operation and disassembly of power plants:

- International platform for the exchange, transfer, and bundling of technical know-how
- Joint platform for technical cooperation
- Central place for the coordination and cooperation of national and international research projects
- Platform for the formulation and determination of standards regulating the construction of any kind of power plants
- Expert pool dealing with all major issues of power plant construction and operation
- Training facilities.

The activities for providing these products and services have to be assessed in view of efficiency and up-to-dateness, and resources have to be identified and mobilised that are needed for the new tasks in the field of renewables. The core competencies need to be kept and new activities in the area of renewables are to be started.

VGB PowerTech’s «Technical Services» as service at the site comprising engineer consultancy, damage analyses, material investigation in the laboratory, supervision of construction and assembly, quality management/expediting, and chemical investigations are to be maintained, because they support members in case of concrete issues and problems related to power plant operation.

Number of members: High level

With 511 members, the number of VGB PowerTech’s members has slightly risen by 2% in comparison to the previous year. This trend underlines the acknowledged expertise and value of the technical association. The power plant capacity represented by VGB member companies amounts to some 530,000 MW.

The member companies are located in 36 countries; 25 of which with domiciles in Europe. Outside Europe there are another 11 countries with VGB membership: Argentina, Australia, Brazil, China, India, Israel, Japan, Libya, Mongolia, South Africa and the USA.

The structure of members also underlines the broad base of the association for heat and power generation: 181 belong to public supply and 96 to industrial supply. 207 companies are sponsoring members and 27 are extraordinary members.

VGB: Focusing on service

Communication and publications

Since the autumn of 2011, VGB PowerTech has been publishing the guidelines for the construction and operation of power plants in the form of «VGB-Standards». The former VGB Guidelines and Instruction Sheets are converted gradually into VGB-Standards. With 40 VGB-Standards already being published, VGB is on the right track to quickly terminate this process.

The «KKS Power Plant Designation System» is of global importance. The same applies to the RDS-PP which was adopted to meet the new requirements of current electricity generation. The «RDS-PP» was also extended by the needs of wind power thus making a valuable contribution to the service and added valued of wind power.

VGB PowerTech is also supporting technical communication. Current trends and findings in power plant engineering are abridged for readers in VGB PowerTech, the organ of the association. Studies on important issues support members in their daily business. Examples are the White Paper «Torrefied/refined pellets for biomass co-firing» and the compendium «Health relevance – Environmental health aspects of power generation from coal» which proves that air quality is practically not or only marginally influenced by additional immissions from coal power stations.

Support know-how: Keeping and backing competencies

Also in the future we need to cover current and forecast demand for qualified power plant personnel. This also applies to university courses. VGB PowerTech supports the companies in coordinating efficient support of university training and university research. This is mainly done by VGB Forschungstiftung, which organises joint research and supports future know-how. Outstanding performances of young engineers are awarded with the Heinrich-Mandel Award and VGB PowerTech’s student courses are conducted in order to provide an insight into practical power plant engineering.

We hope you will enjoy reading the VGB Annual Report 2012|2013!

Prof. Dr.-Ing. Gerd Jäger
Chairman of the
VGB Board of Directors

Erland Christensen
VGB Executive Managing Director
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VGB PowerTech: Partner for Electricity Generation
VGB PowerTech e.V. is the European technical association for power and heat generation with international relationships. VGB’s 511 members from 36 countries represent a power plant capacity of 530,000 MW thus in 2012/2013 VGB achieved again a new maximum in terms of «members», «countries», and «power plant capacity».

The VGB Essen-based Secretariat consists of the following Competence Centres (Figure 1):
- Nuclear Power Plants (CC1),
- Power Plant Technologies (CC2),
- Renewables and Distributed Generation (CC3),
- Environmental Protection, Safety at Work and Chemistry (CC4) and
- Technical Services (CC5).

Since the beginning of 2012, CC2 has been renamed «Power Plant Technologies» in order to underline the traditional links and cross-sectional tasks of CC2 with the other VGB Competence Centres.

VGB PowerTech also set up a new Competence Centre 5 «Technical Services» for the well-known and established sections of quality control, water chemistry, and materials laboratory. CC5 will make optimum advantage of the existing synergies and will serve as central contact for all important technical issues and tasks.

These Competence Centres – supplemented by teams for Research, Controlling/IT, Marketing, and Administration – work through all issues concerning heat and power generation and associated environmental protection issues – in close collaboration with EURELECTRIC on European and BDEW (Bundesverband der Energie und Wasserwirtschaft, Berlin/Germany) on national level.

In order to fulfil the statutory tasks, honorary committees were set up by the VGB Board of Directors. The VGB Technical Advisory Committee is responsible for allocating the committee members and determination of tasks. Currently committees are active in four fields with a large number of technical and special committees and working groups. The «European Technical Committees (ETCs)» are of particular significance for European tasks. An overview about the structure of the European organisation of VGB is given in Figure 2.

Additionally, workshops and R&D projects are organised with European partners. The development of VGB at European level is coordinated by the VGB Technical Advisory Board.

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**Figure 1: Structure of VGB PowerTech e.V., the European Technical Association for Electricity and Heat Generation.**
During the year under review, the committees and working panels of VGB convened at over 180 meetings. All VGB members are informed about the results of these meetings through the monthly «VGB Newsletter» by e-mail, through the VGB Home Page, and via internet (closed user groups). Other interested parties can also obtain the VGB Newsletter free of charge by e-mail. Interested parties can register at www.vgb.org | Publications.

Apart from overseeing the activities of the committees, the VGB Secretariat also performs other tasks. In addition to working on the rules and regulations in form of VGB-Standards, VGB is also responsible for organisational support and coordination of joint research of power plant operators in the VGB-Forschungsstiftung (Research Foundation). The joint research supplements the company-specific research objectives. Furthermore, the VGB Offices organise seminars, symposia, conferences, and the annual Congress «Power Plants». These meetings are further platforms for the international exchange of experience within VGB PowerTech.

Against the background of the current challenges and the restructuring of European heat and electricity supply, VGB focuses on:

- continued internationalisation of VGB,
- renewables and the related technologies as well as synergies,
- technical issues related to future conventional generation,
- bundling of technical expertise and services for members companies in the fields of
  - power plant concepts
  - fuels and furnaces
  - steam generators
  - steam and gas turbines
  - electrical engineering, I&C, and IT
  - materials and civil engineering
  - operational, maintenance, and environmental management

including VGB’s technical services in the fields of:

- engineers’ consulting
- damage analysis and material test laboratory
- monitoring of construction and assembly/quality monitoring
- external chemical investigations
- Creation of technical Standards (no-official standards), in detail:
  - since August 2011 VGB Guidelines and VGB Instruction Sheets have been published as VGB-Standards
  - data bases and technical information in all fields of generation
  - coordination of projects and R&D measures
  - European networking with associations like EURELECTRIC, EUTurbines, Foratom, Euracoal and others.
  - training and further vocational training of power plant personnel (at KWS and KSG/GfS)

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Fig. 2: European organisation of VGB.
The VGB Executive Managing Director is, in the personnel union, also the Managing Director of VGB-Forschungsstiftung e.V., Kraftwerksschule e.V. and VGB PowerTech Service GmbH (Figure 3). He also has a close association with the Kraftwerksschule e.V. and the Gesellschaft für Simulatorschulung (GfS), which are responsible for training concerning nuclear technology. Furthermore, he coordinates the distribution of tasks amongst other sector associations with the managing directors of these associations.

KRAFTWERKSSCHULE and KSG|GfS

The competence of operating staff is, to a great extent, a determining factor in the security, cost-effectiveness and environmentally-friendlyness of power plants. Even in the current times of liberalisation, the contribution of personnel to the value of a company is decisive for its competitiveness.

The VGB members have long since realised the importance of training and further vocational training for their employees. Drawing up guidelines for the training of operating staff set the course for the qualification of power plant operators and shift supervisors, in particular, at an early stage. The Kraftwerksschule e.V. (KWS, PowerTech Training Center) was founded in 1957 and since then has trained and updated training for employees in member companies (Figure 4).

The personnel at nuclear power plants are trained in The Simulator-Centre KSG|GfS in Essen-Kupferdreh/Germany. Simulator training for reactor operators began on Klinkestraße in Essen in the VGB Offices as early as 1977. In 1987, the KSG (Kraftwerks-Simulator-Gesellschaft mbH) and GfS (Gesellschaft für Simulatorschulung mbH) companies were founded by 11 German and two international energy supply companies. KSG provides the simulators in the new Simulator Centre and the appropriate infrastructure which GfS uses to carry out its training (Figure 5).

VGB PowerTech Service GmbH

VGB PowerTech Service GmbH (PTS) is essentially responsible for collecting and distributing the existing know-how at VGB. It publishes the VGB PowerTech international journal as well as VGB-Standards guidelines, instruction sheets, conference proceedings, technical scientific reports, VGB books and brochures and KWS training manuals.

VGB FORSCHUNGSSTIFTUNG

The tasks of the VGB-Forschungsstiftung (VGB Research Foundation), founded in 1970, and the results achieved in the financial year concerned are described on pages 62 to 65 of this report.

Fig. 4: The Training Centre of the KRAFTWERKSSCHULE E.V./PowerTech Training Centre Association in Essen-Kupferdreh with the new building.

Fig. 5: The Simulator Centre of the KSG|GfS in Essen-Kupferdreh.

Fig. 3: The VGB Group.
Results of VGB’s Activities
During the reporting period, restructuring of Competence Centre C1, i.e. its committees and panels, was finalised (Figure 1).

In future, the general committee (GC) will monitor and control the structure of committees and panels, and therefore it will meet three times a year. The associated technical committees (TC) will mainly deal with the following issues:

- Exchange of operating experience,
- Cross-utility project management (about 60 new projects every year),
- Services (e.g. qualification of equipment, assessment of contractors, assessment of safety culture, consultancy, expertise), and
- Organisation of interfaces with external bodies.

The total number of working panels (WP) was cut from 27 to 13, and the number of associated working parties (WP) was even more reduced. The personnel resources now available are going to be employed for future project management; details are being communicated.

All committees, panels, and parties basically welcome international participation and cooperation. Several VGB members have already accepted the invitation for cooperation and have (again) nominated their experts.

Since VGB had been set up, it was the first time that individual tasks were described for CC1 and its three technical committees.

In the following, examples are given about the committee and panel work:

- Elaboration of a contract with the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and GRS [German organisation for nuclear power plant and reactor safety] about the requirements for avoiding air crash on nuclear power plants still in operation,
- Exchange of information and harmonisation of operator positions on political issues like the new act on finding a geological repository for waste from nuclear power plants («Endlagersuchgesetz»),

Fig. 1: New structure of CC1 «Nuclear Power Plants» committees and panels.
- Operator comments on the new nuclear codes and legislation,
- Operator lawsuit for financial compensation because of the shutdown of all nuclear plants ahead of schedule,
- Damage at reactor pressure vessels in Doel-3 and Tihange-4 as well as assessment of possible transferability,
- Organisational issues of shutdown plants,
- Findings and lessons learned (related to reliability) from Fukushima,
- Consequences from the international discussions about the design of refueling with a view to the new LOCA (loss-of-coolant accident) criteria,
- Completion of the new VGB-Standard on a system for assessing safety culture,
- Harmonisation of several (about one per month) operator presentations at the Reactor Safety Commission (RSK), and
- Discussion about the permission of CASTOR containers and plans on the removal of fuel elements in shutdown plants.

Special Committee «Plant Engineering»/Technical Committee «Engineered Safety»

Ludger Mohrbach and Thomas Linnemann

During the reporting period, the Special Committee «Plant Engineering» met three times and another two special meetings were held in order to discuss some of the above topics and to establish the new committee and panel structure of VGB’s CC1. The committee members also dealt with the results of the EU stress test and the measures and actions to be derived from the results of these tests, model strategies for spare parts keeping, further improvement of IT security in power plants, and models on advanced project management. In 2012, the committee members discussed a total of 28 new projects. Beside, the committee members decided to cease the VGB nuclear courses for students and to carry out another meeting of university lecturers to be held in Erlangen in the autumn of 2013 which is to be jointly organised with the German Atomic Forum (DAF).

With its 128th meeting on November 14, 2012, the Special Committee «Plant Engineering» stopped operating. It was the only VGB committee that had – independent of the VGB Board – its own statutes and was able to award projects.

The constituent meeting of the Technical Committee «Engineered Safety» took place on April 9, 2013. Apart from discussing the committee’s tasks and its interaction with its related working panels, the committee also determined contact persons for project reporting. One panel chairman each is to report on current activities at future committee meetings.

Working Panel «Evidence Methods»

Thomas Linnemann and Ludger Mohrbach

During the reporting period, the panel’s activities were still focused on the discussions between plant operators and authorities about the requirements resulting from plant-specific post-Fukushima safety checks of German nuclear power plants («RSK safety checks»), the recommendations to be derived from EU stress testing, and the BMU safety requirements to be met by nuclear power plants (new regulations and codes).

In this context, the panel coordinated and passed different concepts:

- Additional, mobile emergency devices (for optimising the robustness of three-phase power supply),
- Implementation of plant-internal emergency measures aiming at the withdrawal of heat from fuel storage pools,
- Guide for implementation of the RSK recommendation about failure of a primary heat sink,
- Elaborated arguments on the requirements of measures to feed the reactor cooling system within the scope of emergency protection,
- Implementation of general recommendations made by the German Commission on Radiological Protection (SSK) and RSK about the planning of emergency protection measures to be made by nuclear power plant operators.

Tab. 1: Papers organised by the Working Panel «Evidence Methods» and delivered at the meetings of the RSC Committees «Plant and System Engineering» (AST), «Electrical Equipment» (EE), and «Reactor Operations» (RB).

<table>
<thead>
<tr>
<th>Committee</th>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>RB</td>
<td>Effect of fuel element deformation: follow-up paper on the feedback</td>
<td>April 17, 13</td>
</tr>
<tr>
<td>RB</td>
<td>Current state on the investigations on fluctuating neutron flux in PWR</td>
<td>Feb. 28, 13</td>
</tr>
<tr>
<td>AST</td>
<td>Current state on the experimental verification of criteria for LOCA</td>
<td>Dec. 20, 12</td>
</tr>
<tr>
<td>RB</td>
<td>Comparison between RSC recommendation and VGB Guide on</td>
<td>Dec. 14, 12</td>
</tr>
<tr>
<td>EE</td>
<td>Unavailability across partitions due to electrical coupling between</td>
<td>Nov. 21, 12</td>
</tr>
<tr>
<td>RB</td>
<td>Experience made with the Instruction Sheet M 120 and planned</td>
<td>Oct. 11, 12</td>
</tr>
<tr>
<td>DKW</td>
<td>Indication of cracks in the reactor pressure vessel of the Belgium</td>
<td>Oct. 09, 12</td>
</tr>
<tr>
<td>EE</td>
<td>Fluctuation of neutron flux in PWR: provisions for filtering neutron</td>
<td>Sep. 21, 12</td>
</tr>
<tr>
<td>RB</td>
<td>Application of safety management systems: experience made in</td>
<td>Sep. 13, 12</td>
</tr>
<tr>
<td>AST</td>
<td>Robustness of precautionary measures to avoid flooding of the</td>
<td>July 05, 12</td>
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The panel members also discussed emergency measures to control flooding of the reactor building annulus in pressurised water reactors (PWR) and venting of the safety containment, development and establishment of plant-internal emergency measures (SAMGs: Severe Accident Management Guidelines) as well as the systematic approach suggested by RSK for identifying possible measures to increase robustness in plants. Following the latter discussion, the panel decided to have robust analyses carried out in all plants still being operated. The results were to be presented in the second quarter of 2013.

The panel also coordinated the official requests on issues discussed by the RSK Committees «Plant and System Engineering» (AST), «Pressurised Components and Materials» (DWK), «Electrical Equipment» (EE), and «Reactor Operation» (RB) and organised ten operator reports during the period under review (Table 2).

The panel contributed to the elaboration of the national report for the second extraordinary conference on the Convention on Nuclear Safety (CNS) that took place at the headquarters of the International Atomic Energy Agency (IAEA) in Vienna from August 27 to 31, 2012. The conference, attended by selected operator representatives, was held in order to evaluate the post-Fukushima activities of the convention parties. After the conference, the panel provided harmonised VGB answers to questions posed to Germany by individual convention partners.

At the beginning of 2013, work started on the German national report for the sixth ordinary CNS conference to check the post-Fukushima measures that were taken at the headquarters of the International Atomic Energy Agency (IAEA) in Vienna from August 27 to 31, 2012. The conference, attended by selected operator representatives, was held in order to evaluate the post-Fukushima activities of the convention parties. After the conference, the panel provided harmonised VGB answers to questions posed to Germany by individual convention partners.

At the beginning of 2013, work started on the German national report for the sixth ordinary CNS conference to check the post-Fukushima measures that were taken. This conference will also be held in Vienna from March 24 to April 3, 2014.

The panel delivered again relevant parts of this report.

By the end of November 2012, the panel conducted a workshop in Essen «Support of main focus 2012». The research institutions involved in VGB’s «support of competence» reported on the progress made in their field of research and development during the former year.

The panel decided to keep the four to six week meeting rhythm due to the considerably work load and the various tasks.

Working Panel «Reactor Core»
Guido Vallana

Current projects are dealing with issues of neutron-physical and thermo-hydraulic core design as well as design and operating behaviour of fuel assemblies and fuel rods.

The panel also participated in the preparation and realisation of a follow-up presentation «Effects of the deformation of fuel assembly on operating behaviour of fuel elements and control rods in 2012».

In 2012/2013 the following projects were successfully terminated and according to schedule:
- Brittle tests of cladding tubes,
- Investigation on the exactness of measuring the medium burnup of fuel assemblies in pressurised water reactors,
- Fuel degradation tests to be carried out in the Halden reactor,
- Preparation and realisation of the above-mentioned follow-up presentation.

During the reporting period, the panel also dealt with:
- Fracture of hold-down springs of fuel assemblies with steel guide tubes,
- OECD Halden project; future German participation,
- Formation of hybrids in cladding tubes upon dry storage,
- Findings made during inspections,
- Requirements on the safety of criticality when changing fuel elements.

System- and product-related quality Management
Andre Seidel and Georg Schäfer

The following panels are mainly dealing with cross-plant tasks of system and product-related quality management within the scope of technical procurement.
Working Panel «Contractor Auditing and -qualification» (VGB WP «CA/Q»)

On December 31, 2012, the list of contractors, run by the VGB Working Panel «CA/Q» on behalf of the VGB Consortium «Contractor Assessment», comprised about 703 contractors for components and services important to safety engineering in nuclear power plants. In 2012, a total of 176 contractors were assessed at site in order to certify their suitability according to KTA Standard 1401. These assessments are mainly being carried out by external auditors – qualified by VGB – only 31 audits were made by qualified nuclear power plant staff. Since all auditing documents are filed, it is possible to retrieve contractor qualification according to KTA Standard 1401.

These assessments are mainly being carried out by external auditors – qualified by VGB – only 31 audits were made by qualified nuclear power plant staff. Since all auditing documents are filed, it is possible to retrieve contractor qualification according to KTA Standard 1401.

The module «contractor list» of the VGB Information System provides cross-utility information and documents about contractor-related feedback of information.

Auditor trainings were again carried out during the reporting period (Figure 3).

Working Panel «Electrical and I&C in Engineering»

Jörg Kaiser

The panel coordinates the technical issues of different VGB internal and external committees and panels (among others on KTA regulations), develops VGB policies, and analyses and evaluates events of general importance.

This also includes findings and knowledge from parallel committees and panels dealing with conventional power plants, mainly large electrical components like generators and transformers. Issues like LOCA accident resistance of electrical equipment are part of the activities of the committees and panels of electrical engineering and I&C. During the reporting period, the panel members had to deal with two issues from the RSK Committee «Electrical Equipment» (EE):

- Phase failure of the 345-kV grid connection in the US Byron nuclear power plant: A working party was set up for carrying out a generic investigation. Work on this very complex topic will at least last until end 2013.

In mid-2012, VGB distributed the version 5.0 of the VGB investigation report on the partial loss of emergency power supply in the Forsmark-1 nuclear power plant. Thus, the responsible working panel had met its task and was dissolved. For finalisation of the related pass-on message, the written expert statement on the additional human factor simulation, included in version 5.0, is needed.

Mobile emergency diesel supply

Following the assessment of the Fukushima event, the authorities require additional measures for cases of «long-term black-outs».

A Working Party «Mobile Diesel», headed by the Working Panel «Safety Assessment» and coordinated by the Working Panel «Electrical and I&C in Engineering», was set up. The party was to deal with the implementation of process-related requirements and the development of marginal conditions from the viewpoint of electrical engineering. With reference to the RSK safety check of May 4, 2011, the party developed a strategy for optimising the robustness of three phase current supply in German nuclear power plants. In a statement that was presented mid-2012, recommendations were made – if desired separately for PWR and BWR plants – about the

- Procurement of an additional mobile emergency diesel set,
- Supply of devices and equipment important for safety technology,
- Design of the emergency diesel set,
- Storage, and
- Operation at place of installation.

The concepts and scope of commissioning tests as well as the scope and frequency of recurrent testing were presented in an annex. Implementation of these measures will be communicated by the Working Panel «Electrical and I&C in Engineering» within the framework of the exchange of experience.
Ageing management of I&C components according to KTA 1403

Jörg Kaiser

The tasks in the field of ageing management of I&C were adjusted to the new requirements. The Working Panel «Electrical Engineering and I&C in Nuclear Power Plants» coordinates the activities among the plants. The focus is on the extension and linking of tools of the VGB data base «information system». The necessary tasks and specifications were defined by the working group in charge, passed on to the relevant committees for approval, and orders were awarded.

Information on damage mechanisms, expected ageing behaviour, and reactions from maintenance procedures are structured and integrated into the database as so-called reports on component ageing. The database supplier had to make considerable adjustments in order to meet the new requirements resulting from extension and adoptions.

A valuable database was created which centralises all generic information of function relevant electrical and control components and their ageing mechanisms including the principal mechanisms of detecting ageing. Necessary measures (e.g. preventive replacement of components or assemblies) can be taken in due time within the scope of ageing management because the information can be evaluated individually for each plant. Besides, drafting of basic and status report is being considerably simplified.

The complete software module is to be delivered by mid-2013. Then it is to be implemented by the individual plants with plant-related allocation (e.g. assemblies and diagnosis measures).

The panel members also passed the basics for an adjusted, cross-committee overall concept on keeping the functions. This concept is continuously being adopted, it contains the following modules:

- Determination of status with reference to proven characteristics, testing according to requirements and ageing condition of special components,
- Necessary measures to maintain repairability,
- Cross-plant spare parts’ management,
- Testing and preconditions for new build measures (redesign).

Working Panel «Material and Component Integrity»

Jens Ganswind

The current activities of the Working Panel «Materials and Component Integrity» concentrate on more general questions in connection with ensuring integrity of mechanical components in BWR and PWR plants by taking into account mechanical, thermal, corrosive, and radiochemical conditions.

These activities are mainly determined by authority requirements as well as requirements from revised KTA rules and events in foreign plants.

Therefore, the panel focused on:

- Event-related exchange of experience about damage to solve problems and transferability of these events to other plants/situations,
- Safeguarding of component integrity by using appropriate integrity concepts and fracture mechanical calculation methods,
- Initiation of investigation projects to understand damage and to determine damage mechanisms,
- Damage prevention and guarantee of component integrity,
- Interdisciplinary tasks (NDT, water chemistry),
- Implementation of findings in plants,
- Public relations and cooperation in committees (publications, papers, standardisation committees).

The focus is on the following:

Component integrity/concepts of fracture mechanics

Representatives of operators, expert organisations, authorities, manufacturers, and research institutions drafted the new KTA 3206 «Analyses regarding Rupture Preclusion for Pressure Retaining Components in Nuclear Power Plants». Findings from panel members‘ publications «integrity concept for pipe systems as well as leakage and fracture postulates in German nuclear power plants), the Areva guideline «Fracture mechanical concept for pipe systems important to radiation safety», and the «integrity proof of pipe systems» established by Materials Testing Institute of Stuttgart University (MPA) were taken into account. The regulation is currently red by the parties.

Assessment of damage cases

If damage occurs, the cases are analysed to identify the root cause. Besides, the damage mechanism, determination of remedy as well as transferability to other plants are being determined.

Within the scope of recurrent ultrasonic testing, e.g. one finding was detected in the mixed weld seam of a reactor pressure vessel feedwater stud. The depth of the finding amounted to more than 75% of the wall thickness and it proceeded axially within the mixed weld seam. Characterisation indicated that stress corrosion cracking on the nickel weld material (alloy 182/82) had caused the damage.
The damage could be repaired by a full structural weld overlay (FSWOL) according to ASME Code Case N-740-2 with the nickel weld material alloy 52M. The component can still be tested.

**Research projects**

The panel supervised ten research projects which are related to corrosion, fatigue, and fracture mechanics, occurring to the materials applied in nuclear power plants. The influence of radiation was partly considered, too.

**Working Panel «Non-destructive Testing»**

_Jens Ganswind_

The panel is mainly dealing with the exchange of experience about testing techniques, messages to be passed on, RSK recommendations, and the support and mentoring of research projects that are of inter-utility interest as well as with the cooperation in nuclear standards and codes.

**KTA 3201.4** comprises requirements to be met by analysis techniques that have to be adhered to, therefore, a Working Party «Ultrasonic Testing – Analysis Techniques» was set up. The party launched a project to determine the capabilities of analysing techniques available on the market, to reveal the limits of process technology, and to create a database for subsequent deliberate qualification.

Six different testing companies from Germany and the Netherlands have been assigned. The investigations are completed and are being evaluated. The project is to be terminated in the autumn of 2013.

**ENIQ activities**

The panel was promptly informed about the state of discussion about the «European Network of Inspection and Qualification» ENIQ. On international level, information is being exchanged and fed back intensively. This is demonstrated by the third revision of the ENIQ guideline on European level. Meanwhile most European states but also Canada and China qualify according to ENI which is to be integrated as of 2014 into the EU initiative «NUGENIA».

The panel also cooperates in the revision of the KTA Standard 3211.4: «Pressure and Activity-retaining Components of Systems outside the Primary Circuit; Part 4: In-service Inspections and Operational Monitoring». The revised standard was published in the Bundesanzeiger (Federal Gazette) in winter 2012.

**Working Panel «Ageing Management»**

_Thomas Linnemann_

The panel, which ceased its work during the reporting period, focused on the implementation of the KTA 1403 «Ageing Management in Nuclear Power Plants» as well as on cross-utility issues of ageing management related to turbines and generators, I&C, and civil engineering. During the period under review, the panel members also wrote an article about the benefit of ageing management. It was published in the May issues of «atw – International Journal for Nuclear Power» and VGB PowerTech.

**Working Panel «Management System in Nuclear Power Plants»**

_Thomas Linnemann_

During the reporting period the panel members elaborated an operator paper about the experience made with the application of safety management systems in nuclear power plants and underlined their experience with examples from practice. The paper was delivered to the Reactor Safety Commission (RSK) in September 2012.

The meeting of executives responsible for quality assurance (QAM) took place in the Isar nuclear power plant on May 8 and 9, 2013. The QAM and personnel in charge of management systems meet once a year.

**Working Panel «Seismic Design»**

_Jens Ganswind_

The issues dealt with by the panel during the period under review were determined by questions on seismology, seismic design, and safety analysis. The panel was supported by different research institutes.

The panel members are also involved in revision of the KTA Standard 2201 «Design of Nuclear Power Plants against Seismic Events» – part 1 to 6.

The seismic expert reports for intermediate storages erected between 2002 and 2005 are e.g. the basis for the new KTA Standard 2201.1. Additional probabilistic safety analyses were carried out and updated for the German nuclear sites within the scope of the individual «RSK safety check». In older seismic expert reports it was often not possible to pre-determine the reference horizon for the soil response spectrum which is of particular importance at sites with natural rock foundation and soft sediment layer on top of it.

During the reporting period the panel initiated further research projects:

- Seismic design of buildings.

![Fig. 5: Example for repairing worn walls by deposition welding.](image-url)
- Participation in an IAEA-ISSC (International Atomic Energy Agency – International Seismic Safety Center) benchmark,
- Elaboration/updating of the earthquake catalogue for Germany and neighbouring locations, investigations on the parameter damping, and
- Optimisation of the simulation programme PSSAEL (probabilistic seismic site analysis with earthquake libraries).

The predecessor «PSSAEL 99» was put on the VGB homepage for free download.

Technical Committee «Nuclear Power Plant Operation»
Ludger Mohrbach

The technical committee, which represents the managers of those nuclear power plants associated with VGB, is meeting regularly every four months in different power plants. Every power plant provides a detailed report on technical plant activities, particularly on non-scheduled events. These are discussed in detail at the meetings. Besides, the committee is discussing the WANO activities and controls its related working panels and parties.

During the reporting period no relevant events occurred. All units could be operated with good to excellent availabilities. However, nuclear units are increasingly being used for grid control. This did not have any negative effects on their operation thanks to their design.

The exchange of experience was focused on post-Fukushima measures, issues of diesel maintenance, contamination of the primary circuit, flaws detected in two reactor pressure vessels in Tihange and Doel, fuel element bending, and wrong assembly of emergency batteries.

Within the scope of restructuring of VGB’s CC1, the technical committee has to deal with additional tasks, i.e. discussion of project applications from the bodies of equipment qualification (q.v.).

Cooperation with the World Association of Nuclear Operators (WANO)
Georg Schäfer

As early as in the autumn of 2011, German nuclear power plant operators committed themselves – similar to all other WANO members – to support WANO’s changed agenda in the aftermath of the Fukushima event, and to provide additional resources.

In the meantime, nine delegates are working for the WANO Paris Centre. Besides, experts are cooperating in special Fukushima working groups on the following issues:
- Design fundamentals,
- Emergency preparedness,
- Severe accident management,
- Nuclear safety performance assessment.

VGB continues supporting its German WANO members in daily operative business by organising staffing and management of event reporting.

WANO peer reviews were carried out in 2012 in the Neckarwestheim nuclear power plant and follow-up reviews took place in Philippsburg and Emsland. WANO experts hold trainings in German nuclear power plants on the issue of «safety culture». Gundremmingen conducted a benchmark on «human performance tools» in the US-American River Bend plant.

International experts were consulted by four German nuclear power plants within the scope of «WANO assist visits» on issues of fire protection, control of plant operation, and emergency management. E.ON Kernkraft and EnBW Kernkraft actively supported the WANO training programme by assuming WANO workshops on the optimisation of WANO peer reviews in the field of «engineering» and planning of the transition from power operation to post-operation.

A total of 52 staff members from German nuclear power plants took part in international WANO missions. Another 60 persons attended 13 WANO workshops and seminars.

Working Panel «Practical Radiation Protection»
Lena Jentjens

Events and developments of plant operation and decommissioning of nuclear power plants are being focused at the panel meetings that take place twice a year. Besides, the panel, i.e. its associated working parties, dealt with:
- The working party of federal government and federal states revised the «Guideline about the qualification of commissioners of radiation protection in nuclear power plants and other plants for the fission of nuclear fuel». The panel commented on the draft within the scope of a technical discussion.

- In case of nuclear accidents involving humans, documents needed for subsequent medical examinations have to be passed on to the obligatory accident insurer according to the radiation protection ordinance. In accordance with the responsible industrial injuries corporation (Berufsgenossenschaft), the panel developed a form for data transmission, which has been made available in the meantime on the web page of the industrial injuries corporation.

Since May 2012, a nearly consolidated version of the EU Basic Safety Directive on radiation protection has been available. The panel commented again on this directive. The responsible EU Committee ENISS mainly agreed on that point.

The proposal of the panel to integrate practical data into DIN ISO 11929 «Determination of the characteristic limits (decision threshold, detection limit and limits of the confidence interval) for measurements of ionising radiation – Fundamentals and application» was accepted by the Nuclear Committee (KTA) and the proposal was realised in form of a so-called KTA report. A KTA working group was set up for that purpose (representatives of authorities, operators, experts, manufacturer of measurement equipment); three representatives of the working panel are also cooperating. A VGB recommendation for realisation of DIN ISO 11929 is to be formulated in addition to the KTA report.
Radiation-relevant accidents are happening repeatedly worldwide within the scope of non-destructive (NDT) material testing. Together with the German Society for Non-Destructive Testing (DGZfP), the panel is elaborating a first draft for a VGB recommendation by the end of 2013.

The panel is currently revising the VGB Recommendation «Minimum requirements on the training of radiation protection technician (VGB)» and «Minimum requirements on the training of radiation protection engineer (VGB)». Besides, VGB is drafting a new overview on radiation protection qualification.

One authority representative (GRS) and two operator representatives (from the panel) represent Germany at the bi-annual meeting about the information system on Occupational Exposure ISOE run by OECD and IAEA. The panel supported the European symposium that took place in June 2012 with papers and cooperation in the programme committee.

The ISOE working group SAM (Severe Accident Management) that was set up in 2012 is probably to elaborate a report by the end of 2014. The panel is actively involved. It is also planned to participate in the related workshop.

The panel is also cooperating in additional committees and panels, among others of the Technical Association for Radiation Protection (Fachverband für Strahlenschutz), the Working Panels «Physicians in Nuclear Power Plants», the committee «Emergency Protection» of the Radiation Protection Commission (RSK) and of BGETE (Accident Prevention and Insurance Association). A joint study is being developed with the latter investigating the risk of cancer of staff exposed to radiation.


Working Panel «Mechanical and Process Engineering»

Heinrich Grimmelt

Also during this reporting period, the members of the Working Panels «PWR» and «BWR» intensively exchanged experience on current events from operation and maintenance. Particularly events from inspections like e.g. special checks, schedules, special NDT, retrofits and plant changes as well as inspection results were on the agenda. At the meetings, the panel members discussed reportable and non-reportable events with the focus on findings and measures derived from such events for taking preventive action.

After more than 30 years, the PWR panel ceased business on February 27, 2013 at its 121st meeting. The same holds true for the VGB Working Panel «BWR». The new Working Panel «Mechanical and Process Engineering» was set up within the scope of restructuring VGB’s CC1. All members of the former Working Panels «PWR», «BWR», and «Maintenance Manager Workshop» will participate in the new panel. Apart from German nuclear power plants, four nuclear power plants from Switzerland, the Dutch Borssele and the Brazilian Angra plant (corresponding member) have also sent representatives.

Working Panel «Maintenance Manager Workshop»

Heinrich Grimmelt

The working panel was to exchange experience about planning and realisation of maintenance measures in order to improve their efficiency.

The panel focussed on treating of unplanned situations on the reactor floor. Problems may occur in PWR as well as BWR which hinder smooth inspection. It was e.g. anticipated that the adjustment mechanism of the reactor pressure cover failed. In this case it would have been impossible to rebalance the crossbeam for crane operation. The panel ordered drafting of an instruction how to behave in such case.

Among others, the panel recommended procurement of special tools in order to react to unplanned situations.

Working Party «Human Performance Optimisation»

Thomas Linnemann

The working party was to identify and to describe relevant tools (tools for avoiding failures) of professional acting for the German language area. Besides, the party was to support introduction of such tools at the sites. These targets were met on the basis of the VGB concept for the implementation of tools for professional acting. The party organised the exchange of experience on each tool with contact persons from individual sites and elaborated additional VGB recommendations on implementation for selected tools.

Besides, options for practical training with these tools were investigated and assessed, corresponding training documents were drafted, issues of trainer training and training of operator staff were settled at the training site in Thionville/France and the establishment of national training facilities was advanced. This involved the mobile training facility («container solution») by E.ON Kernkraft, which was handed over – equipped with the necessary devices – in April 2013 for carrying out practical training. The stationary training device at KSG/GfS is to be finished as of the third quarter 2013 and ready for use.

Working Panel «Commissioners for Nuclear Safety and Human Factors»

Working Panel «Event Analyses»

Working Panel «Safety Culture in German Nuclear Power Plants (VGB-SBS)»

Guido Vallana

The VGB Assessment System Safety Culture in German Nuclear Power Plants (VGB-SBS) has been applied in German nuclear power plants since 2001 as a procedure to be carried out according to individual operators’ responsibility.

Since the beginning of 2012, version 3.0 has been available which meets the requirements of the international standards on safety culture. The new VGB-SBS comprises four main elements: «administration», «organisation and communication», «realisation of activities», and «learning and changing».
Usage and efficiency of the new VGB-SBS was verified by a pilot assessment made in a nuclear power plant as well as by additional full assessment carried out in 2012 and 2013. For the first time the new VGB-SBS was used successfully in a foreign German-speaking nuclear power plant.

The first version of the VGB guide on holistic event analysis was passed in June 2003 by the VGB Working Panel «Committees for Nuclear Safety and Human Factors». The operators’ guide was revised in October 2011 due to an RSK recommendation «Guide for the Realisation of Holistic Event Analysis». A discussion between RSK and operators that took place in December 2012, resulted in the current version state 04/2013.

Apart from interpreting reporting criteria and the exchange of experience, the exchange of experience made with author – services (corresponding member) are represented. The focus of the new panel is on «KSB-specific tasks», «safety culture», «holistic event analyses», and «Hf specific issues».

Andre Seidel

The panel focused on the exchange of experience about emergency trainings in Germany, Switzerland, and the Netherlands. Experts from AREVA (representatives from the crisis task force at the Erlangen and Offenbach sites) as well as representatives of Kerntechnischer Hilfsdienst GmbH (KfG, nuclear emergency services) are permanently involved.

Practical feedback of information and application of technical and administrative measures like the findings from Fukushima and the resulting requirements as well as changing marginal conditions of plants in the post-operation phase have had major influence on emergency management at the sites and the corresponding discussions among panel members.

Further issues of discussion referred to the drafting and application of technical and administrative measures like:
- EDF-supported second documentation for the task force,
- Systems for electronic determination of the status quo and reporting, electronic involvement of external organisations like e.g. AREVA NP task force, KHG, authority for disaster control,
- Systems for computer-aided monitoring of protection targets,
- Concepts for alarm organisation, and
- Drafting of emergency manuals as well as the implementation of the recommended emergency protection from the national peer review 2009 and general recommendations of radiation protection and reactor safety commission for planning emergency measures by nuclear plant operators.

Within the scope of safety technical requirements/measures as precaution against risks (catalogue of requirements of BMU), the panel members continued discussing «additional measures for maintaining training and competency – training of task force members» and «computer-aided diagnosis and prognosis tools» for determining the radiological situation in support of the plant-internal task force.

The issue of emergency management was shifted to the Technical Committee «Nuclear Power Plant Operation» after restructuring the committees and panels of CC1.

Technical Committee «Decommissioning and Disposal»
Katrin van Bevern

After publication of the EURATOM-Waste-Management guideline in summer 2011, the committee members observed the implementation in Germany, particularly the developments fostered by the BMU concerning a national disposal programme and the act on selecting a site for waste producing heat.

VGB elaborated a joint comment with DAIF on the amendment of the 14th German Atomic Energy Act (transposition of the EU Disposal Directive) as well as on the draft of the act on selecting a disposal site.

In 2012, the annual exchange of experience and information with Mr Sailer, chairman of the disposal commission (ESK), launched in 2012, was not continued due to the intensive work on the national disposal programme. It is planned to continue the dialogue in 2013.

VGB has been member of the European technology platform for final disposal IGD-TP (Implementing Geological Disposal Technology Platform). VGB is observing the trends in European research in order to identify possible influence on the national final disposal concepts and to be able to act pro-actively at an early stage.

The Federal Ministry of Economics (BMWi) regularly approaches VGB asking for support upon drafting German reports for EU and OECD inquiries. This applies in particular to the support of the «Brown Book» of OECD/NDA («Nuclear Energy Data») and the EUROSTAT inquiry «Statistics on Nuclear Energy». VGB is also an established contact for the annual «Red Book» (Uranium Resources, Production and Demand) of IAEA and OECD/Nuclear Energy Agency. The Federal Institute for Geosciences and Natural Resources (BGR) is also asking for regular VGB support in connection with the «Red Book».

The committee also dealt with:
- Guides for the periodic realisation of periodic safety checks for intermediate storage (PSU-ZL), pilot projects Gorleben storage of shipping casks (TBL) and intermediate storage site Emsland (SZL),
- Observation of the development and talks with BMU on the Bremen act on harbour operation (see VGB Annual report 2010/2011),
- Co-operation in the advisory board of EURATOM,
- Updating of the speaking notes concerning uranium procurement for the general assembly of member companies,
- ESK stress test,
- Exchange of experience about precautionary disposal and utilisation verification,
- English translation of the VGB disposal brochure,
- Annual calculation of the average nuclear fuel cycle costs,
- Updating of the «disposal schedule».


- Support concerning the issues supply and disposal for the Technical Committee «Nuclear Power Plant Operation» and the general committee of CC1.

**Working Panel «Nuclear Materials Monitoring»**

Katrin van Bevern

Apart from the exchange of experience, the panel observes current monitoring measures by EURATOM and IAEA. After introduction of the new randomly-based safeguard inspections («Integrated Safeguards» [IS]) in 2010, the panel focused on their implementation.

A member survey already conducted in 2011 revealed that the inspection expenditure was reduced by 40 to 45 % at plant sites and by some 50 % at intermediate storage sites. This trend was confirmed in 2012.

Despite the resources saved through IS, IAEA as well as EURATOM are planning further measures to make savings. Thus, a number of projects (e.g. introduction of remote data transmission, casks to be sealed by operators) were initiated which could reduce personnel work load within the scope of loading campaigns planned for 2012 and the following years. Therefore, measures were taken to build up confidence towards EURATOM, i.e. the frequency of information about loading campaigns was increased from annually to bi-annually. Besides, the concept documents to be delivered 200 days prior to the campaign, were passed on to EURATOM as early as in April 2013 although the campaign will start only in the autumn of 2014.

Another central issue of the panel is the observation, cooperation, and positioning on the introduction of remote data transmission in interim storage sites and nuclear power plants. After EURATOM had made several initiatives to introduce remote data transmission at different sites, a field tests on remote data transmission was initiated in 2011 along the line from the Ahaus intermediate storage (GNS) to Luxembourg/EURATOM within the scope of the German support programme. The project confirmed feasibility and efficiency.

After having involved the state authorities, EURATOM started with the area-wide introduction of remote data transmission at the sites. Besides, the field test will be continued.

According to EURATOM’s wishes, remote data transmission is also to be introduced soon at the reactors. Against the background of nuclear phase out, this was several times doubted and it was suggested to complete the introduction of remote data transmission at intermediate storage sites in order to gain experience that could then be used as basis for the introduction at reactors.

Generally nuclear plant operators and operators of the nuclear fuel cycle are of the opinion not to assume mandatory tasks like cask sealing with reference to safeguards. At the same time, operators signalled their willingness to negotiate if the tasks to be assumed are simply «back up» measures. Since operators as well as inspectors are interested in simplification with a view to the forthcoming loading campaigns, this attitude can be considered a careful change of opinion for neglecting the assumption of mandatory jobs. Care has to be taken that the development towards linking the seal (EOSS) with monitoring camera is furnished with a function for written or electronical acknowledgement of the sealing. The operators may not suffer from any drawback resulting from this method of sealing.

According to EURATOM, the current concept on the basis of annual «Physical Inventory Verification» and additional random inspections according to IS, remains valid in the post-operation phase, i.e. when nuclear fuel is still present. After removal of nuclear fuel, inspections in two to three years intervals are expected depending on the progress of disassembly of key components. When having achieved safe enclosure, inspections are assumed to take place every five years. Thus, expenditures in decommissioned plants are manageable for operators and the EURATOM concept is acceptable.

During the decommissioning in 2012/13, it turned out for the first time that disassembly can be impaired by IAEA monitoring measures. VGB has already protested at the BMWi and EURATOM. The panel will particularly observe the IAEA monitoring measures in shutdown plants.

Further current issues

- Cooperation in the Working Group «Monitoring of Nuclear Material» (AKU) and Programme Council of the BMWi/IAEA Support Programme,

- Observation and discussion with BMWi and inspectorates on the creation of a valid legal basis by adjusting the «Facility Attachments» of IAEA and «Particular Control Regulations».

- Exchange of experience and assessment of IS in Germany, adhering to the 24 (48) hours of announcement prior to random inspection,

- Report on remote data transmission on the ESARDA symposium 2013,

- Exchange of experience about current inspection practice by EURATOM and IAEA within the scope of the new IS regimes; handling of safeguard devices that remained in the plant and their transport.

**Working Panel «Cask Handling and Storage» (BAU)/Working Panel «Intermediate Storage»**

Andre Seidel

Representatives of the head offices of nuclear power plant operators, of the 12 intermediate storage sites at the nuclear power plants, the Ahaus (TBL-A) and Gorleben (TBL-G) fuel element intermediate storage sites, and the intermediate storage site Nord (ZLN) in Greifswald as well as the Swiss ZWILAG joined for the exchange of experience. Representatives of manufacturers for transport and intermediate storage casks for spent fuel elements (GNS Gesellschaft für Nuklear-Service mbH and TN International) also attended the meetings.

The Working Panel «Cask Handling and Storage» mainly deals with the operation of the intermediate storage sites at the power plant sites as well as the exchange of experience on issues of cask loading for short-distance intermediate storage.

The panel members also discussed particularities of storage operation, site-specific utilisation concepts as well as experience made with existing testing regulations and their adoption to changed marginal conditions. Information and records on licensing steps and their coordination in the panel are preconditions for checking the possibilities of joint treatment by the utilities affected, like, e.g.:

- Permits for new cask designs (CAS-TOR® V/19 and V/52 with 96’ permit as well as TN®24 E),

- Mixed storage according to § 6 AtG, and

- Retrofit of cranes used at the intermediate storage facility.
In the light of shutdown, concepts are increasingly needed which guarantee the autarkic operation of intermediate storage sites close to the site and the long-term provision of necessary infrastructure. A working party was set up to deal with the issue.

A working party observed the activities of the German Nuclear Waste Management Commission (ESK) (Committee on Waste Conditioning, Transport and Interim Storage (AZ), i.e. the development of «Guides to the performance of periodic safety reviews for interim storage facilities for irradiated fuel elements and heat-generating radioactive waste» as well as recommendations on the technical ageing upon interim-storage of irradiated fuel elements and heat-generating radioactive waste (ageing management).

Mentoring of the activities of the «Federal Coordination Office for Information on Cask Handling (KOBAF)» is another focus of the panel. KOBAF is operating databases and the BIBO platform (on-line authority information library) for mutual information of federal state supervisory authorities and their experts. Status discussions are held regularly in order to reflect practical experience and the operators’ benefit by taking into account operators’ financial expenditure. Increased synergies could be achieved through extended utilisation of the databases also by experts, and time could be saved within the frame of modification procedures requiring authority permission.

Following restructuring of CC1, issues formerly dealt with by the Working Panel «Cask Handling and Storage» are now treated by the Working Panel «Interim Storage». A separate working party will deal with cask loading and its intermediate storage.

Working Panel «Decommissioning»
Katrin van Bevern

After the 13th amendment of the German Atomic Energy Act which involves termination of the permission for power operation of eight nuclear power plants as well as additional plant shutdowns by 2022, the panel guarantees regular exchange of experience among plants already decommissioned and plants to be decommissioned.

Experience has shown that disassembly of nuclear power plants is a technically solved task. In recent years, operators, authorities and experts gained a wealth of experience upon the decommissioning and dismantling of nuclear power plants. Decommission has progressed, mainly due to the disassembly of the Mülheim-Kärlich, Stade, Würgassen, and Obrigheim nuclear power plants.

Besides, parts of regulations have changed, e.g. the «Guide decommissioning» and «Final storage conditions Konrad».

In 2011 updating of the «Reference concept decommissioning» was ordered to give further evidence about the technical feasibility of decommissioning and dismantling of nuclear power plants. A group comprising members of the panel is supporting the project. Apart from techniques and costs, requirements of the atomic regulations are explained. The same applies to the requirements for the disposal of residues and wastes, inventories, masses and radioactivity of type-specific BWR and PWR reference plants. The general part was finished in 2012; the part related to costs will probably be finished mid-2013.

At the beginning of 2010 the panel had set up a Working Party «Contamination of Buildings and Clearance» which discussed among others issues like clearance routine, measurements for making decisions, evidence of exposition scenarios and nuclide vectors. Thanks to the intensive exchange of experience it was possible to directly involve the findings into DIN 25457 “Activity measurement methods for the clearance of radioactive substances and nuclear facility components” which is currently being revised. These issues will probably be finalised by the end of 2013 and the results will be summarised in a report.

In addition to the exchange of experience on decommissioning, the panel also discussed the following projects:

- Observation and cooperation in «IAEA Safety Guides and Requirements» on decommissioning, data, management of the PRIS data base (Power Reactor Information System),
- Contact with the World Nuclear Association and ENISS,
- OECD/NEA: cooperation and observation of the activities on decommissioning, among others. «Decommissioning Cost Estimation Group»,
- VGB paper for the KONTEC 2013 Conference «Conditioning of Radioactive Operational & Decommissioning Wastes».

Working Panel «Waste Management»
Katrin van Bevern

After publication of the VGB disposal brochure at the beginning of 2012, the panel finalised the English translation «Waste Disposal of Nuclear Power Plants – a Technologically Solved Challenge» by the end of 2012 and put it on the VGB homepage. The English version is not to be printed. The presentation transparencies are already used in papers.

In 2012 the panel members focused on the exchange of experience with current developments in the treatment of radioactive waste of nuclear power plants and other nuclear facilities. This mainly applies to conditioning, storage and documentation of wastes fit for storage at the Konrad site.

The panel no longer appears in the new CC1 structure. At its last meeting in the autumn of 2012, the panel members recommended continuation of the exchange of experience on the basis of the guidelines of the disposal commission for intermediate storage of radioactive waste with minor heat release. The Technical Committee «Decommissioning and Disposal» accepted the recommendation and set up the Working Party «Waste Management» which is to exchange experience in 2013.

The panel also dealt with the disposal commission and its committees, the KTG working group final storage, contributions for the annual meeting on nuclear technology, post-qualification of waste for the Konrad final repository, review of the 4th IAEA Joint Convention 2012, the new act for looking for a final repository, the EU technology platform final repository, and the 14th amendment to the nuclear act/national disposal programme.
Power Plant Technologies

Herbert Urban

VGB PowerTech also notices the signs of advancing Europeanisation. The General Committee «Combustion Power Plants», until now with German as working language, and the European Technical Committee (ETC) «Generation and Technology» had agreed to merger by the end of 2011. Since the first joint meeting on May 4, 2012, another two meetings of the new designated General Committee/European Technical Committee «Power Plant Technologies» took place during the reporting period. According to the VGB statutes, the new committee is still acting as general committee, but it is also dealing with current issues from the country-specific view points of all members. The committee members are also selecting the papers and determine the scope of the VGB Conference «Power Plants in Competition» and are involved in the selection of the awardees of the «Quality and Health & Safety Award» that was awarded for the first time at the last VGB Congress in Mannheim.

During the reporting period, VGB intensively supported and cooperated with BDEW and EURELECTRIC. The discussions about supply safety are dominated by demand in new grids, necessary storage technologies, and new requirements on fossil-fired power plants. This was clearly reflected by continued work in the field of joint issues like network codes (ENTSO-E) or back-up control. Particularly with regards to issues of European network codes, the work is long-term and complex. After having incorporated some improvements required by ACER, it is now being examined by DNV KEMA before the European Commission will carry out the legislative procedure. VGB will remain involved in discussions with relevant parties. Report is also to be given on major changes of projects status during the reporting period.

New orders for engineering and new materials were placed for the high-temperature project COMTES+ which is the follow-up project of the expiring COMTES700 project. The planned operation, scheduled for September 1, 2013, is very critical because supply of the new materials is delayed which is quite normal within the scope of research and development projects.

The project HWTII, headed by GKM, was started successfully in October 2012. The number of operating hours already totals >3,000 h. The plant runs according to schedule.

The PEPP database (PEPP – Platform for Experience for Power Plants) is being set up. It is to be used for collecting all important accidents and damage to fossil power plant components in order to learn lessons for design and modification of manufacturing of faulty components as well as all HSE measures. In January 2013, the prototype was presented to all project members. The test phase started in May 2013 and the base is to be used as of June 2013. Participants’ training started by the end of June 2013.

The quality initiative «Pro Quality», requested by our members for quite some time, had to be delayed and will now be dealt with by the responsible Technical Committee «Material and Quality Supervision».

The structural change caused by the turnaround in energy policy in Germany and Europe also changed VGB’s focus. VGB’s strengthening of activities in the field of renewables that was already launched during the last reporting period is also affecting CC2 (Power Plant Technologies) which is involved in extending the activities in CC3 (Renewables and Distributed Generation). The new policy and related activities, to be elaborated jointly with the main committees, are to be presented by the beginning of 2014.
As regards conferences and events, the general committee was very successful in the reporting period. However, the number of participants was declining. The large events like «Steam Turbines and Steam Turbine Operation» in Friedrichshafen, «Power Plants in Competition» in Neuss, and the VGB Congress in Mannheim, had very interesting lecture programmes that were accompanied by top-level technical exhibitions.

Technical Committee «Power Plant Concepts»

Hans-Joachim Meier

The last decades focused on the technical advancement of fossil-fired power plants (gas, hard coal or lignite) and the increase of installed unit capacity as well as increase of net efficiency. Continuous increase of unit output from some 150 MW in the middle of the last century to more than 300 MW, to 600 MW and up to currently some 1,000 MW installed power plant capacity became state of the art, particularly in coal-fired power plants. Due to the economy of scale in terms of specific investment costs (€/kW installed power plant capacity), it has also been an incentive to continuously increase unit output. The entire efficiency was to be raised by taking into account environmental aspects, thus increase in capacity went hand in hand with continuous increase in steam condition, i.e. the net efficiency of hard coal- and lignite-fired units.

In the last decade, VGB mainly supported the advancement of conventional European power plant design by its Emax initiative which was aiming at increasing the efficiency and cost effectiveness of new power plants. Besides, the current stringent requirements to be met by environmentally compatible coal conversion processes are to be further improved.

The development activities of the last decade are characterised by research projects, which were acknowledged European-wide. The power plant concept «Reference Power Plant North Rhine-Westphalia», presented by VGB in February 2004, has been several times realised in Europe yet. The concept involves a technically and economically optimised power plant with live steam parameters of 285 bar/600 °C/620 °C and net efficiency of some 46 %.

The second step of the VGB Emax initiative, characterised by further increase of net efficiency up to 50 %, was realised by the construction and operation of the so-called COMTES700 test plant. The development activities were accompanied by comprehensive engineering works on a 600 MW demonstration plant which is part of the VGB Study «NRW Power Plant 700 °C» (PP700). Additional important trials on the operating behaviour of tubes, pipes, and forged pieces for future highly efficient power plants, are running in Grosskraftwerk Mannheim. Besides, tests are being carried out in the ENEL Andrea Palladioi power plant in Fusina/Italy within the scope of the European research project ENCIO. The results of all 700 °C research projects demonstrate that the nickel-based materials need additional qualified work in order to reduce technical risks of this highly-efficient power plant technology.

Although these research results are all very encouraging, the international committee members drew the conclusion at their last meeting that the European endeavours towards advanced, highly efficient power plant concepts had become sluggish. The discussions with member utilities represented in the technical committee revealed that in Europe, and particularly in Germany with its new energy policy, the current political general conditions do not leave scope for cost-intensive advancement of conventional power plant engineering. The members came to the conclusion that this is mainly due to the current electricity market, i.e. the profits made at the wholesale power market are not sufficient to earn the research funds needed. It is even worse that not enough profit is made to invest in urgently needed new replacement projects to renew the ageing power plant portfolio. The problem is that residual load to be provided by fossil-fired conventional power plants is not refunded sufficiently at the electricity market, and thermal power plants are not utilised sufficiently because more renewables-based electricity is being fed into the grid, i.e. electricity generation costs are often not earned.

The electricity generation costs in €Cent/kWh depending on utilisation of a thermal power plant are shown by quality in Figure 1.

The strong dependence of electricity generation costs on plant utilisation is demonstrated in Figure 1. The figure shows that electricity generation costs of a power plant operated in medium load for e.g. 5,000 full load hours, are nearly doubled when the power plant is operated for 2,000 hours only. However, since the plant is needed for grid stabilisation, it often cannot be shut down despite its uneconomic operation.

The situation gets even worse when a power plant unit was erected anew and the electricity generation costs are increased by very high fixed costs from interest payments.

The situation is much more dramatical for gas-fired co-generation plants. Apart from the losses resulting from insufficient plant utilisation, operators have to cope with highly fluctuating gas prices.

The simplified view underlines that the future development tasks will be shifted from «increasing efficiency» towards «economic operation».

In December 2012, VGB conducted jointly with BDEW a survey among German member companies in order to capture the atmosphere among utilities in Germany that is currently undergoing a turnaround in its energy policy. The results of the survey are depicted in Figure 2.
Since there are hardly incentives to invest in new power plants, utilities were asked about the development tasks for plants in operation.

Retrofit measures like a) increase of load following capacity, b) improvement of economic efficiency, and c) improvement of plant efficiency were identified by 55% as most important measures. Some 52% believed that the reduction of minimum load of existing power plants is needed in order to be able to better make up for the non-available feed in of renewables-based electricity.

However, 36% of the companies asked, also answered that it was necessary to increase the lifetime of conventional power plants.

Figure 3 shows the situation of the current thermal power plant fleet that can be utilised according to demand and which modes of operation result in increased or decreased residual lifetime of thermal power plants.

Since power plants are generally designed for 200,000 full load hours, it could be assumed that plants designed for medium load with 5,000 full load hours/a could be easily operated for some 40 years. It could also be assumed that the plants could easily be operated beyond their designed lifetime of 40 years when not being utilised too much. However, reality looks different because the enormous increase in plants’ load cycles results in stresses reducing their lifetime. Therefore, retrofits are often needed to achieve the design lifetime of the highly stressed components of thermal power plants.

The survey conducted and the new targets for the advancement of thermal power plants encouraged the Technical Committee «Steam Generation Plants» to initiate the new research project «Partner Steam Power Plant» (P-DKW). The concept of this initiative is aiming at retrofitting plants already in operation in order to be able to securely compensate grid instabilities due to the fluctuating in-feed of wind- and photovoltaic plants. Within the scope of the research initiative «Partner Steam Power Plant» (steam power plant as partner of renewables) it is to be investigated which technical measures have to be taken in order to realise these tasks economically efficiently and reliably.

It is planned that the research project that is being coordinated by VGB will start in the summer of 2013.
Adjustment of market positions in EU

Fig. 4: Internal structure of the Technical Committee Power Plant Concepts.

Co-combustion of biomass was also another important topic. It was decided to deal comprehensively with this issue and to centralise all results in the Working Panel «Steam Generators». The panel will assume coordination measures.

The panel members were also dealing with quality problems. This applies to new-built projects as well as to retrofits and replacements. In a lot of areas, the problems cannot be generalised because mostly details are concerned with considerable effects on complete power plant operation. Problems with the new material T 24 (7 Cr Mo V Ti B 10 – 10) are added on. A working party was set up to deal with these issues and all new-built projects.

Apart from existing new plants and current commissioning, additional new plants are not being planned. The majority of operators are planning extensions to units based on biomass or any other kind of renewables.

Working Panel «Fuel Technology/Firing Systems»

Ludwig Müllcr

The meeting that took place during the reporting period dealt with:

Minimum load, start-up and shutdown

Mr Schlessing, former boiler engineer in Grosskraftwerk Mannheim and engineer for boiler commissioning at EVT, Stuttgart, reported on its operating experience with startup and shutdown as well as low load operation, which were not duly considered at that time, but which are very important today:

If steam pressure is kept on a relatively high level at load reduction, the low steam volume will result in a quadratically decreasing pressure loss and thus in inadmissible distribution of the steam flow in the superheater tubes.

In cases where low load operation – less than three hours – is expected, the plant should rather be shut down immediately because deliberate start-up and shutdown operation is more economical than extended operation periods of low load operation.

In case of tower boilers, the water level in the vessel is to be overfed upon shutdown and the economiser is to be re-fed during standstill so that it does not run dry of steam.

Bowl mills are to be purged with hot primary air because only half the purging velocity is achieved with equal primary air mass flow at ambient temperature.

Upon sudden change of several percentage of the number of feed-in revolutions, the fuel-water vapour control displays a contrary behaviour, which can be reduced by momentary switching of the controller to deliberate fuel water vapour feeding resulting in stable and faster load changes.

Due to the influences of changed fuel quality on operating behaviour of the boiler (mill and furnace), it was suggested to continue the exchange of experience by a permanent topic on the agenda:

- Operating experience with lignites/ imported coals/secondary co-fuels.

From the general exchange of experience, the following is to be highlighted:

- The term «minimal load operation» was introduced by one plant in order to make a distinction between the formerly usual minimum load of some 35 % to the current 12.5 %.
Working Panel «Fluidised Bed Combustion»

Ludwig Müller

As regards the exchange of experience, the panel members mainly dealt with those plants which were subject to revision during the reporting period:

- Insufficient qualification of high-pressure welders caused considerable delays during boiler inspection.
- No increased tube wall corrosion was detected after several years of co-combustion of secondary fuels.
- A high velocity flame treatment, carried out in 2004, is still in good condition.

The exchange of experience also focused on plant extension and co-combustion as well as the related experience.

The English translation of the revised VGB Instruction Sheet M218 «Gas Distributor Plates in Fluidised Bed Systems» has been available in the meantime.

The 6th operator workshop took place in Cracow/Poland on September 18/19, 2012. Operating experience made with fluidised bed systems was presented in 19 papers. The international audience, with the largest group coming from Germany, discussed the papers. At the panel meeting following the workshop, two Polish fluidised bed operators announced their willingness to cooperate in the panel.

The second meeting of the working party revising the VGB Instruction Sheet VGB-M219 «Refractory Linings in Fluidised Bed Combustion Systems» took place on March 11, 2013. The party members are now elaborating the foci laid down at that meeting.

The panel members decided to organise a joint technical conference together with the VGB Working Panels «Steam Generators» and «Industrial and Co-generation Stations» to be held in Weimar on March 26/27, 2014. The FBC panel is to make three to four contributions each on the topics «corrosion-erosion» and «co-combustion».

The German Bundestag (parliament) passed more stringent emission limit values to be observed by old plants as of 2016.

Working Panel «Thermal Waste Utilisation»

Ulrich Schirmer

After several fires had occurred in fuel storages (waste bunkers), which partly caused considerable damage to buildings, questions arise about the root causes and usefulness of fire prevention and precaution recommendations. As early as in the 80ies of the last century, fires had occurred frequently in waste-to-energy plants also causing considerable damage to buildings. At that time and today the reasons could not be identified unambiguously, however, a relation to high heating values of individual waste fractions was obvious. Whereas in the past there did not exist any written regulations, e.g. in order to find out whether existing regulations were not adhered to, today reference could be made to VGB and VdS instruction sheets and it can be found out whether these rules were obeyed to or whether they were ineffective. Today, the panel members are of the opinion that water extinguishing plants that do not use quenching water on purpose, are only partly successful because most water is consumed outside the fire instead at the centre of the fire. Large-area fires are rare, because of the common bunker design, fires are detected in due time before developing into a surface fire.

The VGB Instruction Sheet VGB-M-217 «Particularities of Fire Protection of Waste to Energy Plants» was revised within the
The revised new edition of the Instruction Sheet VGB-M 216 «Refractory Lining in Waste Incineration Plants» with comprehensive extensions on quality management and the English version of the Instruction Sheet VGB-M 216 «Recommendations for Design and Properties of Waste-fuelled Steam Generators» were also published.

Revision of national legal frame conditions for waste combustion harmonised these regulations with real plant conditions. However, discussions are still needed in future in order to underline the closeness of current emission values and limit values. Further increases of limit values would entail unjustified expenditures. The reasons are partly difficult to explain because Germany is partly having limit values that are not common in Europe.

Continuation of this discussion is being expected in connection with the revision of the EU opinion on BREF waste incineration. In the short term, the panel will try to settle individual issues like information on accompanying reactions upon NOx reduction according to SNCR technology and summary of the largely available results about the effects of residence time and flue gas temperature on combustion quality and thus release of carbon hydrogen compounds that are difficult to decompose.

A two-day conference on the above issues and additional topics like recycling of raw materials from combustion residues — provided that suitable techniques are selected within the scope of traditional combustion technology — were the highlight of this year’s activities of the Working Panel «Thermal Waste Incineration».

Working Panel «Industrial and Cogeneration Stations»

Werner Hartwig

The panel is increasingly growing due to the turnaround in German energy policy and the related increase of topics. It was considered to bundle all operators of waste heat recovery boilers in the panel in order to be able to discuss technical facts and individual problems more detailed.

One issue was the shortage in skills and the loss in knowledge. Training concepts and its realisation have been discussed for quite some time. Approaches have failed yet due to one-sided direction and lack of readiness of operators. A new concept has been presented following the initiative of one company. This involves parallel training in the Power Plant Training Centre (KWS). Some companies have already signalled support and will nominate power plant operators to attend the training.

Unfortunately, the number of accidents in industrial co-generation stations increased in the last six months. Accidents within the framework of maintenance activities and scaffolding are the only clear trend. VGB elaborated a list showing the accident risks of plants in order to sensitise operators of smaller plants. Thus, operators can examine their plants and processes for possible hazards.

Working Panel «Flue Gas Cleaning Technology»

Andreas Wecker

All issues related to flue gas cleaning like desulphurisation, denitrification, particulate removal, and other trace elements are combined in the Working Panel «Flue Gas Cleaning Technology».

A research project was completed during the reporting period:

VGB Project Nr. 337 «Optimisation of a Condensing Wet Electrostatic Precipitator (ESP) for Particulate Matter and Aerosol Separation» and another project was overseen: VGB Project Nr. 353 «Studies on the Technique of Flue Gas Desulphurisation with Seawater Focused on a Simultaneous Generation of Electricity and Drinking Water»

The innovation of the R&D project focuses on the use of brine, which is generated during the production of drinking water, in the flue gas desulphurisation process of fossil-fired power plants. The coupling of the system on both, the material and the energy side, leads to a significant reduction of the necessary amount of water (in addition to the already known beneficial effect obtainable by the use of waste heat from the power plant). Thereby resources can be saved and the possibility of effective secondary treatment can be established. In addition, the catalytic effect of trace elements (iron, manganese, etc.) regarding the oxidation can be improved significantly. The salt content is reduced through the back mixing of brine before the discharge, to minimise negative impacts on flora and fauna.

The panel is dealing with possible retrofit measures to maintain emission limit value of the new 13th Ordinance to the Federal Emission Control Act (BImSchV) and the effects of the application of high-sulphur coals from the USA.
- Swallowing capacity of the HP turbine too large
- Steam leakage in the area of the HP shaft seals
- Shaft vibrations bearing 1 and rear generator bearing not within zone A (vector turning)
- Knocking at the live steam control valve, left
- Permissible noise level not met.

Two gear wheels of the drive pinion of a rotor turning device were demanded at a turbine speed of some 700 min⁻¹ due to faulty control. The rotor turning device was temporarily procured by a SPAT of similar design and the damaged rotor turning device was repaired in the meantime. The damaged teeth on the pinion of the rotor resulted in wrong measurement of revolution speed. The pinion on the turbine rotor had to be replaced during a two week standstill.

The main inspection at a turbo set after 100,000 operating hours was scheduled for 65 days. The inspection comprised MP- and LP partial turbines, generator, main steam valves, LP transfer station, and condenser pump.

The HP barrel-type turbine remained mounted and is probably to be replaced completely in 2016. The schedule was very ambitious due to the findings – listed in the following – to be expected:
- 2/3 of radiations in the LP turbines at the ring sealings and assembly surfaces of the bearing supports were repaired by forged rings,
- The sealing strip above the L-1 stator row were completely lost, reason: erosion at the LPRG in GGG40 and welded guide vane rings,
- Erosion at the guide blade profiles of the MP inflow ring,
- Cracks a the tension studs of the valve covers at the transition shaft to thread,
- No findings at the 3 LP rotors, especially at the blade root of the L0 blades or fir tree notch in the rotor (only LP 1 checked).

In a feed pump drive turbine, the largest final possible stage with an axial downstream flow of 2 m² is being applied.

Vibrational behaviour of the freely standing final stages at nominal revolutions turned out to be critical. Reduction of the minimum number of revolutions down to 2,000 r/min was asked by the customer. This was due to load reduction at night times and avoidance of using electrical feed pumps.

Four EVK160 valves were replaced. One of the valves was tested by destructive testing procedures. It turned out that warm cracks caused by manufacture cannot be excluded. Crack growth caused by creeping is not very likely.

A report was given about the inspection of the barrel-type feed pump. Spare parts were preplaced by refurbished parts. The casing was adopted by deposition welding and subsequent turning with mobile equipment. It turned out that some dimensions were wrong and some production steps had been forgotten.

Two days after commissioning, a highly fluctuating amount of relief water was detected and thus the shaft position changed. The turbine tripped at maximum temperature of the axial face seal. After disassembly, rubbing was detected at the relief piston and first pump impeller. These damages were due to exceeding the manufacturing tolerances at the impeller. The tolerances at the relief part were also insufficient.

Working Panel «Steam Turbines»
Peter Richter
Damage was detected at the heat protection shield of an MP partial turbine. The upper and lower part of the heat protection shield were designed as welding construction and secured at the side with three bolts. The bolts were ruptured at the upper part due to vibrational cracking. Four bolts were found, the other bolts were carried over by the steam flow. One bolt went through LP1 and one bolt each by LP2. The damage resulted in three months standstill.

A report was given on a condenser damage of the 600 MW class. Condenser damage occurred short time after reconstruction of the LP by-pass section.

The tube bundles in identical power plants were replaced in the steam condensers in 2007 and in 2009. Apart from a new drilling image, they are characterised by modified distances between the supporting walls which made it impossible to connect them to the existing reinforcement in the condenser.

No damage was detected in the following years. In 2011 and 2012 the by-pass stations of unit 1 and 2, respectively, were redesigned. Pressures upstream of the last expansion stage were slightly increased and the arrangements of holes in the «dump tube» were modified. A short while after commissioning, damage was observed at the supporting walls of the condenser – particularly close to the extraction header A1.

While the original by-pass guided the steam radially to the condenser, the «dump tubes» release the steam in axial direction on the header line, extraction A1.

It is assumed that the flows in both the by-passes interact with each other up to 4 times of sonic speed and are also deflect due to the unfavourable extraction. The condenser supporting walls are excited to vibrate which causes vibrational cracks at the weld seams and plates itself.

![Fig. 6: Internal structure Technical Committee Machines.](image-url)
A water hammer occurred at a turbine after three days of operation which caused considerable damage. A strike of 7/10 mm was detected at the rotor. The water hammer was due to:

- Valves or drain pipes that were not incorporated by I&C,
- Wrong decline of the extraction lines,
- «Water sack» in one of the drainage valves.

It was reported that the drive of a trip valve of a steam turbine in a solar thermal plant was broken. The hydraulic and steam spindle were only held by the coupling. This damage occurred twice. The root cause was a vacuum that developed upstream of the valve cone which made the valve repulse causing the damage.

A non-back-biased compensator was employed in a plant with axial downstream. The foundation of 850 tonnes was put on spring supports. The foundation design was to take up the maximally possible 100 t vacuum tension of the foundation. However, the fibre plates laid between foundation and spring packages had a much smaller friction factor which caused the foundation to shift by 22 mm.

A piece of cloth had been forgotten in the evaporator line of the oil feed to floating seal. This caused rupture of the seal with subsequent pressurisation of the oil system. Oil escaped and the steam turbine caught fire.

It is more and more reported by operators that they are to operate their plants very deep in the part load regime. However, it has to be borne in mind that at very low part load, steam turbines are highly endangered by vintage-heating or ventilation caused by baffle flows. In case of doubt, manufacturers are to be involved in order to carry out calculations.

Working Panel «Gas Turbines»

Peter Richter and Manfred Freimark

Structured and standardised status reports are drafted about remarkable experience and findings from the panel’s activities. These reports are made for single gas turbine series and models of different capacity. They focus on single problems as well as principle issues and problems with fleets of individual gas turbine models due to integrity design deficits detected. Within the scope of the exchange of experience, the panel members discussed damage, refurbishment and design modification of GT components with OEM and non-OEM as well as lifetime extension and problems with operation.

Operators are still highly interested in cooperating in the panel because of the meaning of gas turbines in the context of changing market conditions and the benefits resulting from the community work highly appreciated by utilities. Thus, for years the number of panel members has been 100 % above the number required by VGB statutes. Despite increasing work burden and difficulties to schedule the meetings, the panel is not to be split up in order to take due account of the issues.

With reference to the efficiency initiative, low loss vacuum gear boxes are being employed instead of standard gear boxes for the realisation of LE measures, because good experience was made in old and existing plants. The related significant reduction of the heat rate results – depending on the operational regime – in a relatively short ROI. It is remarkable that some EOM have not realised yet how easily gas turbine efficiency can be increased.

Marketing of existing GT systems for grid operations, like primary and secondary control as well as minute reserve, and the related instationary stresses, result in a significant increase of damaged components of the hot gas pass.

The results of new modified low-NOx premix burners in existing plants confirm that the reduced NOx-ELV amounting to 50 mg/Nm³ for natural gas operation can be met below the combined cycle values and co-generation efficiency limits laid down in the 13th BImSchV.
Test cycles and concepts of turbine protection as well as the architecture of turbine overspeed protection of older gas turbine plants are to be modified. This conclusion was drawn after a spectacular damage had occurred at an older aeroderivative gas turbine of the 20 MW range with natural gas firing. The damage was due to significant overspeed of the power turbine after being disconnected from the grid.

After VDMA had finalised the VDMA 4315 «Turbomachinery and generators – Application of the principles of functional safety, part 6 risk assessment of gas turbines», it was agreed with VDMA to amend the VGB Guideline VGB-R 121 «Overspeed, Limiting- and Protection Devices on Gas Turbine Systems».

The early damage of TBC coatings of different turbine components loaded with hot gas is still giving rise to questions on the reliability of TBC coatings as design tool for increasing the performance of high-temperature gas turbines and issues of the advancement of TBC concepts.

**Working Panel «Cooling Systems in Power Plants»**

**Wolfgang Czolkoss**

Currently the panel is dealing with possibilities for increasing efficiency of cooling systems, changes enforced by licensing procedures of future cooling tower types, and investigation of microbiological risks related to the operation of cooling towers.

Modifications at the air intake of cooling towers and model calculations were carried out in order to decrease the cold water temperature. All these measures are assessed differently. The further development is being observed. Currently there are no further improvements for increasing cooling tower efficiency or alternative cooling concepts.

Future back cooling systems will be mainly hybrid cooling systems or cell cooling towers for reasons of licensing procedures. The members of the panel presented and discussed different current projects in terms of design, licensing procedure, and as far as available, first operating experience. The first spring meeting took place at the construction site of the Moorburg power plant where the hybrid cooling tower could be inspected. The new requirements on acceptance measurements of hybrid cooling towers were discussed intensively. This applied in particular to the definition and assessment of «plume freeness». A new working party will deal with these issues and if necessary the group will draft a new standard.

The Working Party «Micro Biology in Cooling Systems», that was jointly set up with the Working Panel «Chemistry of Water Treatment», terminated the microbiological investigations at several natural draught cooling towers of German power plants. The investigations are now being evaluated and assessed.

The VGB Guideline VGB-R 135 «Planning of Cooling Towers» is being revised by a new project group and merged with VGB-R 129 «Recommendations for Winter Operation». The Technical Committee «Civil Engineering» will deal with civil engineering issues and related standards. The project group «Cooling Water Standard» of the Working Panel «Chemistry of Water Treatment» is revising together with the Working Panel «Cooling Systems in Power Plants» the VGB Guideline R 455 P «Cooling Water Guideline». The current edition is restricted to water treatment and the interdependency cooling water/material in turbine condensers and other heat exchangers. When revising the standard, further components and other problems upon the operation of cooling systems will be mentioned and reference will be made to codes, guidelines, and standards. Thus, the standard will be considerably being extended; revision is to be terminated by the beginning of 2014.

**Fig. 8:** Damage at a two-stage power turbine caused by significant overspeed.

**Technical Committee «Electrical Engineering, I&C and IT»**

**Jörg Kaiser**

The Technical Committee «Electrical Engineering, I&C and IT» and its related working panels deal with current daily issues (e.g. generator damage, transformer monitoring, modernisation of I&C, quality supervision) and coordinate research projects. Besides, the technical committee deals with strategic issues (e.g. concepts for E and I&C projects, requirements to be met by the interface power plant-grid, consideration of E and I&C in connection with renewables-based generation) and elaborates VGB-Standards for the field of electrical engineering I&C. The internal structure is shown in Figure 9:

It is a real challenge to link the topics with the committees and panels of nuclear- and renewables-based power generation, mainly wind and photovoltaics. The electrical large components, i.e. generators and transformer, are directly linked to the VGB committees and panels of nuclear engineering, i.e. through representatives as well as regular mutual reports at committee meetings. Activities on E- and I&C issues related to renewables-based power generation, experience with motors (i.e. comparable generator size), frequency converters and I&C applications (so-called SCADA systems) are to be involved.
KEU (Electrical Engineering, Instrumentation and Control, Information Technology with technical exhibition)

After the positive feedback on KEU 2012, that took place in the Estrel Convention Center in Berlin May, preparations started for the next KEU 2014 to take place in Landshut, May 6 to 8 2014.

The concrete programme planning has already started yet; the concept will orient at the last KEU. Apart from technical papers, the issues of the energy turnaround will be on the agenda. Students will be supported as usual.

Primary control – Wear model

Power plant operators are highly interested in having exact knowledge about the cost structure for providing primary control. For operators of power plant fleets it forms the basis for comparing different ways of providing primary control and thus enables determination of the most favourably priced variant. Also operators of individual plants need to know the costs for providing control reserves in order to determine marginal costs and to facilitate strategic decisions. Besides, the different variants like throttling of live steam valve or condensate and extraction accumulation can be compared with each other.

Exact knowledge about expenditures (costs) is important for plant operators in order not offer in control power beyond own costs.

Additionally, maintenance strategies can be optimised and plant availability can be increased when having exact knowledge about the mechanisms. Information can also be provided which plants are to be used to balance fluctuating feed-in of renewables and which plants might need to be retrofitted.

Rostock University carried out investigations in close cooperation of the chairs for technical thermo hydraulics and electrical engineering from August 2012 to July 2014.

Working Panel «Electrical Equipment»

Jörg Kaiser

Different VGB-Standards are being elaborated. Quality is still an issue of central importance.

Generators

The VGB Project Group «Generators» maintains the damage data base and holds technical discussions with manufacturers to evaluate current events and to identify jointly optimum solutions to improve operations and long-term stability of generators in the future. The last discussions were held with Siemens in March 2013.

Quality supervision of generators is to describe within the framework of a VGB-Standard supervision and tests during manufacturing and to comprise testing methods and guide values. Work is to be terminated in 2013.

The VGB Guideline of 2006 on improvement of the H2 safety of hydrogen-cooled generators is being revised by an own subgroup supported by a generator manufacturer. Revision was needed because of concrete information by explosion protection experts from VGB committees and panels.

Transformers

Ageing management, monitoring options, and methods of large-scale transformers are in the focus. Concrete activities comprise assessments of events at multiple contact switches and a monitoring system for such switches. A discussion was held with a manufacturer; joint recommendations were harmonised and information on processes and products were exchanged. A working party is establishing a table comparing maintenance and monitoring measures in individual companies. A data collection is available on the issues of «online monitoring» and «transformer instrumentation».

A project group will elaborate criteria for assessing the quality of generator oil, oil preparation, and handling along the supply chain including factory testing. A subgroup was also set up to deal with VGB recommendations on civil engineering fire protection.

Motors and drives of frequency converters

The former guidelines ZLM and ZLU are the basis for elaborating a new VGB-Standard VGB-S-168 «Motors and Drives for Frequency Converters». The Working Panel «Electrical Equipment» set up a project group comprising utilities’ experts as well as representatives of renowned manufacturers. The standard can be completed by mid-2013.

Operational safety in electrical engineering

A project group of the working panel elaborated a VGB-Standard, which defines the electrical systems and components of a power plant, which requirements are to be met and how to apply them in the sense of the ordinance on operational safety (German Health and Safety at Work Regulations, BetrSichV).

A contribution is also to be made to uniformly understand estimation of hazards caused by all power plant electrical systems and components. It has to be settled whether and to which extend protection measures have to be taken by safety systems (E/E/PES) and which have to meet categories according to criteria of safety integrity.
Working Panel «Control and Instrumentation and IT»
Jörg Kaiser

Standards
The former VGB Guideline R123C1 «Volume 1 Measurement Technology» was checked for up-to-dateness and its demand for revision was determined. Different parts, especially with a view to new materials for impulse lines, immersion sleeve etc., will be modernised.

A Project Group «Measurement Engineering» was set up. The group is responsible for revision of the VGB-Standards VGB-S-704-43 which provides recommendations for the arrangement and design of remote measurement devices of common measured process variables as well as local measurement equipment in conventional and regenerative plants for electricity and heat generation.

The focus is on long-term functional safety and low maintenance efforts. It preferentially contains proven practical solutions.

Discussions with manufacturers and service companies
The Working Panel «&C and IT» held discussions with manufacturers of different &C components within the scope of its meetings in order to present and discuss special issues and to debate realisation of the VGB Guidelines of the R170 series.

The last discussion with Siemens took place in September 2012. The functioning and events totalled to T3000- and T2000 systems as well as communication between manufacturers and operators were discussed and assessed. A list with advanced investigations and measures was passed and forms the basis for further activities.

Power plant – Grid
Increasing European and national activities at the interface power plant – grid, changing political requirements as well as changing technology and operation of grids have directly influence on power plants.

Different groups (particularly EU Commission, group of regulators (ACER), Federal Network Agency (BNetzA), Federal Ministry of Economics (BMWi), operators of transmission grids) contacted the associations asking for coordinated and often short-term statements within the scope of e.g. consultation or in support of formation of opinion. The statements required are often supporting other committees and panels (particularly EURELECTRIC, BDEW), and are partly used as individual VGB position.

The European Working Panel «Power Plant Grid» coordinates the issues and project groups and deals with the tasks identified. Within the scope of a research project, the strategic question about the stability of the entire system power plant – grid, when feeding in more renewables-based power, is to be investigated.

European grid codes
An individual project group of European member companies is responsible for formation of an operator opinion about the grid codes by Entso-E. The group is closely cooperating with EURELECTRIC.

According to operators’ view, the most important is the EntsoE Network Code for Requirements for Grid Connection Applicable to all Generators «Requirements for Generators». VGB has critically accompanied the whole process of drafting and consultation. However, the current draft of the Network Codes contains requirements which can be a huge burden for operators. After some of the ACER requirements were incorporated, the Network Code is now being assessed by DNV KEMA before the European Commission will launch the legislative procedure. VGB is still involved in the discussions with experts and responsible offices of the European Commission. In Germany, first measures are taken for organising national transposition. Transposition in the individual member states will remain on the panel’s agenda.

German regulation and standardisation of rules for grid connection
Implementation of the European energy policy and particularly of the German policy results in new requirements of the energy act and corresponding ordinances of ministries and of the BNetzA.

During the reporting period, the responsible project group of the panel drafted position papers on
- Amendment of Energy Economy Law (EnWG),
- Redispatch,
- Permit of individual grid earnings,
- Earnings for idle power,
- Coordination of power plant inspections with transmission grid operators (UNB),
- Positioning about grid earnings and procurement of pumped storage power,
- Accompanying and positioning of the discussion about the medium- and long-term securing of generation capacities (particularly market design, capacity mechanisms); direct representation of operators’ interest in the power plant forum of BMWi,
- Comments on the EWI Study «Investigation into a sustainable electricity market design for Germany»,
- Energy information grid,
- Development of grid planning, and held discussions with the relevant authorities.

System stability
Increasing fluctuating generation, particularly wind and solar power, is affecting
- Conventional power plant parks,
- Transmission and distribution grids, and
- Consumer behaviour.

The question arises concerning the effects on future secure reliable electricity supply. The question has to be answered whether there are physical or system technical limits restricting stable operation of the entire system power plant – grid. The Stuttgart and Rostock Universities investigated these issues within the scope of a VGB Research Project: «Influence of Increasing Generation and Consumption Volatility on Reliability of Supply».

This project made a major contribution to the European process to settle the issues within the field of tension between political requirements and scientific constraints. EURELECTRIC is involved in project execution and assessment.

At the deadline of the annual report at hand, the preliminary final report had not been evaluated. The project results will be published in the autumn of 2013.

Technical Committee «Civil Engineering»
Jürgen Lenz

The members of the conference of German ministers responsible for urban development, civil engineering, and housing (ARGEBAU) have already issued a couple of years ago «References for checking the structural safety of buildings by the own-
According to European Directives, certain «damage classes» have to be determined after having been allocated to buildings – after having been allocated to applicable «damage classes» – have to be checked at determined intervals. According to European Directives, certain power plant buildings – this applies particularly to stacks – also have to be inspected within given periods.

The Technical Committee «Civil Engineering» dealt with this topic. It was ascertained that on the one hand operators (also) have to meet legal requirements concerning maintenance of buildings and that on the other, undesired damage caused by impacts on plant availability, is detected in due time within the scope of regular inspections (mostly oriented at regular unit inspections or –standstills).

A VGB-Standard (VGB-R 613) was already published for the «lifetime management of cooling towers». A similar standard is being prepared for stacks. It has to be added which power plant buildings are to be monitored and to what extent. Obligations related to plant operation are to be made transparent in order to exclude legal consequences of wrong organisation. Maintenance and condition monitoring of power plant buildings turned out to be a task which calls for defined requirements and instructions, i.e., VGB publications, to carry out measures.

Besides, the regular exchange of practical experience is also recommended. Therefore, it is planned to dissolve two working panels associated to the committee which finished their duties and to set up a new Working Panel «Maintenance of Power Plant Buildings/Condition Monitoring» within the scope of the reorganisation of the Technical Committee «Civil Engineering». A second working panel is to deal with planning, design, and erection of power plant-specific buildings and is to be entitled «Building Concepts/Specific Civil Engineering Solutions». Power plant-specific buildings involve re-cooling equipment, stacks, silos, containers as well as different pipes for feeding and disposal. Closed storage yards (Figure) are particularly challenging. Constructions with wide-stretched wooden roofs e.g. turned out to be technically and economically favourable. On the occasion of the VGB Congress 2011, the company Holzbau Amann GmbH, Weilheim-Bannholz, was awarded the «VGB Quality Award 2011» for supplying the roof of the coal storage yard of the Moorburg power plant operated by Vattenfall Europe Generation AG.

Revision of the (future) VGB-Standard «Application, Design and Quality-assurance Criteria for the Use of Fibre-reinforced Plastics in Power Plant Construction» (former VGB-R 609) has been continued; further details were defined. The partly large gaps of European and national standards are to be filled in view of power plants-specific application (material requirements, calculation/dimensioning and design of GRP components). Main cooling water lines (DN 2600) often have been made of GRP in recent new build projects.

Numerous European countries will hardly grant plant permission for the construction of new re-cooling systems, i.e., high natural draught wet cooling towers, although this variant is most favourable in terms of the energetic assessment of an entire power plant unit and in terms of emissions/immisions (discharge flow gases and germs etc.) apart from open circuit cooling, which, however, is only an option at sites close to coastal regions. Therefore, another two VGB publications also receiving international attention, namely «Planning of Cooling Towers» (VGB-R 135) and «Structural Design of Cooling Towers» (VGB-R 610), are to be revised in the short term. Revision of the VGB Guideline «Application of Wood in Cooling Tower Design» (VGB-R 611), edition 1996, has been launched. It will cover new-build projects in countries with long and severe frost periods and maintenance in general.

Major civil engineering Eurocodes were introduced on July 1, 2012, requiring practical implementation. The modified requirements were partly considered in (revised) VGB publications (e.g. in VGB-R 610 «Structural Design of Cooling Towers»), further publications (e.g. in VGB-R 602, «Indication and Application of Actions on Buildings in Power Plants») still have to be adopted.

The current structure – «general part» and supplementing «national annex» – of the superior European standards (EUROCODES in particular) is to be adopted when revising the VGB Guideline VGB-R 610. The «general part» is to cover recommendations for general applications and the «national annex» is to describe particularities of local situations (e.g. impacts caused by wind or temperature). Thus, the guideline became unrestrictedly applicable in the related countries.

The VGB-Standard «Structural Design of Nuclear Power Plants» (VGB-S-026-00-2012-08-DE, edition 2013) reflects the state of experience upon planning, design, and retrofitting of buildings for nuclear power plants. The experience is mainly based on findings related to the latest German Konvoi nuclear power plants and the European pressurised water reactor (EPR) as currently being built in Finland and France.
During the reporting period, the following issues were on the agenda of the Technical Committee «Materials and Quality Supervision»:

- Material development concepts and research projects for highly-efficient power plants and future plant generations,
- Measures ensuring quality within the scope of procurement, production, and assembly of steam boiler, pressure vessels, and pipe systems,
- Assessment of damage at pressurised components,
- Regulations on the procurement and operation of pressurised equipment,
- Requirement to be met by bearing structures of offshore wind power systems and related transformer stations,
- New final reports on the following research projects are available:
  - 260 «Esbjerg Test Rig»
  - 296 «COORETEC TD-1: Non-destructive testing of nickel alloys»
  - 301 «Creep behaviour after cold deformation II – Extension by alloy 740»
  - 339 «Investigation of long-term creep, alloy 263, samples from project 290: MPA»

The research project 365 on «Coarse grain structure in austenitic materials» was approved by the VGB Board.

Further intermediate results were communicated for the project «Development of a new generation of 12 % Cr-steels». A so-called Z-phase which much higher strength values in comparison to common 12 % Cr steels is developed in the structure because of optimised heat treatment and chemical composition.

The committee also dealt with the following research projects:

- 725 °C high-temperature material tests II in Großkraftwerk Mannheim (GKM),
- Evaluation of extrapolation procedure on the creep behaviour of heat-resistant steels,
- Influence of multi-annealing on the creep behaviour P91 and P92.

The VGB Working Group «Incorporation of TRD into VGB Regulations» terminated in 2012 implementation of the technical delta from the TRD series 100 «materials» against the standardisation of VGB regulations (particularly VGB-Standard VGB-S-109-2012). In 2013 the group is dealing with the TRD series 200 «manufacturing».

A report was given on the activities of the VGB Steering Committee «T24» and the Working Party «T24». Different investigations on welding, heat treatment, material structures, and stress corrosion cracking were continued. The paper «Stress corrosion cracking at T24», which had been held at the VGB Congress 2012 in Mannheim, was presented at a committee meeting.

The working group focuses on the following subjects:

- Thick-walled components under creep stress,
- Assessment of weld seams,
- Assessment of changes in pressure and temperature,
- Assessment of component lifetime and interdependency of creep fatigue.

Dealing with these issues is to extend the data base and development of improved regulations which are then to be incorporated into VGB-standards with positive effects on lifetime assessment of pressurised high-temperature components. Options of financing were checked for the project «calculation procedures».

A report was given about the investigation of a ruptured tube bend in the final superheater of a boiler. Tube rupture occurred at the suspended heating surfaces after some 7,000 operating hours due to decreasing wall thickness caused by erosion-corrosion. Several manufacturing problems with electrostatic precipitators (ESP) were presented. Rupture occurred due to manganese-sulphide lines upon the application of metal sheets that were not of Z-quality.

Creep damage occurred at the start-up lines made of the material 13CrMo4-5. The damage occurred at the straight pipe. It ruptured completely in the machine house.

The majority of the committee members agree on the standardisation project «requirements to be met by welded supporting structures of off-shore wind power plants and related transformer stations». The supporting structure covers tower and base structure including all assemblies. The standard is not to apply to turbine (nacelle with generator support, rotor blades).

The technical committee accompanies the initiative of the CEN Committee TC 54, which had set up a working party to elaborate the draft prCEN/TR 764-8 »Pressure Equipment and Assemblies – Proof Test«. A joint base is to be formulated for pressure testing according to DGRL for steam boiler, pressure vessel, and pipe systems.

A VGB Workshop «Material and Quality Assurance» took place on June 19, 2013 at the VGB offices in Essen.

**Fig. 11: Internal structure of the Technical Committee Civil Engineering.**
Working Panel «Pipe Systems, Valves and Pressure Vessels»

Christian Stolzenberger

The panel met at Schmiedewerken (forging company) in Großrittersdorf and at the valve company PERSTA in Warstein. Mr Lahoye from GDF Suez and Mr Gabrysch from EnBW became new panel members. The chairman, Mr Harnisch from RWE, and Mr Koalick from Vattenfall was elected new chairman; Mr Fischbeck and Mr Lahoye are his deputies.

As regards the exchange of experience, a report was given on findings at a mixed preheater. Investigations of the inside revealed erosion-corrosion at the internals caused by wear and elution. Root cause analysis identified too high flow velocities that developed because no protective layer could develop. A large area had to be replaced by slot welding.

Surface cracks were detected at internals of feedwater vessels after 20 years of operation. The cracks are due to manufacturing flaws, because the vessel was subject-ed to several compression tests in order to decrease residual welding stress. One of these tests achieved 1.3 of the permissible design pressure which led to the damage. Conditioning leakage and steam leakage noise was detected at the transition to an outlet header to a hot reheater line. A crack of a length of 80 mm was found at the conically-shaped bottom next to the circumferential weld. The crack location indicated to additional stresses from heat expansion and external mechanical load. A systematical damage is assumed because the damage detected at conically-shaped bottoms was due to insufficient heat management upon production more than 30 years ago.

Cracks on half of the weld seam length were detected in a high-pressure turbine stub after some 100,000 operating hours. The crack was due to larger, «off-design», load which was confirmed by post-calculations. The stub was replaced and the maximum temperature was limited. The panel recommends FEM calculations for thermal sleeve stub.

A straight pipe of a start-up line (20 bar/530 °C) of a steam turbine ruptured along its length and fortunately caused systematical damage is assumed because the conically-shaped bottom next to the circumferential weld. The crack location indicated to additional stresses from heat expansion and external mechanical load. A systematical damage is assumed because the damage detected at conically-shaped bottoms was due to insufficient heat management upon production more than 30 years ago.

Corrosion protection at the steel works had to be partly repeated at a nearly completed ship unloader. Impellers and blowholes had to be replaced due to insufficient material testing certificates. High steel screw connections, made by different manufacturers, were delivered and had to be replaced. The railing had to be replaced due to deviations from regulations and weld seam flaws. Impact toughness for –20 °C was missing for the joint pins made of 42 CrMo4.

Insufficient quality control by contractors was observed in different new-build projects. This applied in particular to the documentation of quality problems with sub-suppliers. Besides, customer and contractor underestimated the requirements on welding the material T24 which resulted in delays of more than one year. Extra costs and additional expenditure upon the supervision of construction and assembly were ascertained. Besides it was noted that suppliers did not carry out all or sufficiently the test to be made and thus these tests have to be repeated within the framework of supervision of construction and assembly. This is considered an attempt to shift costs to contractors.

Revision of the VGB Guideline R 501, in future designated VGB-Standard S-013, is completed. In the autumn, it will be harmonised jointly with FDBR before publication.

The panel got in touch with the VGB European Working Group (EWG) «Wind Energy» in order to transfer the experience made with construction and assembly of conventional power plants to wind power plants. The EWG «Wind Energy» and the panel will meet for the first time in the autumn of this year.
**Technical Committee «Maintenance Management»**

Heinrich Grimmelt

The exchange of experience remains the main activity of the technical committee. However, selected companies are also permitted to attend the meetings to present their new products and service. Report is given on damage and unfortunately on accidents.

**Influence of renewables feed-in on maintenance**

The cost pressure remains and even increases due to the shrinking market (key word residual load) for coal-fired power plants. Consequently budgets and personnel are being reduced. Flexibilisation of personnel is pushed ahead, operating personnel is delegated for maintenance tasks, weekends and public holiday working will increase.

Technical problems will increase due to frequent load changes. More capital is being consumed. Components with a repair period of three to four days are operated until failure.

Clear effects on maintenance strategies are currently not obvious.

**Workshop: The cold end**

Following the request by the technical committee, VGB offices organised a workshop dealing with the cold end. The lectures dealt with thermodynamics in general, corrosion problems, cleaning and preventive maintenance.

64 participants took part in the successful workshop that was sponsored by EnBW. Due to the positive response, the workshop is to be repeated in the autumn of 2013.

**Technical Committee «Power Plant Operation»**

Herbert Urban and Jörg Kaiser

The technical committee focuses on operational and strategic topics within the scope of the operation of electricity generation plants and co-ordinates the activities of its associated working panels. Operational issues from the field of renewables are gaining in importance.

Issues like quality of supply, maintenance of power plant components, and assessment of current events are of particular significance for plant operation. These are the modules that guarantee efficiency and competitiveness and form the basis of cross-company activities. VGB offers effective tools, e.g. VGB-Standards and data bases, for event and damage management to support successful and efficient activities.

From the strategic point of view, European issues, that are more and more directly affecting power plant operation, are of special importance. Examples are European emissions and immissions threshold values and requirements to be met by the interface power plant – grid. Training and advanced training of power plant personnel, knowledge management, and trainee concepts are important subjects to secure the long-term competitiveness of utilities.

**Working Panel «Training of Power Plant Personnel»**

Hans-Werner Otte

The working panel dealt with the latest developments in the field of qualification of power plant personnel. Besides, information and experience about the training and advanced training programme of the Power Plant Training Centre (KWS) were exchanged. The panel addressed the following issues:

**Working Party «Revision of Advanced Plant Operator (Kraftwerker) Training»**

During the reporting period, the Working Party «Revision of Advanced Plant Operator (Kraftwerker) Training» dealt with the new training curriculum recommended. The party aims at revising the training contents that meet current requirements of power plant operation and the state of the art of power plants. The new recommendation for advanced training of plant operators f/m is to be adjusted to the appearance of the general curricula of the different shift supervisor (Kraftwerksmeister) courses. On May 1, 2013, the ordinance about the examination for approved «plant operator, f/m» was modified by the German Federal Ministry of Research and Technology in accordance with BMWi, after hearing of the main committee of the Federal Institute for Vocational Training. The modification mainly involves changed minimum operational practice during training which was reduced to 12 months. Due to the modification, the party also has to deal with the structure of the practical part.

**Working Party «Training 4 Future»**

During the reporting period, the Working Party «Training 4 Future» terminated its development work, i.e. the future training and advanced training of power plant personnel. The party had to holistically outline the competences and skills needed for current and future power plant operation by taking into account the dynamics of the marginal conditions of the markets involved. Besides, recommendations are to be made for taking action on different company levels. A model of competency was developed that also focuses on a broad range of skills. Apart from that model, an assessment scale was determined and a process for application was developed which resulted in combination in a system for managing competencies. The process description is to be published as VGB-Standard.

**Working Party «Operational Practice»**

The party discussed different issues which can be summarised under the heading «operational practice» and which can be allocated to the field of training. Focal issues are the Act on Renewables (EEG) and the new regulation BGR/GUV-R 240.

Increasing in-feed of renewables-based power into the grid imposes new requirements on conventional power plants. It is possible that in future conventional power
Database supported development of VGB-standards

Apart from these challenges, the party dealt with new regulations which influence power plant operation. The new regulation BGR/GUV-R 240 e.g. makes decisive reference on isolation procedures:

- Isolation,
- Working at pressurised components,
- Inspection of plant components.

The working party is aiming at elaborating recommendations for implementing guidelines R175 first published in 2006 even more detail in the new VGB-Standards, creation of new definitions, harmonisation of work permit and safety isolation/disconnection procedures the operator’s point of view.

The responsible project group comprises utilities and experts. The group will have completed revision by mid-2013. Then expert discussions with I&C manufacturers and plant management systems are planned in order to harmonise requirements and solutions. The Standard is to be published by the end of 2013.

**IT security**

IT security is relevant in all areas from power plant operation to administration, particularly when using networks. A staged protection system is described in even more detail in the new VGB-Standard VGB-S.173 «IT, Security for Power Plants». It is based on the former VGB Guideline R175 first published in 2006 and currently being revised. Appropriate recommendations for action are particularly important for the practical realisation of IT security in control systems in order to tune reliability and availability optimally.

The responsible project group comprises utilities and experts. The group will have completed revision by mid-2013. Then expert discussions with I&C manufacturers and plant management systems are planned in order to harmonise requirements and solutions. The Standard is to be published by the end of 2013.

**Working Panel «Performance Indicators»**

Stefan Prost

During the reporting period the working panel dealt with the revision and translation of guidelines for the definition of parameters, the elaboration of an inter-plant statistics for hydro power plants, and the advancement of the power plant information system (KISSY).

VGB published the technical-scientific reports «Availability of Thermal Power Plants» (VGB TW 103 V) and «Analysis of Unavailability of Thermal Power Plants» (VGB TW 103 A) for the reporting period 2003 to 2012. A total of 668 power plant units with a total gross capacity of some 270,000 MW were evaluated for the current reports. In comparison to last year’s report, additional utilities from Germany, France, and the
It was agreed to pass on the KISSY data to other organisations like e.g. IAEA (International Atomic Energy Agency) or WEC (World Energy Council) in order to support VGB members regarding the provision of availability data. WEC basically changed reporting and asked for annual unit data. Corresponding preparations are under way to meet the request. However, special emphasis is on the anonymity of units. A PGP data base (performance of generating plant) will be set up for every member involved in KISSY.

Standards

The VGB-Standard «Basic Terms of Electricity Generation» (VGBS002T01) can be obtained from the VGB shop in the German and English language. The French version was also completed; a Portuguese translation is under way.

The Standard «Principles and Systematics of Determining Availability of Thermal Power Plants» is being revised. The future VGB-Standard VGBS002T03 will be designated «Technical and Commercial Parameters for Power Plants» in order to take due account of the increasingly important commercial parameters. Besides it is being considered to determine parameters in order to compare conventional and renewable power plants.

Wind power plants

The Project Group «KISSY/Wind Energy» comprises of international members of the VGB European Working Groups «Wind Energy» and «Performance Indicators». The group is to set up an event data base for recording unavailabilities of wind power plants. Weak points are to be identified in order to make improvements. Availability parameters will be defined and evaluated in a second step.

KISSY

The Project Group «Availability Statistics for Hydro Power Plants» comprises international members of the VGB Technical Committee «Hydro Power Plants» and the European Working Group «Performance Indicators». The group elaborates the principles for cross-utility availability statistics of hydro power plants. The «Hydrogen Guidelines», first published in 1992, was transferred into VGBS002T02 and completely revised.

KISSY was extended in order to integrate availability data on storage and pump storage plants. This year, the VGB members involved in KISSY were asked to report availability data for storage and pump storage plants. The data can be evaluated online and visualised with the following diagrams:

- Time availability,
- Time utilisation,
- Number of changes of mode of operation,
- Operating hours per turbine set, and
- Performance and unavailability.

R&D projects

Jointly with the Dutch company DNV KEMA the panel conducts the research project «Reliability Indicators». A total of about 86,500 of unavailability events, not related to components from KISSY, during the period 2002 to 2011 will be investigated. It is planned to develop evaluation methods and to define parameters which make statements on component integrity. These parameters are to support the optimisation of power plant components upon planning as well as maintenance strategies during operation.

Perspective

The results of the R&D project «Reliability Indicators» as well as new renewables parameters caused current considerations about a new KISSY module, e.g. entitled «Performance». Existing information for two KISSY modules «Availability» and «Unavailability» would be integrated. New evaluation methods and diagrams would be developed which e.g. compare renewables and fossil-fired power plants.

Working Panel «Acceptance and Control Tests»

Wolfgang Czolkoss

Assessing of power plant processes, i.e. of new plants, after retrofits and modernisation measures as well as during current operations, in terms of economic efficiency and environmental compatibility, is an important aspect of power plant operation. Acceptance in the sense of verifying warranties is laid down in specifications and agreements which are normally carried out by specialised measurement groups after the job (modernisation, retrofit etc.) has been executed. The Working Panel «Acceptance and Control Tests» is creating a common base of understanding between operator and contractor and makes recommendations for selecting specialised measurement tools as well as assessment and verification methods. The panel members are cooperating in various committees of e.g. VDI or international standardisation committees in order to perform these tasks.

Existing regulations and their applicability to renewables are being examined against the background of the increasing importance of renewables-based generation. Firstly loose ends in the CSP (solar power) regulations were discussed which involved still unknown factors like ageing of mirrors and heat transfer fluid. However, due to the high investments, CSP are likely to play a minor role in comparison to photo voltaics. Therefore, no further activities are planned in this respect.

Netherlands provided data.

It was agreed to pass on the KISSY data to other organisations like e.g. IAEA (International Atomic Energy Agency) or WEC (World Energy Council) in order to support VGB members regarding the provision of availability data. WEC basically changed reporting and asked for annual unit data. Corresponding preparations are under way to meet the request. However, special emphasis is on the anonymity of units. A PGP data base (performance of generating plant) will be set up for every member involved in KISSY.
elaborating or revising VGB-Standards:

The following project groups (PG) are involved in acceptance and control tests. Process monitoring systems determine the relevant parameters which form the operators’ base for short- and medium-term decision. A VGB-Standard on detailed determination of methods of monitoring process quality will be elaborated by 2014. The PG was also involved in the completion of the relevant chapters of the VDI Guideline VDI 4603 «Operation and process monitoring in power generation and utilities».

Report was given on the positive experience made with a continuously working CO₂ measuring system which meets the current monitoring guidelines and is being accepted by responsible authorities. In comparison to common calculations, comprising mass flows and laboratory analyses, the system immediately provides measured data. The pilot project was accompanied by comprehensive test measurements which were mainly made to verify and confirm the system’s accuracy and reliability.

Assessment of new measurement procedures and equipment, particularly with a view on its applicability in acceptance and control test, is still on the panel’s agenda.

Recently the panel members discussed the applicability of Coriolis flow meters for measuring feedwater flow. Due to limited flow rate, they can only be used in smaller plants.

Wireless transmission of measured data was also on the agenda. It seems that this technique is rather suited for stationary monitoring of branched systems than for acceptance measurements.

The following project groups (PG) are elaborating or revising VGB-Standards:

Project Group «Monitoring of Process Quality»

Special information systems are needed to optimise current operation in order to achieve secure assessment of the power plant process. The methods of these systems are similar to the assessment systems.

Project Group «R130/131»

Two project groups are revising the VGB Guideline R130 «Acceptance Measurements and Operational Monitoring of Water-cooled Surface Condensers» and R131 «Acceptance Test Measurements and Operation Monitoring of Air-Cooled Condensers under Vacuum». The revisions are to be completed by the beginning of 2014.

Project Group «Uncertainties of Measurements»

The measured data provided by plant instrumentation are more or less correct depending on the quality of the measurement technology applied. These mistakes are passed on to subsequent systems thus falsifying parameters that are derived. Theoretical optimisation potentials cannot be fully exploited. The Project Group «Uncertainties of Measurements» elaborated a Standard supporting determination of uncertainties of on-line measurement. The Standard is to be completed mid-2013 at the last group’s meeting.

Revision of the KKS Guideline

The application of RDS-PP (Reference Designation System for Power Plants) in hydro power plants requires the application explanation B 116 D1 which is being drafted by the panel which also comprises hydro power experts. The work is nearly done and is to be finished in 2013.

Revision of the application standard for wind power plants was continued, i.e. it was completed and the draft was presented for public consultation. An editorial team (ET) was set up in order to involve wind business in the current consultation process. The team is made of experts from the wind business and designation systematic. All loose ends are to be settled in one process. The optimum compromises are to be made for the version to be published. The activities are to be terminated in 2013.

The working panel set up an internal structure for answering queries and as first level support. This structure is also helpful when determining the demand for relevant, short-term adjustment of VGB-Standards.

Working Panel «Reference Designation and Plant Documentation»

Andreas Böser

The application of RDS-PP (Reference Designation System for Power Plants) in hydro power plants requires the application explanation B 116 D1 which is being drafted by the panel which also comprises hydro power experts. The work is nearly done and is to be finished in 2013.

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Revision of the KKS Guideline

An application was made to update the KKS Guideline VGB B105 (maybe B 106 is also affected). It is considered generally necessary to update these documents because KKS is still used when extending/renewing existing power plants.

Documentation and technical plant data

The documentation Guideline R171 is to be extended by issues related to renewables. It is planned to integrate wind business. Revision is to result in a uniform data base of plant documentation.

Experience made with conventional power plant is to be adopted. Currently neither operators nor manufacturers do understand clearly which documents are needed for the operation and maintenance of wind power plants. The plant owner, even if he is not the operator, is responsible for HES (health, safety and environment). Thus, the owner needs relevant plant documentation (operation and maintenance) in order to meet these obligations.
Renewables and Distributed Generation

Targets of the European Union

Ulrich Langnickel and Sebastian Zimmerling

The EU countries set themselves ambitious targets for the extension of renewable sources of energy (renewables). With the EU Directive 2009/28/EC, a guideline for renewables was laid down with binding national targets in order to increase the share of renewables in final energy consumption to 20% and in traffic to 10% by 2020. Accordingly, about one third of the total electricity generated in the EU is probably based on renewables. For wind power e.g. the forecast increase will amount to some 495 billion kWh in 2020 compared to 200 billion kWh in 2012. This is the result of the national action plans of the EU member states for the extension of renewables (Figure 1).

The developments in the individual member states regarding support and utilisation of renewables are assessed by the progress reports to be elaborated every two years. If the specific targets are not being met, measures are to be developed or implemented in order to interfere and control the process. On March 27, 2013, the EU Commission presented for the first time a progress report that referred to the official Eurostat data of the years 2009 and 2010. Assessment of the report showed that in 2010 the total share of renewables in final energy consumption amounted to 12.7%, i.e. already in 2010, in 20 member states and in the entire EU the share of renewables was above the targets laid down in the national action plans for the years 2011 and 2012. The EU-wide target for that period was to amount to an average share of 10.7%.

The data for 2010 are mainly due to the positive developments in the heating and cooling sector. 15 member states did not meet their targets in the area of electricity generation. Non-observance of national targets is most obvious in the area of wind power. According to member states’ plans, offshore generation capacities are to amount to 140 billion kWh (44GW) in 2020. However, following a study carried out on behalf of the EU Commission, the share of offshore generation could only be around 43 billion kWh due to lacking national ambitions. According to estimations, the amount of onshore generation

Fig. 1: Share of renewables in EU-27.
will possibly be only around 210 billion kWh instead of 354 billion kWh (169 GW) as planned originally. Following these trends, only 253 billion kWh will be achieved which would be 50% of the originally envisaged 500 billion kWh to be installed by 2020. The strong increase in photovoltaics in recent years put the number of plant installations above the expectations of national action plans. However, it is expected that also in this field new-build projects will slow in the forthcoming years due to decreasing subsidies and the sluggish market situation.

If the administrative and infrastructure problems will not be solved, it is unlikely that the targeted utilisation of renewables will be achieved by 2020. Besides, the effects of the economic crisis and permanently changing support schemes have also to be taken into account. Thus, a lot of member states will have to take measures to meet their targets.

Sustainable utilisation of biomass is to amount to 232 billion kWh by 2020. However, this share will also be met only when reducing administrative and infrastructural burdens. According to the above-mentioned progress report of the EU Commission, only 83% of the target will be achieved. The introduction of binding sustainability criteria for solid and gaseous biomass is currently being developed on European level. Existing European certification systems are to be fully integrated in forest management, in order not to put extra administrative burden on producers and consumers. It is the main target to establish uniform sustainability criteria for imported biomass and to harmonise such criteria within the EU. Market and trade barriers are to be demolished and a stable market environment has to be guaranteed for investors. The core issue are 60% less CO2 emissions in comparison to fossil sources of energy, a harmonised method of CO2 balancing and prohibition of biomass from areas with high bio diversity and high carbon stock. These recommendations are also part of the European Commission’s report (COM(2010)11) on sustainability requirements for the utilisation of solid and gaseous biomass in electricity generation, heating and cooling.

Technical Committee «Hydro Power Plants»

Jürgen Lenz

After initiation of a new energy policy in Germany in 2011, the total share of renewables applied in electricity generation is to be increased to 80% over the next 40 years. Mainly volatile feed-in based on wind and solar power will be supported. These plants, however, need thermal power plants as «backup» for maintaining supply security due to the fluctuating availability of renewable sources.

Utilisation of the hydro power potential as renewable source of energy is limited in Central Europe, however, noteworthy increases could be made in the Alpine and Scandinavian countries. Existing capacities are to be kept in any case and to be extended by different retrofit measures.

Hydro power is playing a special and inevitable role as regards the urgently needed provision of large-scale storage capacity for the fluctuating generation of renewables-based electricity and related stabilisation of the grid. In this connection, hydro power is partly not applied as direct renewable source of energy (in case of utilisation of water reservoirs without natural inflow), but it is an ideal «partner» of the other renewable sources due to its flexible balancing possibilities. Occasionally it is talked about the high German electricity exports despite eight shut down nuclear power units. However, it has to be born in mind that surplus electricity within the transmission grid that cannot be used nationally is offered at economically unfavourable conditions to interested consumers. In the long term this is not tolerable for any economy, i.e. intermediate buffers and proper marketing according to demand is inevitable.

The generally mature technology of hydro power plants and of pumped storage plants in particular guarantees high availabilities at high operational efficiency also in the part load range. Economic planning and operation of hydro power plants are undeniable as long as no unjustified environmental requirements have to be met and other technologies prevent hydro power through subsidies or any other taxes and levies distorting the market. In fair competition, hydro power would not face any difficulties. A fair political framework would have to be set up. Jointly with EURELECTRIC WG Hydro, the VGB Committees «Hydro Power» and «Hydro Power Plants» are taking endeavours to find open ears on the European political scene.

Drafting of a «guide on the design, computation and execution of fatigue-stressed components» as VGB-Standard was among the major tasks of the VGB Technical Committee «Hydro Power Plants». Practical reference for acting is to be made as regards important partial aspects like material, component and stress lists. Based on the comparison of different, common evidence approaches it had turned out that only in case of uniformly agreed procedures it can be assured that all parties can assess e.g. lifetime independently of varying assumptions. In this sense, the guide is to provide uniform, principles accepted by operators, planners/manufacturers, and consulting engineers.

Publication of officially acknowledged rules for fish passes is (still) delayed (Austrian guideline, German DWA instruction sheet) which made it impossible to describe binding principles. However, the Austrian association of the energy industry (OEI) initiated an expert opinion for assessing fish ladders in Austria. The requirements were partly less stringent than the draft guide, but there is no doubt that the measures taken are sufficient and work. Upon further consideration of the issue, conclusions could be important. A current report reflecting on VGB’s estimation is now to be made available to the hydro power members as (internal) support for arguments.

Future workshops of the (German) «forum fish protection» («forum-fischschutz») taking place with German, Austrian, and Swiss hydro power operators are (continued) to be observed actively. The VGB technical committee is to be informed periodically and asked for comments.

Treatment of the issue of «public safety» has been concentrated on an «emergency and crisis management». Individual findings, descriptions, and practical management programmes as well as training options were discussed within the scope of a workshop. It was agreed to continue the exchange of experience.

Concerning the issue of «functional safety», the responsibilities/tasks of «manufacturers» and «customers» were drafted which exist within the scope of CE classification of machines/components in hydro power plants. Apart from new-build projects, it was also ascertained that renewals and retrofits of existing plants are also relevant for risk assessment and obligation to designation. Suitable processes are to be discussed and described on the basis of practical «impulse documents».
Comprehensive reports were given on the company-internal dealing with HSE elements (health/safety/environment), long-term experience and (newly) introduced improvements (general requirements). Generally, the avoidance of accidents was of top priority. Important conclusions were also drawn from «near misses». Continuous exchange of experience is to support ongoing optimisation of safety programmes and is to reduce the number of accidents.

The «Bavarian definition» for an «ecological hydro power plant» describing it as being equipped with an «ecological turbine» was considered sceptically. Further information, and if needed adequate reactions by hydro power plant operators, were discussed briefly; the issue is to be observed in the future.

At numerous sites, also in Central Europe, additional extension potential of hydro power was explored and started up. The Reißeck II pumped storage plant in Carinthia/AT (Figure 2) is currently being extended. Within the scope of optimisation of the existing power plant systems Malta and Reißeck/Kreuzeck new pump turbine sets (2 x 215 MW) are going to be installed in a cavern. The project is being jointly executed by VHP, KELAG, and Energie AG. Full operation is scheduled to start by the end of 2014.

European Technical Committee «Use of Renewables and Distributed Generation»

Ulrich Langnickel

The European Technical Committee «Use of Renewables and Distributed Generation» is assessing the technical development and possible applications of renewable sources and distributed generation. The requirements from operators’ viewpoint are underlined in particular. Since utilisation of renewable sources of energy is highly depending on EU energy legislation, a representative of EURELECTRIC is reporting promptly about the general conditions set in Brussels.

The international committee is co-ordinating the activities of the four European Working Groups «Wind Energy», «Biomass», «Biogas», and «Distributed Generation» and supervises different national and international research projects, the results of which are presented and discussed in the groups. Besides, the committee is publishing position papers on the efficient use of renewables and organises technical conferences dealing with the above issues.

Fig. 2: Building site pumped-storage hydro power plant Reißeck II of VHP

The significance and tasks of the committee are increasing due of the intense extension of renewables. In the future, system integration of renewables and development/demonstration of storage technologies will play a major role. Besides, new innovative approaches like e.g. utilisation of wave energy will be dealt with in a new panel to be set up. The European Working Group (EWG) «Biomass Ash» – established in 2013 – analyses the options for ash utilisation accruing in 100 % biomass-fired power plants.

European Working Group «Wind Energy»

The use of wind energy has to be extended urgently by 2020 in order to meet the requirements of the European Union within the scope of the EU «Energy and Climate Change Package». However, extensions have to be selected deliberately at favourable «wind sites» and by taking into account power-plant specific criteria. By the end of 2012, about 22,297 wind power plants were in operation with an output of 31,308 MW. At that time, the installed capacity in Europe amounted to 109,581 MW (compare Table 1) and worldwide to 282,482 MW. VGB member companies are operating wind power plants with a total capacity of more than 22,000 MW.

The annual conference «Maintenance of Wind Power Plants» took place in Hamburg on March 13 and 14, 2013. The conference was supported by the EWG «Wind Energy» and RWE Innogy GmbH.

Fig. 3: Maintenance for wind power plants.
One important target of the Working Group «Wind Energy» is increasing the availability of wind power plants. In this connection, it is urgently required to adjust operation of wind power plants to the proven methods of conventional power plant operation. Consequent development of plant technology is of utmost importance to increase technical availability of wind power plants. The parameters weight, costs, and efficiency are also playing a part as well as availability. The special requirements for wind power plants derived will be integrated in the VGB-Standard R-171 « Provision of Technical Documentation (Technical Plant Data, Documents) for Power Plants». Among others, this standard deals with the documents needed for plant management and maintenance.

The extension of explanations for applying the RDS-PP designation system for wind power plants – published first in 2007 – is of particular importance. The revised document will be published end of 2013. It comes up to operators’ expectations, i.e. components of different manufacturers are designated uniformly. This systematic includes among others systems, plants, technical devices signals, connections, and documents and applies to mechanical, electrical, and civil engineering as well as I&C. The updated VGB-Standard also includes particular features of offshore wind parks.

Since 1970, VGB has been assessing and evaluating thermal power plants in terms of their engineering and economic efficiency with the aid of KISSY, a power plant information systems developed by VGB. KISSY enables benchmarking with other plants, which is of particular importance to the liberalised electricity market. VGB is aiming at the integration of operational parameters of on- and offshore wind parks into KISSY. This would allow comparison of availability data of plants and components made by different manufacturers. Conclusions could be drawn for optimised design of future plants and knowledge can be gathered, as usual in power plant engineering, to determine e.g. life-cycle costs of individual components and necessary optimisations could be made. However, availability and unavailability of wind power plants have to be defined clearly. The different definitions from the viewpoint of operators will be collected by a joint project group with representatives of the EWGs «Wind Energy» and «Performance Indicators».

Another VGB-Standard «Maintenance of Onshore Wind Power Plants for the Protection of Operational and Environmental Influences» will mainly deal with maintaining foundations and towers. After having analysed possible operational and environmental impacts, corresponding maintenance and retrofit measures will be described. The internationally applicable VGB-Standard should be published by mid-2014 at the latest.

The wind parks alpha ventus in the North Sea and Baltic 1 in the Baltic Sea continue to deliver valuable findings and experience for offshore wind energy (Figure 4). Alpha ventus, comprising 12 plants of the 5 MW range, is the first wind farm that was erected in the German part of the North Sea. In 2012, the number of full load hours amounted to 4,463 h and the electricity generation was 15.3% higher as expected. According to operators, maintenance works per wind power plant amount to up to 450 maintenance hours/a. This is an enormous cost factor that needs to be reduced. The works include among others corrosion protection, checking of safety devices, replacement of broken components, and refilling of operating media like lubricants or coolants.

The foundations are regularly checked by underwater diving inspectors. According to the requirements by the Federal Agency for Marine Shipping and Hydrography (BSH), foundations of wind power plants have to be checked every four years and platforms of transformers every year. Therefore it is necessary to extend the period inspections in order to reduce maintenance costs. Related investigations and accompanying research is needed.

EnBW, operator of the wind park Baltic 1, examined different maintenance concepts which were presented on the VGB conference «Maintenance of Wind Power

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Tab. 1: Installed wind capacity in Europe in 2010, 2011 and 2012.
Plants». Special focus was on the analyses of the expenditures for personnel transfer by vessel or helicopter to the wind power plant sites. Due to the short distance to the shore, it is much more cost effective to employ vessels.

Status reports about the conditions of wind energy plants are continuously recorded and stored with the aid of SCADA systems (system control and data acquisition). It is e.g. possible to remotely control wind power plants via a standard internet browser and to retrieve different plant conditions and reports. However, manufacturers of wind power plants use their own systems which are often not compatible. Besides, different, manufacturer-independent systems are offered on the market. The signals must be harmonised because plant management operators often have to process data of different plant types.

**European Working Group «Safety and Health at Work at Offshore Wind Power Plants»**

Karl-Heinz Puch

A working group of planners, constructors, and operators of offshore wind parks elaborated key issues for an emergency management concept – including the entire North and Baltic Sea – that is currently still missing.

Employers have to observe their industrial protection requirements according to § 10 para. 1 ArbSchG (German Occupational Safety and Health Act) and § 24 para. 1 of the BGV A1 (Employers’ Liability Insurance). The marginal conditions for emergency measures aggravate because most of the wind farms are planned off the shore in the Exclusive Economic Zone (EEC) of the North and Baltic Sea. Neither known and secured, nor efficient structures can be employed in case of emergency. It is accepted by operators as well as authorities that helicopters need to be 24 hours available and that existing capacities need to be extended and bundled. This is also in the focus of the round table «offshore» with VGB participation.

The difficulties disclosed by planning engineers and operators of offshore wind farms within the exchange of experience resulted in the development of a catalogue of requirements for cross-project emergency control stations. This was also published as consensus of the energy industry to lay down the future maritime emergency rescue of offshore personnel. The offshore industry committed itself to elaborate proactively the requirements to be met by a logical and efficient emergency rescue system before the issue has been allocated for good by politics. However, this commitment is not to anticipate determination of the services for the public and operators’ duties but is to be considered as support. The public stakeholders are to be involved in the development of minimum requirements within the scope of the «maritime safety partnerships» in order to make optimum use of current emergency competencies and to boost further development.

The VGB committees will also provide support on the issues of «industrial health precaution» and «safety trainings». Regular workshops are being organised.

The group also collaborates in different bodies of the Employers’ Liability Insurance on the topic of wind energy.

**European Working Group «Biomass»**

Sebastian Zimmerling

Evaluation of the national action plans for renewables utilisation shows that biomass has to play an important part in order to meet the European 2020 targets. Currently VGB member companies are operating biomass plants with a total electrical capacity of more than 4,400 MW.

The EWG «Biomass» – jointly with other relevant VGB committees and panels – deals with technical issues on the operation of biomass-fired plants. The topics cover the whole range of the power plant process from fuel production, provision, and storage up to flue gas cleaning. The topics range from mere biomass-fired plants (Figure 5) to fossil-fired plants with biomass co-firing. Co-firing is a highly efficient option for biomass utilisation. Biomass co-firing is particularly popular in Denmark, Belgium, Poland, Italy, and the Netherlands where biomass co-firing is also supported by different government subsidy schemes. The group also deals with switching from 100 % fossil firing to 100 % biomass combustion.

The EWG «Biomass Ash» was set up to deal in more depth with the issue of ash utilisation from biomass mono combustion. Supported by the EWG «Biomass» and Vattenfall GmbH VGB organises a biomass conference entitled «Challenges of Biomass Combustion» in Berlin in November 2013. The conference is scheduled for 1.5 days and some 100 participants are being expected. The conference will be held in the English language. The conference papers will focus on experience made in large-scale plants with 100 % biomass combustion. After a brief introduction to the conference and the activities of VGB in the field of biomass utilisation, reports are to be given on the challenges when switching fossil-fired plants to 100 % biomass combustion and the new construction of biomass-fired power plants. High-temperature chlorine-induced corrosion and resulting damage as well as operating experience with countermeasures like dosing of additives or hard coal fly ash will also be on the agenda.

Fire and explosion protection when storing different types of biomass will also be on the agenda. The VGB-Standard «Fire and Explosion Protection», published by then, will be presented. The particularities of fire fighting in silos and practical examples of fire and explosion protection will be outlined. To complete the picture an overview over the usage possibilities of biomass ash will be given and the renewable heating and cooling (RHC) platform will be introduced.

![Fig. 4: Offshore transformer platform of Baltic 1.](image-url)
Supported by the EWG «Biomass», VGB participated in the international research project «Demonstration of Large-scale Biomass Co-firing and Supply Chain Integration – DEBCO» that was carried out within the scope of the 7th Research Programme of the European Commission. All process steps from fuel provision up to flue gas cleaning and ash utilisation were analysed. A total of 17 partners from eight European countries took part in the project that was coordinated by Enel Produzione SpA. VGB had to assess what had been implemented and had to contribute to the publication of research results. The results were assessed in close cooperation between the three VGB Competence Centres «Power Plant Technologies», «Renewables, Distributed Generation», and «Environmental Technology, Chemistry, Safety and Health». The project results were communicated at the final conference that took place in Brussels on December 10 and 11, 2012. The conference was attended by 85 participants from 14 countries. Besides, a «guidebook» – showing the major results and observations – was published on the VGB homepage and on the project homepage (www.debco.eu). Some of the findings were also published in the June edition of VGB PowerTech that was focusing on biomass utilisation.

A collection of literature on the topic of biomass monocombustion and co-firing will be put on the VGB homepage (closed user group) in order to continue the good cooperation among the VGB competence centres during the project phase and to intensify the exchange of information between the panels and committees. The Competence Centre «Renewables, Distributed Generation» will update the collection. Selection of literature and access to it is up to the members of the panels and committees participating.

Operators of biomass plants are highly interested in the application of refined biomass which can be produced through torrefaction, steam treatment or hydrothermal carbonisation. Therefore, VGB published jointly with the EWG «Biomass» in May 2013 a white paper about the application of refined or torrefied pellets in power plants. The data was obtained from comprehensive literature survey as well as the comparison of several practical tests made by VGB members. Firstly the paper provides an overview about general technical conditions and process parameters of the three refinery options. Advantages and disadvantages from using the refined products in power plants are also outlined, i.e. comprehensive information about different refining techniques and the resulting fuels is provided. However, neither quality nor quantity of the refined biomass currently available on the market are sufficient to establish the material as common fuel.

Additional research and development are needed to be able to produce a product of uniform quality and in sufficient quantities as alternative fuel to be used in power plants.

**European Working Group «Biomass Ash»**

Hans-Joachim Feuerborn

In Europe, biomass has been utilised for many years in power plants of different size. The interest in biomass is increasing as it is more and more being utilised as primary or secondary fuel in power and heat generation. In some member states, a lot of small plants are operated with biomass firing. Political support schemes boost construction of larger biomass-fired power plants and existing fossil-fired plants are switched from coal to biomass. Therefore, the amounts of ashes are also rising continuously.

In numerous research projects it has been proven that biomass co-combustion is hardly influencing the quality of fly ash. Therefore, upon revision of the European Directive EN 450-1 for fly ash in concrete, the share of co-combustion was increased to 40 % (50 % if fresh wood is co-combusted). However, the high shares of co-combustion can only be achieved with special biomasses. Co-combustion of waste wood is excluded.

Biomass is e.g. defined in the European Directive EN 14588 «Solid Bio Fuels». It contains definitions and descriptions for bio fuels. Besides, quality standards for wood pellets were developed. Naturally, biomasses are quite different because various definitions describe numerous types of biomasses and biomass is often simply a synonym for a lot of different types of biomass if not referred to specific types.

Some European countries have already made experience with biomass ashes, however, these experiences are differing due to varying tax and legal systems. When discussing fuels and combustion technology, the characteristics of the resulting ashes are often not taken into account. In some countries these ashes are used regionally as fertilizer. In Denmark e.g. biomass ashes are specially treated to be used in cement. The share of co-combustion was increased to 40 % (50 % if fresh wood is co-combusted). However, the high shares of co-combustion can only be achieved with special biomasses. Co-combustion of waste wood is excluded.

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The need for dealing with biomass ashes was firstly discussed by ECOBA (European Coal Combustion Products Association e.V.) in 2011. A group of interested parties followed the invitation by ECOBA, EURELECTRIC, and VGB to gather for a 1st meeting on December 15, 2011. The group agreed on comparing the different initial situations in member states and to collect experience on production, characteristics, and utilisation. The work is continued by the VGB European Working Group «Biomass Ash». The group will summarise the experience in a status report on biomasses in Europe. The legal situation as well as the characteristics of different biomass ashes will be assessed in order to extend possible ways of utilisation and to identify new options.

**European Working Group «Biogas»**

**Sebastian Zimmerling**

Biogas can be used in small combined cycle power plants for electricity and heat generation. These plants currently achieve efficiencies of up to 45 % based on methane as primary source of energy. However, economically-efficient biogas plants (Figure 6) need to feed heat into the local and district heating grid or any other alternative in addition to electricity generation. In Germany, at least 60 % of waste heat will have to be utilised according to the 2012 amendments of the German Act on Renewables (EEG).

Biogas can also be treated and fed into the natural gas grid. It can be stored intermediatively and then used deliberately at locations having a heat sink. Upgrading of biogas and feeding into the existing natural gas grid is the decisive advantage of this technology with a view to integrating renewables into existing supply structures and utilisation of storage potentials. According to the 2013 Biogas Monitoring Report of the Federal Network Agency (BNetzA), Germany has achieved only 6.88 % of the 6 billion m³ biomethane to be fed in annually by 2020. Prognoses still forecast moderate growth rates.

In addition to the other biogas upgrading techniques, the group intensively discussed a new membrane system – developed jointly by EVONIK Fibres GmbH with EnviTec Biogas AG – for preparing biogas. The membrane material was particularly developed for a high throughput with simultaneous selectivity and high resistance against organic acids and hydrogen sulphide which have caused serious problems in common membrane procedures. The entire efficiency of the membrane system is comparable to common procedures of pressure swing adsorption or pressurised water scrubbing, however, the methane slip amounts to 0.5 % only. It mainly depends on the selection of the compressor which consumes about 40 % of the total investment.

Power-to-gas applications are another important aspect of utilising the storage potential of natural gas grids. Depending on grid operators’ limit values concerning gas composition, surplus electricity can either be converted in hydrogen by an electrolysis process or into methane. The latter process also utilised CO₂ that has been separated upon biogas upgrading. In addition to positive control energy of biogas upgrading, power-to-gas solutions also offer the possibility to provide negative control energy and to store it intermediate-ly. A pilot project of E.ON Gas Storage GmbH in Falkenhausen was presented to the EWG «Biogas» and the concept was discussed. The pilot plant with an output of 2 MWel or a hydrogen production of 360 m³/h is to be commissioned by the end of 2013.

**European Working Group «Distributed Generation»**

**Ulrich Langnickel**

The European Working Group «Distributed Generation» assesses the technical as well as economical development of small combined heat and power plants. Apart from conventional engine-driven systems, fuel cells, micro gas turbines, and Stirling engines are also considered. Possible areas of utilisation are being explored for these plants which represent an important technical innovation since they enable the use of CHP technology on a very small scale. This applies particularly to local heat supply systems and the commercial and industrial sector.
Emissions/Immissions

Volker Hamacher

The Directive 2012/18/EU of the European Parliament and of the Council of July 4, 2012, on the control of major-accident hazards involving dangerous substances (Seveso III Directive), was published in the Official Journal of the European Union on July 24, 2012. Member states can exclude substances listed in annex RL by giving appropriate and comprehensive reasons. Existing inspection rules will become much more stringent, public participation will be increased. Now inspections and public information also have to be provided for plants which are only subject to basic duty which means an extra burden to these plants. Article 30 could be beneficial when discussing with authorities about the classification of heavy fuel oil. According to article 30, heavy fuel oil belongs to the category «petroleum products» of the Seveso-II-Directive, and in comparison to other regulations of the new Directive [national transposition by May 31, 2015], this article has to be transposed by February 14, 2014. Applications concerning the use of article 30 ahead of schedule have already been accepted in view of the utilisation of HS.

The VGB Research Project «Diffusive Emissions» will be integrated as examples into the VDI Guideline 4285-3 «Determination of diffusive emissions by measurement – Quantification of diffusive particulate matter from industrial plants and agricultural sources». First tests on the PEMS research project (see Annual Report 2010/2011) show that the model needs to be improved. Problems occurred among others due to the differing use of decimal point and comma in the USA and Germany when separating decimal places. The applicability of DIN EN 15267-3 (testing of suitability) and DIN EN 14181 for PEMS systems is carried out section-wise and had not been completed yet. An intermediate report was published on the research project on manual Hg measurement at low concentrations. The results of the processes are published in the Official Journal of the European Union on May 31, 2015.

The tasks and results of the Working Panels «Health & Safety at Offshore Wind Parks» and «Biomass Ash» are described in Chapter 2 «Renewables and Distributed Generation».

Noise Control

Volker Hamacher

The 6th VGB Workshop «Noise Control» took place on October 30, 2012. The workshop papers dealt with the planning and construction of plants and improvements of noise control upon the construction and operation of individual power plant components. High-frequency lines, offshore plants (Fig. 1) and deep frequency noise were also on the agenda. 60 participants, who highly welcomed the workshop and the papers, took part.

As regards the exchange of experience, a report was given on a licensing procedure for the erection of a pump storage plant. It was discussed with the authority whether the noise emissions of construction equipment generally have to be assessed according to «AV (German administrative ordinance) Construction Noise», i.e. also in such cases when a construction machine (e.g. crusher) has to be licensed according to the 4th BlmSchV (ordinance to the federal immission control act). This was confirmed after legal examination. The background is that
the TA Noise does not make a distinction between equipment that has to be licensed and equipment that does not need to be licensed at construction sites (No. 1, para. 2). The AVV «Construction Noise» has to be interpreted in such a way that all equipment used at a site is construction equipment and thus part of the construction site. The leading decisions available (VGH Mannheim of February 8, 2007 and VGH München of May 4, 2011) explain that also when taking into account that a construction site will last for several years, TA Noise will not be applicable. A report was also given on the planned construction of a new power plant. It was recommended to approach the neighborhood early and frankly. One operator e.g. installed a webcam, showing hourly images of the construction progress. The authority accepted the design value of IRW minus 10 dB(A) for noise planning. It was pointed out that in contrast to the existing version of DIN 45680 «Measurement and assessment of low-frequency noise immisions» the new version no longer is to contain individual sounds when assessing impulse sounds. The frequency range to be considered is to be extended to 8 to 125 Hz, i.e. the 100-Hz component of transformers is to be assessed accordingly.

The draft of the new ground water ordinance contains so very stringent regulations for the power business that BDE filed a comment – harmonised with the operators – on January 28, 2013. According to that draft, e.g. anthropogenic background load would not be taken into consideration. The threshold values for lead, cadmium, and mercury were reduced by 50% in comparison to the former draft thus numerous ground waters would not be classified as «good». The level of the threshold values was explained with the EU Environmental Quality Standards (EQS) for surface water. The limit values of the EG Directive 98/83/EG governing the quality of water for human consumption permits mercury values that are 20 times above the values of the general ordinance (1 µg/l instead of 0.05 µg/l).

The committee members discussed the values of heavy metals in surface waters. Tables of the largest German surface waters were presented and it was shown that the values for mercury, cadmium, lead, and nickel are often below the values required by the environmental quality standards. Receiving waters do not need to be checked.

The committee members discussed the waste-water side mercury emissions exemplified by the site in the area of the river Lippe. The biota threshold limits according to EQS were exceeded to the mercury emissions. Therefore, a research project was initiated to investigate the size and distribution of mercury also from diffusive sources. The District Council of Arnsberg suggested modification of operations as immediate measure. The authorities carry

Operational Water Management
Dittmar Rutschow

A new draft on the AwSV (ordinance on plants handling water-endangering substances) was published on August 31, 2012. According to that draft, the requirements for the power industry will be more stringent due to the hazard categories, e.g. boards that were installed at a depth of 200 m have to be removed upon disassembly in order to recreate the original state. The same applies to well construction i.e. the old well needs to be backfilled or disassembled.

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Fig. 1: Hg(0)-tracer gas generating unit of VDZ.

Fig. 2: Bubble curtain for noise abatement during pile driving works.
out measurements at that site six to seven times per year in comparison to the company which carries out some 25 measurements per year. If the authority ascertains that the limiting value was exceeded, no damages can be claimed.

The former emission values of municipal sewage plants e.g. for mercury, cadmium, lead, and zinc were much too high because the so-called section criterion had not been taken into account. If, e.g. due to instrumental analytics only values up to 0.2 mg/l could be achieved, this value was multiplied with the total amount of flowing water. This resulted in faulty too high emission values for municipal sewage plants. Now it has been assumed that the mercury value is around 3 ng/l, which could not be confirmed by any analysis.

Power Plant By-products

Hans-Joachim Feuerborn and Thomas Eck

The Technical Committee «Power Plant By-products» is to ensure utilisation of power plant by-products from coal combustion in pulverised fuel and fluidised bed combustion furnaces. Mineral power plant by-products cover combustion products like fly ash, boiler ash, and slag tap ash as well as products from flue gas desulphurisation (FGD) like FGD gypsum, and SAP product. For decades, by-products have been used as construction materials. The application of by-products (definition and utilisation) is governed by European and national regulations. Therefore, the committee intensively observes modifications of European and German standards. During the reporting period the committee dealt with:

**EN 450-1 Fly ash for concrete**

Revision of the Directive is completed. It was published dated August 2012 and will be transposed in Germany by May 1, 2014 at the latest. Revision focused on co-combustion of larger shares of secondary fuels. Besides, requirements on chemical and physical parameters were changed. All modifications and their reasons are summarised in a background report [CEN/TR 166443]. Revision of EN 450-2 on conformity control has been postponed.

**EN 206-1 concrete**

Revision of the European Concrete Directive EN 206-1 is still under way. The application rules for fly ash in concrete are of particular importance. In addition to the k-value concept, additional principles of performance concepts were added. The concepts are described in detail in a report that is going to be published as CEN report.

**EN 13282 hydraulic road binders**

The guidelines for hydraulic road binders, part 1 for rapid hardening hydraulic road binders and part 3 on conformity criteria were revised and will soon be published as harmonised guidelines.

Part 2 for normal hardening road binders had to be revised again, because requirements concerning a higher loss on ignitions were not accepted. Loss on ignition is now restricted to a maximum of 9 M.-%.

**DAfStb Technical rule alkali**

When revising the alkali technical rule, the German committee for reinforced concrete applied for the «extension of precautionary measures by the utilisation of cement fly ash blends with 30 % fly ash». The application is based on results of latest research projects and experience made abroad.

**DVGW certification report drinking water compatibility**

The certification report drinking water compatibility according to DVGW Technical Rule W 347 «Hygiene requirements for cement-bound materials intended for use in drinking water supply systems» and W 270 «Microbial enhancement on materials to come into contact with drinking water» for the application of fly ash in concrete to be used in components in touch with drinking water have been renewed.

**Ordinance on construction products/ declaration of performance**

As of July 1, 2013, manufacturers of power plant by-products that were made and put on the market in line with the harmonised European guideline for construction materials, have to draw up a «declaration of performance» instead of the «conformity declaration» that had been applicable according to the former construction product guideline. A project group drafted a pattern for the declaration of performance that was made available in May 2013.

**Quality criteria of FGD gypsum**

The quality criteria of FGD gypsum were revised. The criteria are drafted by EUROGYPSUM, VGB PowerTech, and ECOba and can be downloaded from the EURGYPSUM internet page.

**FGD gypsum: comparative investigations on the determination of the degree of whiteness**

A project group carried out comparative investigations on the determination of the degree of whiteness of FGD gypsum. Depending on the investigation equipment, partly large deviations were detected. However, in total the results correlate. The results are summarised for a recommendation for acting.

The committee also initiates and supervises research projects at different universities. Existing fields of application are to be secured and new areas of application are to be extended. During the reporting period, research projects were successfully terminated on «Avoidance of Alkali Silica Reaction by Fly Ash due to External Alkali Supply» (VGB P 323) and on «Development of an Alkali-Silica Reaction (ASR) Performance Test Method for Fly Ash Con-

![Fig. 3: Storage of concrete cubes (VGB P323, Courtesy TU München).](image-url)
crete – Variation of Pre-storage Time and Determination of Criteria (VGB P 329)

Issues on the duration of fly ash concrete and its testing can be settled.

The research projects were supported by VGB funds, levies of interested member companies, and public funds.

By-products from Thermal Waste Utilisation

Karl-Heinz Puch

The Working Panel «By-products from Waste Incineration» is to secure and advance existing utilisation options of by-products from thermal waste incineration. Special attention is paid to the development of alternative preparation techniques.

By-products from thermal waste utilisation are directly affected by the planned «Ordinance on the Determination for the Discharge of Substances into Ground Water, the Utilisation of Substitute Building Materials and the Utilisation of Soil and Material Similar to Soil (comprises new Ordinance on Replacement Materials, article 2)». Therefore, the development is observed with utmost attention. Particular emphasis is put on the established use of ashes of domestic waste incineration as sub-soil of pavements. In February 2013, a hearing took place on the second draft paper of the ordinance. VGB and BDEW gave a joint statement.

The requirements for the hazard characteristics H 14 (eco toxicity) in connection with the classification of wastes into the category «hazardous wastes» and/or «wastes» according to the ordinance on waste catalogue have not been defined yet, neither on national- nor on European level. UBA made a proposal in the European-wide discussion for testing the hazard characteristics H14 by ecotoxic tests. Test procedures suggested by UBA on the verification of ecotoxicity of domestic waste ashes were applied and assessment criteria were defined within the scope of a joint VGB/ITAD research project. The results show that this method does not produce practical results. Procedures suggested in an EU consultation paper orienting on the law on chemicals are currently being discussed. A decision is to be made in the near future.

The results of a research project on the «Recycling potential of waste incineration residues» (Prof Dr-Ing Deike) were presented. The project was aiming at the recycling of utilisable metallic constituents of ashes of domestic waste incineration and possibilities to separate these resources. Current separation of utilisable metals is good (> 90 %); further options need to be researched. Optimised copper separation e.g. would be separated only if the material was needed or could be utilised. However, using remaining mineral fractions as building material has top priority.

Chemistry

Andreas Wecker

The VGB Technical Committee «Chemistry» coordinates the issues to be treated by the VGB Working Panels «Analytics», «Chemistry of Water Treatment», «Chemistry of Flue Gas Cleaning Plants», and «LWR Chemistry» and defines the general conditions and focus of the annual conference «Chemistry in Power Plants». In addition, the committee is dealing with chemical issues of the water/steam cycle and chemical influence on corrosion processes in power plants. The project groups set up by the committee completed the two VGB-Standards, VGB-S-010-T-00-2011 «Feedwater, Boiler Water - and Steam Quality for Power Plants/Industrial Power Plants» and VGB-S-006-00-2012 «Sampling and Physico-Chemical Monitoring of Water and Steam Cycles» in the German as well as English language and presented it on the chemistry conferences 2011 and 2012.

Chemistry of Water Treatment

Dittmar Rutschow

Revision of the Instruction Sheet VGB-M 412 L «Condensate Polishing»

Revision of the Instruction Sheet «Condensate Polishing» M 412 L is completed. The revised sheet – now published as new VGB-Standard VGB-S-412-00-2012-09-DE – can be obtained from VGB PowerTech Service GmbH.

Revision of the Instruction Sheet VGB-M 405 G «Water Demineralisation by Ion Exchangers»

The panel revised the Instruction Sheet VGB-M 405 «Water Demineralisation by Ion Exchangers». It will probably be completed in 2013.

Workshop «Water in Power Plants 2012»

The VGB Workshop «Water in Power Plants 2012», which was attended by 45 participants from four countries (Germany, the Netherlands, Swiss and Belgium), was very successful due to the interesting papers, the venue and smooth organisation. The next workshop will be held in Berlin on September 12/13, 2013.

The following project groups are subgroups of the Working Panel «Chemistry of Water Treatment» and are coordinated by it:

Microbiology in Cooling Systems

The Project Group «Microbiology in Cooling Systems» jointly set up with the Working Panel «Cooling Systems in Power Plants» finished microbiological investigations at several natural draught cooling towers in German power plants. The investigations results are being assessed.
Revision of the Cooling Water Guideline
The Cooling Water Guideline R 455 P is being revised. The current edition is restricted to water treatment and the interdependency cooling water/material in turbine condensers and other heat exchangers. Other components and problems upon the operation of cooling systems will be addressed and reference will be made to other guidelines and standards. The revision is scheduled to be finished at the beginning of 2014.

Chemistry of Flue Gas Cleaning Plants
Andreas Wecker
The panel dealt with the addition of bromide to coal to improve mercury capture at coal-fired power plants. Following the EU Directive, most mercury emissions of European coal-fired power plants are separated from the flue gas in downstream flue gas cleaning systems like DENOX, electrostatic precipitator (ESP), and flue gas desulphurisation plants (FGD). It was proven in large-scale tests, carried out in the USA, that mercury capture can be improved by adding bromide. However, upon a closer look on the US results, it turns out that these results cannot be compared with Europe because a lot of US power plants are not equipped with DENOX and desulphurisation plants and thus no separation rates are achieved when not adding bromide in contrast to European plants where mercury emissions are removed already by flue gas cleaning equipment as described above.

The related KEMA study was completed. There are still unsettled issues related to corrosion and environmental influences caused by bromide emissions. Additional research is needed to verify when bromide addition to coal is of advantage in European coal-fired power plants that are equipped with flue gas cleaning systems. Bromide addition is not considered as BAT due to the numerous uncertainties.

Mercury
The Working Group «Mercury» supervised jointly with the Working Panel «Chemistry of Flue Gas Cleaning Plants» the study on «Possibilities and disadvantages of bromide addition to reduce mercury emissions at coal-fired power stations» carried out by KEMA/The Netherlands. An intermediate report of that study had already been included into the BREF-LCP process. This study was terminated and was also incorporated into the BREF-LCP process. It can be ascertained that the addition of bromide generally reduces Hg emissions in coal-fired power plants. However, there are also some drawbacks related to environment and health. Besides, it has not been settled yet which long-term effects, e.g. boiler corrosion, will result when adding bromide to coal. Therefore, this technique cannot be considered as BAT. In power plants with already very low Hg emissions as in European plants with installed BAT technology, the benefit of bromide addition could be smaller than the negative consequences. In this case, any positive effects on the environmental balance are doubtful.

Another important report by the Hamburg-Harburg (TUHH) university on behalf of the UBA: «Innovative techniques: BAT in selected sectors – part project 01: LCP (revision of the BVT instruction sheet as of 2010)» was also incorporated into the BREF-LCP process.

The report revealed that the total mercury emissions in German coal-fired power plants are quite low.

Analytics
Andreas Wecker
The third round robin test (USA, Japan, China) on checking DENOX catalysts in bench reactor according to the former VGB Guideline R 302 H «Guideline for Checking DENOX Catalysts» was terminated with a good result which was incorporated into the revised VGB-Standard VGB-S-302-00-2013-04-DE that is to be published soon.

The panel is also elaborating a VGB-Standard about analysis procedures in power plants and carries out round robin tests on combustion and residues analytics as well as on checking analysis procedures.

LWR Chemistry
Dittmar Rutschow
The Working Panels «PWR Chemistry» and «BWR Chemistry» decided to merge and to set up a new working panel entitled «LWR Chemistry» after the changed post-Fukushima conditions. The new panel is to bundle the topics which result from changes and the Technical Committee «Chemistry». Besides, it is ensured that all BWR and PWR plants exchange their experience regularly as required internationally.

Increased oxide formation at fuel assemblies was detected in one nuclear power plant between the 8th and 9th spacer. 16 fuel elements of the 23rd loading were affected. The investigations are carried out by a company entrusted and the nuclear power plant. No significant differences between unremarkable reference fuel elements and affected elements could be detected as concerns anions (F-, Cl- and SO42-) and carbon (TOC).

Higher contamination in the area of the reactor floor was detected in one foreign nuclear power plant during the last inspection. After emptying the reactor cavity, highly-active particle-shaped contaminations of Zr-95 and Nb-95 were found. Jointly with a company, the operational events, like early plant shutdown, repair, efficiency of cleaning systems, general reactor operation etc. were analysed in order to identify the sources of contamination. The investigations are still under way.

The panel also discussed decontamination of the primary circuit carried out in one nuclear power plant.

The panel members opted for a round robin test to determine the B-10 contents. The test is to be carried out analogous to the test carried out for chemical parameters.
After four years it has been high time to hold a VGB Technical Conference «Fire Protection». New-build projects like the new unit in the Neurath power plant demonstrated the state of the art in the field of fire protection in power plants. The conference programme focused on the control of crowds in case of evacuation. The situation was compared with protection concepts for e.g. football stadiums. This also involves observation concepts which enable backtracking of flying objects. The ambience of the inspection and the venue was met with surprisingly great interest: some 100 participants exceeded the expectations. The conference dealt with:

- Visit of the new Neurath power plant,
- Fire behaviour of cooling tower fills,
- Fire protection of new-build and redesign projects,
- Nitrogen-water mist for gas turbine noise dampers,
- Legal aspects, conservation of the status quo,
- Simulation programme on evacuation,
- Evacuation of buildings,
- Evaluation of a belt bridge in the Jänischwalde power plant in 2008,
- Explosion protection in the area of fuel feeding,
- Explosion protection, theory and experience from the viewpoint of a long-term operator,
- Concept for transformer protection on the basis of dispersion,
- Arrangement for testing the ignition behaviour of cooling tower fills
- Ignition with isopropanol (10 ml, 30 ml, 125 ml),
- Simulation of convection,
- Sample size, at least 100 cm x 100 cm x 100 cm.

No major events happened last year, therefore, the committee members could focus on e.g. protection of biomass-fired power plants where fuel handling is in the centre of attention of fire fighting. This involves dust explosions as well as self-ignition of fuel storage yards. The possibilities of fire protection of wind power plants were also considered. It is obvious that the geometry of plants does not offer much possibilities for interference, thus measures have to be taken in the area of construction and monitoring. Fire fighting has to be quick in order to combat new fires successfully and immediately. Lifesaving measures are hardly conceived in case of such fires. However, fire fighting concepts in such areas also involve the environment which takes into account additional fire loads like forests and park areas.

Health and Safety

Karl-Heinz Puch

Traditionally, the VGB Technical Committee «Health and Safety» is focussing on experience about the most recent injuries and accidents. In the period under review the committee dealt with serious – and also fatal – accidents. Committee representatives are collaborating in drafting the BU Regulations «Thermal power plants» and «Hydro power plants». The same applies to the new BG Instruction Sheet «Working at high temperatures». The BGR «Thermal power plants» was published by the end of 2012. A video on the issue of labour protection was presented. The committee co-ordinates the activities in the field of «management of external companies». A VGB-Standard for contractor management, among others for the areas of maintenance and power plant new constructions, is being revised. The VGB Service Certificate of SeSaM has proven well when selecting external companies.

The compendium «health relevance of power plants» addresses physicians and comparable groups dealing with health impacts of power plants. It is based on sound scientific examination including reference to existing knowledge gaps and the current focus of discussion. Power plant emissions are to be considered in relation to other emitters like industry, traffic, and households in order to put the issue into a realistic context of environmental medicine. The compendium is also available in English and highly appreciated.

A data base «safety alerts» is to be set up this year. A collection with operating media is also being prepared.
Industrial- and Environmental Medicine/Health Management

Lena Jentjens

Traditionally the technical committee is intensively exchanging experience in the fields of industrial and environmental medicine and health management at its biannual meetings. During the reporting period, the TC and the Working Panel «Medical Scientist in Nuclear Power Plants» focused on the following topics:

Subsequent examination according to § 60 StrlSchV

In § 60, section 5 of the «Amendment of the Radiation Protection Ordinance» that was enforced on November 1, 2011, it is written that industrial medical precaution will only last as long – provided the employee in question agrees – as considered necessary by a physician. DGMS developed criteria to be applied by responsible physicians in order to be able to decide whether and to what extend subsequent examinations are needed. The criteria were presented. Accordingly, subsequent investigations are to be recommended in any case if the professional dose rate of 20 mSv or an annual limit value of the organ dose rate is exceeded. Additional criteria are the combined effect of ionizing radiation and other carcinogenic hazard substances and references to genetically increased radiosensitivity.

Contamination of drinking water caused by hydrazine in one nuclear power plant

During a power plant inspection, routine isolation resulted in a wrong connection between cold water and drinking water which led to a locally restricted blending, i.e. hydrazine, which is according to the Technical Rules for Dangerous Substances TRSG and animal testing carcinogenic, entered drinking water.

Increased lifetime cancer risk or an immediate health risk, even if assuming the worst-case scenario, could not be anticipated.

Iodine tablet

According to §71 AMG, the responsible bodies (authority for disaster control, German armed forces etc.) have to check the usability of iodine tablets. Until 2014, the expiration date is being checked randomly once a year by BMU. It has not been settled yet which checks will be made after that. The committee is in touch with KHG, which is checking the case legally and politically. Currently it seems that BMU will carry on with the checks.

Another important issue was the preparation of iodine blockage in Switzerland where the Swiss army pharmacy is responsible for the procurement and distribution of iodine tablets. The public living in a radius of 20 km around the nuclear power plant receives two boxes of potassium iodine. Areas outside this radius are under the control of the Swiss cantons.

Assessment of hazards caused by mental stress

For some time, mental stress in professional life has been gaining in importance in the field of industrial health management. Often these health problems are much harder to diagnose than just physical diseases and are therefore referred to as «soft» diseases. Mental hazards are difficult to assess because they do not only depend on the individual work place but also on the personality and the private circumstances of living. However, there are some basic conditions which increase mental stress for staff: lacking appreciation by public and by management/company, management, problems in private life, insufficient autonomy and scope of action, uncertainty about the professional future, time pressure, internal competition, and the issue about the meaning of work.

A lot of these items can be influenced by management. It has been known for quite some time that the quality of management is having direct influence on staff health. Therefore, a lot of companies are taking measures to improve management. Staff surveys and training of management are proven tools.

Influenza pandemic

New procurement of neuraminidase inhibitors: At the last meeting it was decided not to procure new neuraminidase inhibitors against the background of the discussions about the effectiveness and the reservation of authorities. There are still sufficient reserves; it can be assumed that the production will be increased in the case of a pandemic. Besides, the significance of basic hygiene measures is to exceed the position of neuraminidase inhibitors.
The current stock of Tamiflu exceeded the date of expiration. However, the current stock is being kept, because it cannot be excluded that the date of expiration will be prolonged.

Reorganisation of processes related to industrial labour in companies

Our companies and nuclear plant staff are facing particular challenges due to the phase out of nuclear power decided by the German government. Apart from the loss of jobs, nuclear plant staff also lost public appreciation. Utilities have started reorganising their businesses which also involves industrial medicine.

International VGB-Committees

Environment

Volker Hamacher

The activities of the European technical committee (ETC) focus on developments in the individual member states and plants (Figure 2) and their relevance to power plants as well as the exchange of experience addressing among others the following issues:

- National transposition of the IED,
- Seveso-III Directive,
- Trading of greenhouse gas emissions certificates,
- Radioactivity of fly ash.

As concerns VGB activities, reports were given on the current state of research projects, the «VGB Quality Award» and the video conference system «GoToMeeting» which enables ETC members to take part in meeting via internet. However, this is to remain the exception. A report was also given on the current state of the VGB data base «PowDat». The committee members also discussed the developments of environmental requirements, among others the IED (i.e. rules for plants < 50 MW (th)), checking of the EU clean air policy, the Gothenburg protocol, suggestions for revising the UVP Directive, suggestion for a guideline on priority substances and consultation of a Commission blueprint on the protection of European water resources. A further report on the state the BREF large combustion plants was provided. Papers were delivered on «Utilisation of power plant end products» and «The challenges of intermittency in North West European power markets».

The European Working Group (EWG) «Emissions Monitoring» dealt with CEN standardisation, e.g. in the field of calibration, data recording/evaluation and measurement of the flue gas volume flow. Members of the working group also cooperated in relevant standardisation projects like PEMS or FTIR flue gas measurement. The group also discussed different handling of measurement uncertainties in member states, determination of control limits of EN 14181 if the licensing limit values are far beyond those of IED and state of the JRC reports on monitoring. As regards trading of greenhouse gas emission certificates, the members discussed direct CO₂ measurement and the uncertainty of the determination of carbon utilisation from stockpile measurements.

Safety and Health at Work

Karl-Heinz Puch

The European Technical Committee «Safety and Health at Work» is dealing with contractor management in maintenance and power plant new constructions. This topic is on top of the agenda. All stakeholders established rules for dealing with external companies, however, their approaches differ which is partly due to national conditions.

Organisational safety of power plant operators is anther main topic to be dealt with.

The LTIF accident record (LTIF = Lost Time Injury Frequency Index, indicating the frequency of labour accidents per million working hours) is being updated. External companies, accidents that nearly happened, and outages are also taken into account. In comparison to other industries, the parameters indicate that an improvement potential is existing.

The group is also collecting and evaluating «safety alerts».

Effective root cause analysis is the precondition for preventive measures. This, however, requires the introduction of corresponding tools, methods, and suitable communication.

The correlation between process safety and occupational health are being discussed and analysed.

The ETC is aiming at extending the scope of its activities and issues from «health and safety» within the scope of mere risk assessment to «quality of life at work».

Alcohol and drugs are new issues on the agenda.

In September 2012, the second VGB «European Occupational Health and Safety Conference» took place in Amsterdam. The conference focused on lessons learned in health and safety in the energy sector. The next conference is to be held in Freising on April 9/10, 2014.

Chemistry

Andreas Wecker

The ETC «Chemistry» is dealing with chemical impacts of co-combustion of different fuels. It focuses on co-combustion of biomass. A harmonisation talk was held with the EWG «Biomass» and «Flue Gas Cleaning» in order to coordinate the activities. A reference data base is to be drafted in support of other working groups. The ETC «Chemistry» wants to set up a panel jointly with the Technical Committee «Chemistry».
ETC Climate Protection
Volker Hamacher

The committee members discussed the Commission’s plans to withdraw 900 million emission certificates from the market in order to strengthen the European emissions trading system. According to the plans, the certificates are only to be «back-loaded» to the market in the two last years of the third trading period (2019/20). This proposal was suggested by the European Parliament with slim majority and returned to the environmental committee of the Parliament. The committee members also discussed the guidelines of the Commission for certain supports of emissions trading regarding the compensation of indirect CO₂ costs, the Commission’s plans to restrict certificates resulting from Joint Implementation Projects, the Green Book of European energy and climate policy until 2030, the linking of EU emissions trading with other emissions trading systems, and the state of international climate negotiations.

Integrated Technical Committees

Monitoring of Greenhouse Gas Emissions

The group members had elaborated statements on the drafts of the MRR Guidance Documents 1 (General guidance for installations) that were passed on by VGB to BMU, BMWi, and DEHSt (German Emissions Trading Authority). It was criticised that the EU requirement, i.e. one tonne of CO₂ equals one tonne of CO₂, is driven into absurdity because it is up to the member states to determine the factor of oxidation. This requirement results in drawbacks of competition for German operators who have to meet an oxidation factor of 1. Besides, the administrative burden was criticised caused by extreme reporting and additional load for operators because monitoring concepts had to be field early together with licensing documents, however, at that time the Commission was still working at a number of guidance documents which needed to be considered or even improvements of the concept. The group’s objections were not taken into account.

The group also formulated questions/remarks on risk assessment to be made according to art. 12 para. 1b of the monitoring ordinance. The remarks were passed on to DEHSt. They deal with accuracy of measurement, acceptance of quality data of foreign products applying non-European standards, the replacement of measuring equipment, and the duty of keeping company-internal process instructions. Among others, it is required that risk assessments are to be made only for B and C plants and are to apply to flows highly loaded as well as to fault risks within the own sphere of influence; the assessment is not to be based on calculation factors used for reference values or which are determined by accredited laboratories. The group has also drafted ideas for improvement concerning FMS (form management system) software for monitoring plants and passed on the ideas to DEHSt. More user-friendly visualisation and operation is to be achieved. DEHSt appreciated the ideas – discussed by the responsible subgroup (UAG 2) of DEHSt – to improve the recording software.

Deficits were disclosed after member companies had made first experience with the application of the central, EU-wide union register which functions as of now as national commercial register. The group addressed a letter to the Commission suggesting elimination of errors and improvements and also asked DEHSt for support on European level. The Commission appreciated the suggestions and promised to pay utmost attention. When the third trade period starts, accredited experts are to check and testify reports on greenhouse gas emissions according to the new EU accreditation and verification ordinance of June 21, 2012. In this connection, some questions arose among those group members responsible for emission reports. The group asked DEHSt – and also sent a copy to DAkkS (German national accreditation body) – for possible effects on certified monitoring plans or emission reports that were issued by experts whose accreditation will be denied. DEHSt answered that the effectiveness of verification will remain and that there are hardly any changes compared to current legislation. Among others, reports are issued following the principle that accreditation has to be valid when issuing a report, later deny of accreditation does not have any influence on the effectiveness of the reports issued.

Fig. 11: Pilot plant for CO₂-capture.
Immission Protection

Volker Hamacher

The committee focussed again on the national transposition of the IED. The act and two ordinances were published in the German Federal Law Gazette on April 12, 2013 (law) and on May 2, 2013, respectively. Law and ordinances came into force on May 2, 2013. The second ordinance mainly covers the new version of the 13th and 17th ordinances on the Federal Immission Control Act (BImSchV). The association’s arguments were taken into account and improvements were made in comparison to the original BMU drafts. The limit value for particulate matter e.g. of 20/40 mg/m³ remains for existing plants of any size. The same holds true for the mercury limit value of 0.03/0.05 mg/m³ (daily average value /half hour average value); the regulation annual average value applicable to new gas turbines remains unchanged. There are still no limit values for ammonia, HCl, and HF. In contrast to the original plans, the CO limit values were not tightened; the same applies to the consideration of start-up and shutdown procedures that are still not taken into account when determining the daily average value. However, some issues are not settled yet, like the new average annual value for particulate matter amounting to 10 mg/m² for existing power plants > 300 MW (th), the annual average value for mercury of 10 µg/m³ (both as of 2019) or the tighter values for existing peak load gas turbines and older combined cycle gas turbines. These tighter values cannot be avoided in the European context.

According to article 23 of the IED, the member states have to introduce a system for environmental inspections of IED plants. Some responsible authorities have already contacted operators in this respect. Considerable preparatory work has been done by the Cologne District Council which has developed a monitoring concept. Among others, criteria (determined on the basis of potential and real environmental impacts as well as operator-related criteria) for risk assessment are defined which in turn schedule the inspection frequency – every one to three years for IED plants – of individual plants. It is being criticised that at times where utilities have to cut personnel, additional workloads are burdened. It is recommended that inspections according to IED and Seveso Directive are possibly carried out simultaneously.

According to article 72.2 of the IED, the Commission had to check by the end of 2012, whether emissions from furnaces < 50 MW (th) also have to be reduced. The AMEC Institute was entrusted to carry out a study investigating the legal requirements of immission protection in the member states as well as advantages and disadvantages of corresponding emission limits and possible trading options. Besides, the Commission intends to present a draft revision of the NEC Directive by the end of 2013; the targets of which are to be increasingly adjusted to the targets of air quality control. A draft revision of the Air Quality Directive is also expected by the end of 2013.

The fifth and final international negotiation round for a mercury convention was completed. About 900 delegates of more than 140 states met. About four years after the mandate had been accorded to elaborate a UNEP agreement, it was passed on January 19, 2013 as worldwide binding instrument to cut utilisation of anthropogenic mercury and to decrease harmful mercury emissions. The convention comprises elements to decrease hazards caused by mercury emissions in trade business and mercury supply, products, industrial processes, and plants. The convention also regulates treatment of mercury as waste and upon storage. It also contains rules and measures for small-scale gold mining for the protection of miners. A committee, which is to monitor enforcement of the convention and compliance with the regulation, can be set up immediately after the mercury convention will have been enforced (about 50 states have to ratify it). According to the convention, mercury emissions from waste incineration and coal-fired power plants also have to be reduced. Five years after enforcement, plants have to be of «best environmental practice». National measures aiming at Hg reduction are to be taken at existing plants 10 years after enforcement of the convention.

The technical university Hamburg-Harburg (TUHH) was awarded a research project by UBA on the issue of BREF LCP in the early summer of 2012. UBA also reported 62 questionnaires for 48 joint plants to the Seville office. The Seville office made a first assessment and checked consistency which led to several queries at operators. TUHH presented first evaluations of German data at a workshop that took place in September 2012. It became obvious that evaluation of data will put high requirements on the EIPPCB. This is mainly due to the complex plant structure of reference plants and the numerous comments and remarks that were made by operators because of the insufficient flexibility of the questionnaire. At the beginning of March 2013, TUHH presented the final report by consideration of utilities remarks. The report was circulated for final comments, and after all corrections have been made, it will be passed on to TWG and the Seville office as German contribution for revising the guideline. VGB will deal in May with the expected BREF draft of EIPPCB. The Project Group «13th Ordinance to the German Federal Control Act» will coordinate the feedback jointly for VGB and BDEW.
Licensing

Andreas Wecker

The Integrated Committee «Climate and Environmental Protection» took the decision to establish a new Integrated Committee of Experts «Licensing» by merging the former Groups «Licensing» and «Plant Planning». Apart from licensing managers, legal experts are also represented in the new committee to focus on practical legal issues.

The new committee is to deal with central and permanent strategic issues of site development and plant planning and licensing of projects of energy infrastructure (generation plants and grids). Legal projects are to be accompanied and questions arising from licensing procedures are to be addressed focusing on new regulations and developments that are required.

The committee also concentrates on compensation upon intervening with nature as regards contents, kind, and scope of compensation measures, climate legislation in the individual federal states, current issues of regulations and the discussion about the federal compensation ordinance as well as policies with a view to the election of the German parliament in September 2013.

Water and Soil Conservation

Dittmar Rutschow

The Integrated Committee of Experts «Water and Soil Conservation» discussed the development of draft ordinances for plants handling water-endangering substances. The following items are still being criticised:

- Requirements for the retention of firefighting water in the area of transform-

- Regulation on the retention of rain wa-

- Modification of hazard category from A to B, and

- Interim arrangements need to be ad-

The items «bagatelle threshold», «interim arrangements» and «power plant by-

The legal procedure related to the trans-

The Bund/Länder Arbeitsgemeinschaft «Soil Protection» (LABO) jointly developed with the Bund/Länder-Arbeitsgemeinschaft «Water» (LAWA) a support document for the initial state report (AZB) for soil and ground water according to article 22 of the German industrial emission guideline (draft of September 13, 2012). The group discussed the paper and discovered several problems that will be faced by opera-
tors when having to draft the AZB. If prior charge is assumed, the operator is pre-
scribed the soil depth from where to take samples and the grid of sampling.

The IPG believes that in the AZB general issues of soil protection are mixed with requirements of the IED. Only IED require-

The IPG will try to discuss the issues with the authors of the support document to make it more practical because currently it is very complicated.

Waste and By-products

Thomas Eck

The central issues of the Integrated Com-

the «Disposal Manual» was also revised completely. The group also dealt with the REACH registration of power plant by-

Adoption European Waste Catalogue

The European Commission is currently checking the adoption of hazardous char-

When the associations were heard on the General Framework Ordinance on the Pro-

When the associations were heard on the General Framework Ordinance on the Pro-

Requirements for the retention of fire-

When the associations were heard on the General Framework Ordinance on the Pro-


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The European requirements, particularly with a view to the definition of by-products and the end of waste characteristics, were nearly 100% taken into account when transposing the directive into German law. However, concrete definitions are still missing on issues like product/by-product/waste and the end of waste characteristics.

In practice, there are ongoing discussions whether power plant-by-products are subject to the waste law or not, e.g. as concerns transport. VGB and BDEW had several discussions on state and federal level and drafted corresponding documents without really settling the issue. The federal states are also at diverging opinions. It is not being expected that a uniform German-wide regulation will be achieved in the short-term; therefore, the AIF will have to deal with it in future.

Ordinance on construction material

The new EU Regulation on Construction Products (EU 305/2011) of March 9, 2011 has been partly enforced since April 24, 2011. On July 1, 2013 this regulation will repeal the current EU Directive on Construction Products that was transposed in Germany through the law on construction products. The articles important for manufacturers will only become binding as of July 1, 2013. Among others, manufacturers have to issue a declaration of performance which replaces current declarations of conformity. An ad-hoc working panel with members of the IFA and VGB Technical Committee «Power Plant By-products» was set up to determine actions necessary. The VGB Project Group «Quality Management» was asked to draft a pattern for the declaration of performance. Work is nearly completed; a harmonised pattern for performance declarations and CE designation for fly ash in concrete according to DIN EN 450-1 as well as explanations will be available after final issues will have been settled with external monitoring companies and CEN consultants.

Ordinance on fertilisers

When the ordinance on fertilisers (DüMV) was revised, the associations VGB, BVK, and BDEW applied and asked for consideration of hard coal ashes as permissible initial substances for fertiliser production. However, ash application was intended to be quite restricted (utilisation as culture media only, in closed systems only; restriction of screen line) which would have prevented application. These restrictions were deleted from the new version of the DüMV of December 5, 2012 after the associations had objected again and had provided technical statements. This success is mainly due to the explanations of VGB, BVK, and BDEW.

Disposal Manual for Energy Service Companies

The «Disposal Manual for Energy Service Companies» was completely revised and designed anew with the 17th supplement by the Project Group «Disposal Manual for Energy Service Companies» (November 2012). Apart from editorial issues, all chapters were adopted to the new KrWG that had been enforced on June 1, 2012. Further legal changes in the area of waste and hazardous substances were also taken into account.

Law on Recycling Economy (KrWG) being implemented

The IFA has been dealing for quite a while with the issue of legal certainty of power plant by-products within the scope of the national transposition of the European General Waste Directive. In Germany it was transposed by the amendment of the Law on Recycling Economy (KrWG) and was terminated when the KrWG—enforced on June 1, 2012—had been passed in February 2012.

The so-called framework ordinance is an ordinance that determines requirements for discharging substances into ground water, the utilisation of substitute construction materials, and the utilisation of soil and materials similar to soil. The ordinance covers new regulations of the ground water ordinance, the federal soil protection and contaminated soil ordinance as well as the deposit ordinance and for the first time a decree of an ordinance on substitute building materials. After the BMU had presented a much criticised first draft at the beginning of 2011, a second revised draft was presented by the end of 2012.

In January 2013, VGB and BDEW elaborated written comments which are mainly based on the 2011 comments and continued with the main issue of criticism of 2011. In the second draft, a distinction is made between wastes, by-products, and the termination of waste characteristics for the application range of substitute building materials. Although a uniform decree is appreciated, this issue, and many others, has not been formulated ideally. The draft is as much debated as its predecessor from 2011. A Bund/Länder working group was set up and it cannot be excluded that a third draft will be presented in 2013, i.e. it is not being assumed that the ordinance will be passed soon.

Disposal Manual for Energy Service Companies

Dittmar Rutschow and Karl-Heinz Puch

The Sub-group «Working Media» of the ITC «Dangerous Goods/Hazardous Materials» has been dealing with the following issues:

- Mineral dust
- cooperation in a corresponding TRGS
- Amendment of the Ordinance on Hazardous Substances,
- REACH/GHS (Globally Harmonised System).

The characterisation of operating media in power plants according to both regulations is being discussed. A support document was drafted.

A workshop is to be held in 2014 for the application of requirements relevant to power plant media.
Maintenance

When revising large steam turbines, failures are being revealed again and again that were made upon tendering and planning of these installations. Necessary works had either not been executed or had to be made subsequently which led to additional costs, besides, no quotations for optional work were asked for. This opened up the floodgates to the service partners for immense additional claims.

One of our member companies realised these deficits. Jointly with VGB’s consulting engineers, a tailor-made supply and service package was developed for an existing turbine. This package will serve as basis for future tenders. If only small or medium inspections are planned, the package can be adjusted according to needs.

Turbine condensers

Deposits and corrosion in cooling tubes of turbine condensers and other heat exchangers can be detected and investigated by endoscopic inspection. In several cases, special cleaning measures could be launched due to these inspections and the operating mode of the tube cleaning devices could be initiated and controlled. Thus, decreases in turbine output and corrosion of cooling tubes could be stopped avoiding tube leakages. In one case it could be detected that the output losses were due to limestone deposits removed incompletely and air intake at a leaking preheater flange of a condenser. VGB localised the air intake with a special CO₂ leakage detection device.

Boiler

- Optimisation of a power plant site with three thermal power plants. The main job comprised neutral technical consultancy and subordinate bench marking of the three power plants in terms of generation and logistics as well as engineering and maintenance. The technical processes of individual units and the entire plant as well as potentials for improvement and optimisation were assessed. The existing steam grids (5 steam systems with pressures of 100 bar up to 1.5 bar) were also checked in order to identify optimisation potentials.

- Damage investigations were made at five biomass-fired heating power plants. This also included fuel sampling and laboratory investigation of the tube and pipe materials. Such investigations bear future potentials, because insurance companies hardly employ damage engineers in contrast to VGB which is well suited and ready to carry out damage and laboratory investigations (unique position of VGB).

- Examination of an internal insulation between gas turbine and waste heat boiler and related components (sub-constructions). This mainly comprised inspection of the combustion chamber up to the evaporator. The examination was to be focused on the high-temperature insulation of the combustion chamber.

- Determination of the physical properties of a steam cooler as regards lifetime of the bends influenced by drop erosion.

- Drafting of a specification by taking into account all technical rules for pressurised parts like evaporator and superheater surfaces as well as live steam outlet header.

Fig. 1: The new scanning electron microscop (SEM) of the VGB Technical Services.
- Investigation of the failure of a sealing (comb profile) at an injection cooler.
- Investigation and determination of insulation damage at two boilers. Considerable damage at two boilers was detected with the infrared camera.
- Statement of the operating behaviour of a 25 t boiler.
- Statement on the damage of new, still not commissioned ESP.

Water chemistry

Water chemistry is increasingly dealing with issues of plant operation, which is also finally a consequence of the ongoing rationalisation in the area of water chemistry. Regular seminars in the field of water chemistry and laboratory are appropriate measures to counteract loss of expertise. In these seminars practical examples are given to outline the consequences for power plants when deviating from quality parameters.

Comprehensive and valuable knowledge could be gained when accompanying switching of the cycle chemistry in a fossil-fired unit. The unit called for particular attention; because it had been the first time that a unit using the material T24 was switched to combined (i.e. oxygen-rich) mode of operation.

Materials laboratory

During the reporting period several damage cases were investigated by the VGB materials laboratory and recurrent tests were carried out in VGB member plants. Traditionally the focus is on the investigation of components of the steam generator and connecting tubing.

Investigations of the susceptibility to stress corrosion cracking of T24 were of particular interest. VGB experts were able to describe factors decisive for crack formation and remedies could be defined. The influence of the O₂ contents of the boiler feedwater could be proved under laboratory conditions resulting in the requirements of strictly controlled O₂ dosing and to limit it by special measures particularly during initial operation. Thanks to the close cooperation with water chemistry, VGB managed to define realistic requirements and to implement them in the Neurath power plant. Apart from the interaction between O₂ contents and crack formation, the influence of heat treatment at temperatures clearly below the annealing temperature was also investigated. It was found that heat treatment in the area around 500 °C clearly decreases the tendency for crack formation.

The investigations of T24 have not been terminated in 2013 and will be continued in the future.

Fig. 2: View of the diffractometer for analytics of the VGB Technical Services.
R&D Activities and VGB RESEARCH FOUNDATION

Sabine Polenz, Guido Schwabe and Ludger Mohrbach

VGB PowerTech offers to its member companies a neutral platform for joint research. The research activities are controlled by the experts from VGB member companies which are organised in the VGB technical committees with the support of the relevant VGB technical advisors (Figure 1).

The VGB PowerTech technical committees formulate research requirements in their respective fields of activity and examine external research proposals with respect to their practical relevance and short- or medium-term practicability for plant operations. The technical committees and VGB Technical advisors supervise project execution and transfer of results.

Three key research programmes emerged from this bottom-up research coordination:

– Waste management from coal-fired power plants and waste combustion plants (ERKOM),
– New materials for power plants (NWK), and
– Advanced coal power plant with optimised efficiency, economy and environmental sustainability (Emax).

The key to financing VGB research projects are the contributions received from member companies. In addition a general research contribution is levied from ordinary member companies. The VGB Board of Directors decides on spending of these funds. Public funds make a significant contribution to research projects of broad interest.

The Table 1 shows the status of project funding in May 2013. It contains information on the financial interests and publications of research results. Furthermore, the projects worked on within a central research programme are identified. Short descriptions of individual projects are provided on www.vgb.org/forschung and are continuously updated. The website also contains information about the relevant expert contact at VGB Offices as well as notes on results.

In 2012, VGB took part in a total of 38 projects with a total volume of 68.8 million Euros (previous year: 37 projects with a volume of 95 million Euros). Of these, 13 projects with a volume of 1.4 million Euros were started in 2012 (previous year: 15 projects and 50.2 million Euros).

The share of operator funds spent on these new projects was 52 %, 28 % of which was raised through project contributions (specific VGB funds) and 24 % from the joint research contribution of ordinary VGB member companies (general VGB funds). The share of «other funds», including manufacturer contributions, is 1 % only. A considerable share of the funds was raised through public funding (46 %).
### Tab. 1: Projects funded by VGB since 2008, completed projects are highlighted in grey (as of 05/2013).

Projects of the Research programme EUSI-RES are highlighted in green.

<table>
<thead>
<tr>
<th>No.</th>
<th>Abbreviated title</th>
<th>Duration</th>
<th>General VGB funds</th>
<th>Specific VGB funds</th>
<th>Public funds</th>
<th>Other funds</th>
<th>Total volume</th>
<th>Project results</th>
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<td>Panelverkleidung für Hochtemperaturprozesse (Fortsetzung 265)</td>
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<td>Quellkennabbildung bei der Verbrennung II (Fortsetzung 293)</td>
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<td>Neue Werkstoffe für Dampfturbinen IV**</td>
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<td>Großtechnische Anlagen**</td>
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<td>Effiziente Förderstrategien für erneuerbare Energien****</td>
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<td>725 HWT GKM***</td>
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<td>2.699</td>
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<td>Large-scale Biomass co-firing (DEBCO)****</td>
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<td>AKR Performance-Prüfverfahren für Flugaschebeton*</td>
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<td>Freitüberschritten von Flugaschebeton nach X2**</td>
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<td>Ignition Tests with Cooling Tower Piping, Part II**</td>
<td>2008-2010</td>
<td>60</td>
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<td>337</td>
<td>Weiterführende Untersuchungen zum Sulfitwiderstand von Beton* (Fortsetzung 297)**</td>
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<td>338</td>
<td>Ignition Tests with Cooling Tower Piping, Part III**</td>
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<td>Microstructure of Alloy 263 under long term creep loading**</td>
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<td>341</td>
<td>Availability of biomass****</td>
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<td>92</td>
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<td>342</td>
<td>Measurement of low mercury emissions</td>
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<td>1.340</td>
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<td>344</td>
<td>Gips-Zement-FuZoll-Hütten sand-Binderkrem*</td>
<td>2008-2010</td>
<td>281</td>
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<td>AKR-Vermeidung durch Flugasche* (Fortsetzung 300)**</td>
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<td>346</td>
<td>System stability of electricity supply****</td>
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<td>123</td>
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<td>Verification of Repair Concept on Service Exposed A617***</td>
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<td>389</td>
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<td>Ammonium nitrate**</td>
<td>2008-2010</td>
<td>44</td>
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<td>349</td>
<td>New 12% chromium steels**</td>
<td>2008-2010</td>
<td>75</td>
<td>66</td>
<td>282</td>
<td>210</td>
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<td>350</td>
<td>ASR - Variation of Prestorage Time*</td>
<td>2008-2010</td>
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<td>351</td>
<td>COORETEC TD-2: ZfP Nickelguss-Komponenten, Vortudahle**</td>
<td>2008-2010</td>
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* Completed in 2008-2009<br>** Completed in 2009-2010<br>*** Completed in 2010-2011<br>**** Completed in 2011-2012
Tab. 1 (cont.): Projects funded by VGB since 2008, completed projects are highlighted in grey (as of 05/2013). Projects of the Research programme EUSI-RES are highlighted in green.

<table>
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<tr>
<th>No.</th>
<th>Abbreviated title</th>
<th>Duration</th>
<th>General VGB funds</th>
<th>Specific VGB funds</th>
<th>Public funds</th>
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<th>Project results</th>
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<td>Hybrid High Solar Share Gas Turbine System (HYGATE)**</td>
<td>2011-2014</td>
<td>63</td>
<td>1,957</td>
<td>490</td>
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<td>Seawater for REA and Trinkwassergewinnung</td>
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<td>354</td>
<td>HWI 8****</td>
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<td>355</td>
<td>ENCIO****</td>
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<td>COMTES****</td>
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<td>Bromide addition</td>
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<td>Abschlussbericht</td>
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<td>358</td>
<td>Work-related stress among employees in wind turbines****</td>
<td>2012-2013</td>
<td>52</td>
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<td>HOSEP (Self-ignition of biomass)****</td>
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<td>361</td>
<td>Reliability indicators with KISSY</td>
<td>2012-2013</td>
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<td>Wear investigation model</td>
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<td>Calculation methods</td>
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<td>114</td>
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<td>364</td>
<td>Sulphate resistance - literature research*</td>
<td>2012-2013</td>
<td>10</td>
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<td>365</td>
<td>Knowledge to avoid coarse grain structure in authentic materials**</td>
<td>2012-2013</td>
<td>19</td>
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<td>366</td>
<td>Standardised remote terminal unit for wind power plants****</td>
<td>2012-2013</td>
<td>60</td>
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<td>367</td>
<td>MACPLUS-COMTES700/ETR-TV- Cooperation***</td>
<td>2012-2015</td>
<td>15</td>
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<td>368</td>
<td>Further investigations of the sulphate resistance of fly ash concrete (Continuation 336)*</td>
<td>2012-2013</td>
<td>9</td>
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<td>369</td>
<td>Optimierung Spindelabdichtung II (Fortsetzung 317)</td>
<td>2013-2015</td>
<td>339</td>
<td>137</td>
<td>476</td>
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<tr>
<td>370</td>
<td>Investigations and possible solutions to avoid stress corrosion cracking on welds made of T24 material**</td>
<td>2010-2013</td>
<td>1,380</td>
<td>1,380</td>
<td>Final report in progress VGB PT 11/2011, p. 40-44</td>
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Subtotal (starting with no. 307) k€ 2,041 30,249 31,007 9,797 73,095 3
Total (starting with no. 1) k€ 100,229 91,464 57,061 248,754 284,754

* Focal point research programme "Waste Management of Coal-fired Power Plants and Waste Incinerator Plants" (ERKOM)
** Focal point research programme "New Materials for Power Plants" (NWK)
*** Focal point research programme "Advanced Coal Power Plant with Optimized Efficiency, Economy and Environmental Sustainability" (Emax)
**** Focal point research programme "Efficient Use and System Integration of Renewables" (EUSI-RES)
As early as in 2000, VGB took into account the increasing importance of renewables-based power generation by initiating 24 research projects. Therefore, a new key research programme «Efficient Use and System Integration of Renewables» (EUSI-RES) was defined for incorporating finalised as well as projects that are still under way (Table 1, marked in green). The designation of the new key research programme reflects the focus of research on a more efficient use of renewables including its integration into the supply grid. In 2012, at total of three new projects were launched within the scope of this key research programme.

Nuclear power engineering

The VGB Special Committee «Plant Engineering» associated to the VGB General Committee «Nuclear Power Plants» funds operation-related research and development projects for nuclear power plants. These projects are financed by nuclear power plant operators according to the principle of sharing costs across all plants involved. In 2012, a total of 71 projects with a total funding volume of about 7,638,243 Euros were supported.

Collaboration with universities and promotion of vocational training

VGB’s close collaboration with universities is mainly realised through the work of the VGB Scientific Advisory Board which supports VGB on all issues related to research, development and education in the field of power plant engineering. The VGB Scientific Advisory Board comprises about 30 experts from several European countries (Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Great Britain, Greece, Italy, Poland, Slovenia, and Sweden) who represent all faculties of energy conversion and electricity supply.

Summer course for students

Supported by the Scientific Advisory Board and financed by the VGB-Forschungsstiftung (Research Foundation), an introductory course in power plant engineering for students nearing the end of their studies was again held from August 20 to 31, 2012. The VGB Summer School «Power Plants» provides a detailed insight into the industrial practice of electricity and heat generation. The programme includes presentations from all areas of power and heat generation as well as excursions to representative plants. In 2012, 19 students from 14 German, Finnish and Slovenian universities took part (Figure 2). VGB Research Foundation also sponsors subscriptions of the VGB organ VGB PowerTech for university institutions in order to support practical education. Since 2011, the subscription has been extended by the digital edition of VGB PowerTech providing direct access for students and university staff.

Heinrich Mandel Award

The Board of Trustees of VGB Research Foundation awarded the 2012-Heinrich Mandel Award for Power Plant Engineering to Dr. Christophe Vallée for his basic works on experimental investigations of stratified two-phase flows in the hot leg of PWR. The 10,000 Euros prize was awarded at the VGB Congress «Power Plants 2012» on October 10, 2012 in Mannheim by VGB Chairman Professor Dr. Gerd Jäger (Figure 3).

Since 1981 VGB Research Foundation has rewarded the outstanding performance of young engineers in the area of power plant engineering with the Heinrich Mandel Prize. Further information and the winner of the 2013 award can be found on the VGB website at www.vgb.org/mandelpreis.
Krafwerksschule e.V. (KWS)

Heinrich Nacke

General
The overall situation of KWS is good; however, the changes in the industry naturally make an impact on training and advanced training and KWS. These changes partly shifted the foci of some KWS departments.

Training at the KWS
Theoretical Training for Conventional and Nuclear Power Plants

In both departments new foci developed due to the turnaround in energy policy (German «Energiewende»).

Registration numbers for the KWS standard training courses for plant supervisors, plant operators and other advanced training courses from our standard programme are still sufficient.

As mentioned above, the turnaround in German energy policy resulted in new foci in both departments. KWS offers training and advanced training in all fields of renewables. This applies to biomass and/or on-/offshore wind power plants as well as hydro power plants. Besides, standard courses covering new issues related to renewables were added.

The same applies to the department of nuclear engineering training. KWS offers to its members a new plant supervisor course in the field of radiation protection as well as special courses taking into account relevant issues in connection with disassembly and idle operation.
Since this year, KRAFTWERKSSCHULE E.V. has been offering state-of-the-art power plant simulators for training particular operational situations. This applies to all power plant types that went into operation in recent months or are going to be connected to the grid in the near future. This covers the simulator variants of the 800 MW hard coal-fired plants, the 1,100 MW lignite-fired units including main control and instrumentation supplied by Siemens (SPPA T3000) and the 1,100 MW hard coal plants with main control and instrumentation supplied by ABB (ABB 800 XA).

A new combined-cycle variant with main control and instrumentation – HLT SPPA T3000 – supplied by Siemens is available for any training situation.

In recent years, KWS also concentrated on simulators for realising virtual commissioning measures prior to the real commissioning of power plants.

Advanced training for foreign power plant personnel
KWS can support foreign member’s activities and can carry out simulator and theoretical training courses worldwide. KWS knows a lot of structures of foreign training and advanced training. Additionally, KWS elaborates operational solutions jointly with the companies. Lecturer’s expertise is extended by linguistic competencies; course can be run in English and Dutch. The complete training documents are available in the English and Dutch language.

Innovation projects
The development of training models at simulators to meet the new challenges of grid operation is among the innovative tasks of KWS.

Another future project is the development and extension of our E-learning products. We are elaborating virtual structures in order to be able to offer the basic qualification of the power plant supervisor course as E-learning module. The new product is to be presented in 2014.

The range of KWS products is rounded off by the new apartment house. In future, national as well as international guests can use the state-of-the-art KWS facilities also for conferences and use the apartment house at the KWS site for overnight stays.

KWS is still offering at-the-site courses in Germany and abroad. These courses are bespoke according to customers’ needs and can be various out in various languages.

The new apartment house was opened in mid-July 2013. Now, all activities are concentrated on the campus of «Deilbachtal» in Esen-Kupferdreh.

Apartment blocks

Fig. 3: Inside view of a apartment.

Fig. 4: Laboratory.

Fig. 5: Visitors from abroad.
VGB: Events

Angela Langen

During the period under review from July 2012 to June 2013, VGB organised 28 events which were attended by a total of 3,345 participants. Of these, 1,051 people took part in seminars and workshops and 2,294 in conferences and symposia.

Six events were accompanied by technical exhibitions with 294 companies displaying their products and services.

VGB Congress «Power Plants 2012» in Mannheim

The VGB Congress «Power Plants 2012» took place in Mannheim from October 10 to 12, 2012. It was attended by more than 1,000 participants from 26 countries and was held under the motto «Security of Supply – Power Generation at the Crossroads».

Some 142 utilities, manufacturers and service companies exhibited their products and services in the Mannheim «Rosengarten» congress centre.

VGB Conference «Chemistry in Power Plants 2012» in Hamburg

The traditional VGB Conference «Chemistry in Power Plants» and the associated technical exhibition took place in Hamburg from October 23 to 25, 2012. Both conference days were run with two parallel sections – focusing among others on water treatment and water-steam cycle/ analytics. In the plenary lectures, the new VGB Standards on sampling and monitoring of the water-steam cycle were presented and the participants discussed the legionella problems in cooling water cycles. 51 exhibitors and 369 conference participants exchanged their experiences.

VGB Conference «Power Plants in Competition 2013» in Neuss

The triangle of the energy industry comprising supply security, economic efficiency, and environmental compatibility has gained even more in importance since the last VGB Conference “Power Plants in Competition” that took place in March 2011. The main issues got under more pressure since the decision of the German Federal Government to phase out nuclear power and to extend renewables-based power. It has been the first time that the conference motto – “Power plants in competition” – perfectly matched the situation between all kinds of power generation and their interconnection in Europe.

250 participants and 33 exhibitors met in the im Swisstel Neuss/Düsseldorf from April 23 to 25, 2013.

VGB Technical Conference «Gas Turbines and Gas Turbine Operation 2013» in Friedrichshafen

Every two years, operators, manufacturers, insurance companies, authorities, and R&D experts discuss current issues of gas turbines and their operation. The conference had already taken place in 2007 at this venue with 302 participants and 31 exhibitors at the Graf-Zeppelin-Hauses Friedrichshafen.

This year some estimated 320 participants and 48 exhibitors could exchange their views and refresh their contacts from June 11 to 12, 2013.

VGB would like to thank all participants, sponsors, cooperation partners, and exhibitors for the good cooperation. We highly appreciate your participation and we are looking to joint future events.
<table>
<thead>
<tr>
<th>Date</th>
<th>Place</th>
<th>Kind of Event</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 30 and 31, 2012</td>
<td>Lübeck</td>
<td>Seminar</td>
<td>Wasser im Kraftwerk</td>
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<tr>
<td>September 18 and 19, 2012</td>
<td>Cracow</td>
<td>Workshop</td>
<td>Operating Experience with Fluidized Bed Firing Systems</td>
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<tr>
<td>September 20 and 21, 2012</td>
<td>Amsterdam</td>
<td>Workshop</td>
<td>European Occupational Health and Safety</td>
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<tr>
<td>October 10 to 12, 2012</td>
<td>Mannheim</td>
<td>Congress with Exhibition</td>
<td>POWER PLANTS 2012</td>
</tr>
<tr>
<td>October 23 to 25, 2012</td>
<td>Hamburg</td>
<td>Conference with Exhibition</td>
<td>Chemistry in Power Plants</td>
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<td>October 23 to 25, 2012</td>
<td>Essen</td>
<td>Seminar</td>
<td>Schadensanalyse in der Kraftwerkstechnik</td>
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<tr>
<td>October 30, 2012</td>
<td>Essen</td>
<td>Workshop</td>
<td>Lärminderung</td>
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<tr>
<td>November 23 and 24, 2012</td>
<td>Emden</td>
<td>Workshop</td>
<td>Offshore Windenergieanlagen – Arbeitsmedizin</td>
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<td>November 6 to 8, 2012</td>
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<td>Seminar</td>
<td>Chemie im Wasser-Dampf-Kreislauf</td>
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<td>November 7 and 8, 2012</td>
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<td>November 14 and 15, 2012</td>
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<td>November 21, 2012</td>
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<td>November 26 and 27, 2012</td>
<td>Fellbach bei Stuttgart</td>
<td>Workshop</td>
<td>Das Kalte Ende – Betrieb und Instandhaltung von Turbinenkondensatoren</td>
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<td>November 27 to 29, 2012</td>
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<td>Advanced training</td>
<td>Fortbildungsveranstaltung für Immissionsschutz- und Störfallbeauftragte</td>
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<td>December 5, 2012</td>
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<td>10.+11. Dezember 2012</td>
<td>Brussels</td>
<td>Conference</td>
<td>Final Conference «Demonstration of Large Scale Biomass Co-Firing and Supply Chain Integration – DEBCO»</td>
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<td>February 20 to 22, 2013</td>
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<td>Seminar</td>
<td>Chemie im Wasser-Dampf-Kreislauf</td>
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<td>March 12 to 14, 2013</td>
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<td>March 13 and 14, 2013</td>
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<td>March 20 and 21, 2013</td>
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<td>Brandschutz im Kraftwerk</td>
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<td>April 9 to 11, 2013</td>
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<tr>
<td>April 24 and 25, 2013</td>
<td>Neuss</td>
<td>Conference with Exhibition</td>
<td>Power Plants in Competition</td>
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<td>May 13 and 14, 2013</td>
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<td>ÖI-Workshop</td>
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<td>May 15 and 16, 2013</td>
<td>Rotterdam</td>
<td>Workshop</td>
<td>Flue Gas Cleaning*</td>
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<td>June 11 and 12, 2013</td>
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<td>Gas Turbines and Operation of Gas Turbines</td>
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<td>June 19, 2013</td>
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</tr>
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</table>

Tab. 1: VGB events July 2012 to June 2013.
Energy Trade Fairs 2013

Similar to the past years, VGB was again represented at the joint stand of the associations at the trade fair «E-world at energy and water» held at Messe Essen in February 2013, and at the POWER-GEN Europe in Vienna/Austria. VGB took the opportunity to establish new contacts and to acquire new members.

VGB Publications

Christopher Weilbmann

VGB PowerTech Journal

From July 1, 2012 to June 30, 2013 a total of 153 technical articles were published in 11 editions of the International VGB PowerTech trade journal. Since January 2001, the joint international German-English bilingual edition of the former VGB KraftwerksTechnik has been published under the name of «VGB Power-Tech». The redesign of VGB PowerTech has been produced a high level of acceptance amongst member companies, subscribers and readers.

Since 2006, VGB PowerTech offers a digital version of the trade journal. The annual edition is always published at the end of May of the following year. In the meantime, the issues since 1990 were digitalised and are available on DVD covering some 18,000 pages.

VGB-standards

In the course of the Europeanisation of VGB PowerTech e V, it was decided that all VGB Guidelines and Instruction Sheets (hereafter marked and abbreviated VGB-R/M for ease of reference) should basically be published in German and English. They should be converted into documents with the new designation VGB-standards (VGB-S) by August 1, 2011. VGB-Standards can be translated into other languages if demanded by VGB member companies.

The following VGB-Standards, VGB Guidelines, VGB Instruction Sheets, Books and Reports have been completed during the year under review:

- VGB-S-009-S-00;2012-03-EN: Application of data reconciliation in accordance with VDI 2048
- VGB-S-025-00-2012-11-E: Electrical Generating Unit Protection
- VGB-S-026-00-2012-08-DE: Bautechnik bei Kernkraftwerken
- VGB-S-029-00;2012-03-EN: Maintenance-compatible documentation
- VGB-S-032-00-2012-11-DE: Kennzahlen und Checklisten zur Strukturierung und Optimierung der Prozesse in der Instandhaltung
- VGB-S-109-00;2012-08-DE-EN: Werkstoffspezifikation für drucktragende Komponenten in fossil befeuerten Kraftwerken
- Material specification for components under pressure in fossil-fried power plants
- VGB-S132-00-2013-04-DE: Empfehlungen für die Fremdvergabe von Instandhaltungsleistungen und die Überwachung der Qualitätsanforderungen
- VGB-S-S-215-00-2012-11-DE: Feuerfestsysteme in Anlagen zur thermischen Abfallverwertung
- VGB-S-S-217-00-2012-11-DE: Besonderheiten des Brandschutzes in Abfallverbrennungsanlagen
- VGB-S-S-217-00-2012-11-EN: Particularities of Fire Protection of Waste to Energy Plants
- VGB-S-302-00-213-04-DE: leitung zur Prüfung von DeNOx-Katalysatoren
- VGB-M 206e: Coal Bunkers – Planning, design, equipment and operation
- VGB-M 211e: Coal Handling in Power Plants
- VGB-M 218e: Gas distributor plates in fluidized bed systems
- VGB-RV801: Entsorgungshandbuch für Energiedienstleister
- VGB-TB121-13(CD): Kraftwerke im Wettbewerb 2013
- VGB-TB342e-13(CD): Flue Gas Cleaning 2013
- VGB-TB820-13(CD): Brandschutz im Kraftwerk - 2013
- VGB-B 101: Referenzkennzeichensystem für Kraftwerke RDS-PP Kennbuchstaben für Kraftwerksysteme (Systemschlüssel)
- VGB-B 101e: Reference Designation System for Power Plants RDS-PP Letter Codes for Power Plant Systems (System Key)
VGB PowerTech is co-operating with the following organisations and associations worldwide (in alphabetical order):

AGFW | Der Energieeffizienzverband für Wärme, Kälte und KWK e.V.
Arbeitsgemeinschaft Kernmaterial-Überwachung (AKU)
Arbeitsgemeinschaft Druckbehälter (AD)
Arbeitsgemeinschaft warmfeste Stähle
ASME American Society of Mechanical Engineers
Association of European Gypsum Industries
Bundesverband der Energie- und Wasserverwaltung (BDEW)
BDI Bundesverband der Deutschen Industrie
Berufsgenossenschaft der chemischen Industrie
Berufsgenossenschaft Feinmechanik und Elektrotechnik
Bundesverband der Gipsindustrie e.V.
BVK Bundesverband Kraftwerksnebenprodukte e.V.
CEN – Europäisches Komitee für Normung
CENELEC European Committee for Electrotechnical Standardization
Deutsche Akkreditierungsstelle «Stahlbau und Energietechnik e.V. (DASET)»
Deutsche Elektrotechnische Kommission (DKE)
dena – Deutsche Energie-Agentur
Deutsche Gesellschaft für chemisches Apparatewesen e.V. (DEHEMA)
Deutsche Vereinigung für Verbrennungsfragen e.V. (DVV)
Deutscher Ausschuss für Stahlbeton (DAfStb)
Deutscher Verband für Schweißtechnik e.V. (DVS)
Deutsches Atomforum e.V. (DAfF)
Deutsches Institut für Bautechnik
Deutsches Institut für Normung e.V. (DIN)
Deutsches Komitee Instandhaltung (DKIN)
ECOBA European Coal Combustion Products Association
EIPPCB European Integrated Pollution Prevention and Control Bureau
EnergieAgentur NRW
Entsorgungskommission (ESK)
EPPSA, European Power Plant Suppliers Association
EPRI Electric Power Research Institute
ENTSO European Network of Transmission System Operators for Electricity
ELUnited Turbines - European Association of Gas and Steam Turbine Manufactures
EURATOM Supply Agency
EURELECTRIC Union of the Electricity Industry
European Association for Coal and Lignite (EURACOAL)
European Wind Energy Association (EWEA)
Fachverband für Strahlenschutz e.V. (FS)
FDBR Fachverband Dampfkessel-, Behälter- und Rohrleitungsbau e.V.
FGSV Forschungsgesellschaft für Straßen- und Verkehrswesen
FORATOM, European Atomic Forum
Gemeinschaftsausschuss Kennzeichnungssysteme (GA KS)
GfS Gesellschaft für Simulatorschulung mbH
GVC/DEHEMA-Fachausschuss «Abfallbehandlung»
Hauptverband der gewerblichen Berufsgenossenschaften
HEA - Fachgemeinschaft für effiziente Energieanwendung e.V.
IAEA International Atomic Energy Agency
IEA International Energy Agency
IEA Clean Coal Centre
IERE Central Office
ITAD – Interessengemeinschaft Thermischer Abfallbehandlungsanlagen Deutschland e.V.
Kerntechnische Gesellschaft (KTG) e.V.
Kerntechnischer Ausschuss (KTA)
KSG Kraftwerks-Simulator-Gesellschaft mbH
Nationales Komitee des Weltenergierates der Bundesrepublik Deutschland (DNK)
OECD/NEA Nuclear Energy Agency
Performance Indicator Working Group (PIWG)
PGP-Committee (Performance of Generating Plant)
Reaktor-Sicherheitskommission (RSK)
Stahlinstitut VDEh
Strahlenschutzkommission (SSK)
TEC FLAM (Universitäts-Arbeitsgemeinschaft Technische Flammen)
TENPES – Thermal and Nuclear Power Engineering Society, Tokyo, Japan
VDMA Arbeitsausschuss «Gasturbinen»
Verband Kommunaler Städte- und Ortsverwaltungen (KVS)
Verband der Industriellen Energie- und Kraftwirtschaft e.V. (VIK)
Verein Deutscher Ingenieure (VDI)
Verein Deutscher Zementwerke (VDZ)
Wirtschaftsverband Kernbrennstoffkreislauf und Kerntechnik e.V. (WKK)
World Association of Nuclear Operators (WANO)
World Energy Council (WEC)
VGB Members

With its 277 ordinary member companies (power plant operators) from a total of 36 countries, VGB represents an electrical power plant capacity of around 530,000 MW (Figure 1).

In addition to the ordinary members, the work of VGB is supported by 230 sponsoring members involved in energy technology (mostly plant manufacturers and component suppliers) and affiliated members (mostly authorities and associations) in 23 European countries.

The large number of members, a total of 508, in the European and non-European companies highlights the significance of the work of VGB in the field of power plant engineering for the benefit of VGB member companies.

Fig. 1: VGB memberships according to European countries. Outside of Europe, another 17 companies in 11 countries are VGB members.
Power Plant Statistics

Hans-Joachim Meier, Stefan Prost and Jean-François Lehouge

A few definitions and results from the VGB Statistics »Availability of Thermal Power Plants« are presented in the accompanying summary. The data pool was created with the help of the VGB power plant information system »KISSY«. Using KISSY, the operating data from 668 power plants were recorded online.

VGB analysed the data in detailed in its annual reports »Availability of Thermal Power Plants« (VGB-TW 103 V) and »Analysis of Unavailability of Thermal Power Plants« (VGB-TW 103 A). The current annual reports contain the operating results for the operating period between 2003 and 2012. Statistical data for hydro power and pumped hydro power plants are implemented since 2013/2013.

Basic terminology for assessing the capacity of a power plant are shown in Figure 1 and Figure 2. All definitions are explained in detail in the VGB-Standard VGB-S-002-T01 »Basic Terms of the Electric Utility Industry«.

In the explanatory statements and in the statistical analyses, care was taken to highlight in green the operating times in which the power plant was continuously »available«.

Times of unavailability are highlighted in dark red (unplanned) or in light red (planned) throughout. Times in which a power plant was available, but could not be used, are highlighted in yellow.

Fig. 1: Performance indicators for power plant operators and load dispatchers

Fig. 2: Operating diagram and performance indicators
Fig. 3: VGB member units evaluated in 2012.
Fig. 4: Energy availability and energy utilisation. Data for 2012 and mean values for 2003 to 2012.
Fig. 5: Energy unavailability. Data for 2011 and mean values for 2002 to 2011
*) French nuclear power plants without "unplanned disposable labor NV"
Fig. 6: Nuclear power plants: availability data year 2012 and mean values 2003 to 2012.

Fig. 7: Hard coal-fired power plants: data for availability year 2012 and mean values 2003 to 2012.

Fig. 8: Lignite-fired power plants: data for availability year 2012 and mean values 2003 to 2012.

Fig. 9: Fossil-fired power plants: data for availability 2003 to 2012.
Association Structure
VGB Membership
Benefits and conditions of VGB membership

VGB PowerTech e.V. (VGB) aims, in accordance with statutory regulations, to unite all companies for which the power industry is an important basis, with the objective of joint support and raising operating safety, availability, compatibility with the environment and cost-effectiveness for the members of existing and future plants for heat and power generation.

VGB is working on the standardisation and the drawing up of Technical Guidelines and Regulations in the area of the above-mentioned plants.

Membership of VGB is voluntary. Membership with VGB is open to all companies operating the above-mentioned plants. There are three types of membership:

a) Ordinary members
   are companies operating or owning plants for the generation of power and heat. Companies with power plants in different locations can become a member as one body or each power plant can be a separate member.

b) Affiliated members
   are authorities, associations and federations interested in planning, construction and operation of plants for the generation of power and heat. The individual members of such associations and federations do not become members of the VGB.

c) Sponsoring members
   are companies and individuals making a substantial contribution to the planning, construction and operating of plants for the generation of power and heat.

Structure of members
The entire installed capacity of 530,000 MW of the VGB PowerTech members is represented in the following power plants (as of 30 June 2013):

- 306,000 MW fossil-fired power plants
- 130,000 MW nuclear power plants
- 94,000 MW hydro power plants and other renewables

The member contributions are taken in accordance with the contribution regulation for thermal power plants on the installed steam generating capacity and, for non-thermal power plants, for the electrical gross capacity.

In 2012/2013, 25 companies joined the VGB with a total capacity of 5,821 t/h. 22 companies with a total capacity of 13,155 t/h withdrew from VGB.

The installed steam generating capacity of the members at that point decreased by 13,574 t/h or 1% to a total of 1,514,584 t/h as a result of the steam generating capacity of the new members and after the drop in the steam generating capacity of the withdrawn companies.

The headquarters of 359 members are located in Germany, the country in which VGB PowerTech was set up in 1920. The headquarters of 152 members (30%) are located in further 35 countries in Europe and other parts of the world.

<table>
<thead>
<tr>
<th>Country</th>
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<tbody>
<tr>
<td>Argentina</td>
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<tr>
<td>Australia</td>
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<td>Belgium</td>
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<td>Brazil</td>
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<td>China</td>
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<td>Denmark</td>
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<td>Germany</td>
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<td>United Kingdom</td>
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<td>Russia</td>
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<td>Spain</td>
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<td>South Africa</td>
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<td>Czech Republic</td>
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<td>Turkey</td>
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<td>Hungary</td>
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<td>USA</td>
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</table>

511 Companies from 36 countries
Size of members with thermal power plants according to installed steam capacity.

<table>
<thead>
<tr>
<th>Size</th>
<th>Share 2011/2012 in %</th>
<th>Share 2012/2013 in %</th>
<th>Share of total steam capacity 2011/2012 in %</th>
<th>Share of total steam capacity 2012/2013 in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 200 t/h</td>
<td>34.0</td>
<td>34.3</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>201 to 500 t/h</td>
<td>20.1</td>
<td>19.5</td>
<td>1.3</td>
<td>1.4</td>
</tr>
<tr>
<td>501 to 1,000 t/h</td>
<td>8.3</td>
<td>9.4</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>more than 1,000 t/h</td>
<td>37.6</td>
<td>36.8</td>
<td>96.4</td>
<td>96.3</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

On June 30, 2013 VGB had the following membership

<table>
<thead>
<tr>
<th>Public supply companies (utilities)</th>
<th>Number</th>
<th>Steam capacity in t/h</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>181</td>
<td>1,473,169</td>
<td>65.8</td>
<td>97.3</td>
</tr>
<tr>
<td>Industrial supply companies</td>
<td>96</td>
<td>41,415</td>
<td>34.2</td>
</tr>
<tr>
<td>Total</td>
<td>277</td>
<td>1,514,584</td>
<td>100</td>
</tr>
<tr>
<td>Affiliated members</td>
<td>27</td>
<td></td>
<td></td>
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<tr>
<td>Sponsoring members</td>
<td>207</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>511</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List of ordinary, affiliated and sponsoring VGB Members (Status: June 30, 2013)

Ordinary members

Abfallwirtschaftsbetrieb Stadt Nürnberg, Nuremberg/Germany
Ahlstrom Osnabrück GmbH, Osnabrück/Germany
Air Liquide Industrie B.V., Rotterdam/Netherlands
Akzo Nobel Industrial Chemicals B.V., Hengelo/Netherlands
Allessa Chemie GmbH, Frankfurt am Main/Germany
AMK – Abfallentsorgungsgesellschaft des Märkischen Kreises mbH, Iserlohn/Germany
Andhra Pradesh Power Generation Corporation Ltd., Hyderabad/India
Arbeitsgemeinschaft Versuchs-Reaktor (AVR) GmbH, Jülich/Germany
Armstrong DLW GmbH, Bietigheim-Bissingen/Germany
AVA Abfallverwertung Augsburg GmbH, Augsburg/Germany
AVA Velsen mbH, Saarbrücken/Germany
AVBKG Abfallverbrennungs- und Biokompost-Gesellschaft mbH, Tornesch-Altenholze/Germany
AVEA Entsorgungsbetriebe GmbH & Co. KG, Engelskirchen/Germany
AVG Abfallentsorgungs- und Verwertungsgesellschaft Köln mbH, Cologne/Germany
AWG Abfallwirtschaftsgesellschaft mbH Wuppertal, Wuppertal/Germany
Axpo Power AG, Baden/Switzerland
Basell Polyolefine GmbH, Wesseling/Germany
BASF SE, Ludwigshafen/Rhein/Germany
Bayer MaterialScience AG, Brunsbüttel/Germany
Bayer Pharma AG, Bergkamen/Germany
Bayer Pharma AG, Berlin/Germany
Bayer Technology Services GmbH, Leverkusen/Germany
BEKW Bioenergiekraftwerk Emsland GmbH & Co. KG, Emlichheim/Germany
Berliner Stadtrenigungsbetriebe, Berlin/Germany
Biomass Heizkraftwerk GmbH, Ludwigshafen/Germany
BioMa Energie AG, Salzburg/Austria
BiOPOWER SKW GmbH, Eberhardzell/Germany
BKW ENERGIE AG, Berne/Switzerland
Boehringer Ingelheim Pharma KG, Ingelheim am Rhein/Germany
BP Europa SE, Lingen/Ems/Germany
Brauerei Beck GmbH & Co. KG, Bremen/Germany
Braunschweiger Versorgungs-AG & Co. KG, Braunschweig/Germany
Bremerhavener Entsorgungsgesellschaft mbH, Bremerhaven/Germany
Cargill Germany GmbH, Krefeld/Germany
Carmel Olefins Ltd. Haifa/Israel
Centrales Nucleares Almaraz Trillo, Madrid/Spain
CEZ a.s., Praha/Czech Republic
Colakoglu Metalurji, Kocaeli/Turkey
CURRENTA GmbH & Co. OHG, Leverkusen/Germany
Daimler AG, Sindelfingen/Germany
DNV KEMA, Arnhem/Netherlands
Donausäge Rumpmayr GmbH, Enns/Austria
DONG Energy Power A/S, Fredericia/Denmark
Dow Wolff Cellulosics GmbH, Walsrode/Germany
Drax Power Ltd., North Yorkshire/United Kingdom
DREWAG – Stadtwerke Dresden GmbH, Dresden/Germany
DSM Nutritional Products GmbH, Grenzach-Wyhlen/Germany
E.ON Benelux, Rotterdam/Netherlands
E.ON Energy from Waste AG, Helmstedt/Germany
E.ON Energy from Waste Saarbrücken GmbH, Saarbrücken/Germany
E.ON Kernkraft GmbH, Hanover/Germany
E.ON Kraftwerke GmbH, Hanover/Germany
E.ON Kraftwerke GmbH, Landshut/Germany
E.ON UK plc, Coventry/United Kingdom
E.ON Vattenkraft Sverige AB, Malmö/Sweden
E.ON Westfalen Weser Energie-Service GmbH, Kirchlengern/Germany
EdeA v.o.f., Geleen/Netherlands
EDP Gestao da Producao de Energia S. A., Lisbon/Portugal
Egger Holzwerkstoffe Brilon GmbH & Co. KG, Brilon/Germany
EGK Entsorgungsgesellschaft Krefeld GmbH & Co KG, Krefeld/Germany
eins energie in sachsen GmbH & Co. KG, Chemnitz/Germany
Electrabel Nederland n.v., Zwolle/Netherlands
Electricité de France, Paris/France
ELETRONUCLEAR S. A. Dept.: Assessoria de Segurança Nuclear – ASEO, Rio de Janeiro/Brazil
EntW Stadtwerke Mannheim GmbH, Mannheim/Germany
ENTW Bernhard Schulte GmbH, Wiesbaden/Germany
ENBW Kraftwerke AG, Stuttgart/Germany
ENEL Ingegneria e Ricerca S.p.A., Roma/Italy
energetika JAVNO PODJETJE ENERGETIKA LJUBLJANA p.o., Ljubljana/Slovenia
ENERGIE AG Oberösterreich, Linz/Austria
Energie Steiermark AG, Graz/Austria
Energie und Wasser Potsdam GmbH, Potsdam/Germany
Energiedienst AG, Rheinfelden/Germany
Energieversorgung Oberhausen AG (EVO), Oberhausen/Germany
Energieversorgung Offenbach AG, Offenbach am Main/Germany
Enertec Hameln GmbH, Hameln/Germany
envia THERM GmbH, Halle/Germany
EPZ, Vlissingen/Netherlands
ERZ Entsorgung + Recycling Zürich, Zürich/Switzerland
ESB Electricity Supply Board, Dublin/Ireland
ESKOM Johannesburg/South Africa
Essent, Eindhoven/Netherlands
EuroSibenergo-Engineering, Moskva/Russia
EVN AG, Maria Enzersdorf am Gebirge/Austria
EWN Energiewerke Nord GmbH, Lubmin/Germany
Federal State Unitary Enterprise, Balakovo Saratov/Russia
Fernwärme Ulm GmbH (FUG), Ulm/Germany
Fernwärme Wien Ges.M.B.H., Vienna/Austria
Formarks Kraftgrupp AB, Öshammar/Sweden
Fortum Power and Heat Oy, Fortum/Finland
Fraunhofer Institut Umwelt-, Sicherheits-, Energietechnik UMSICHT, Oberhausen/Germany
Freudenberg & Co. KG, Weinheim/Germany
GDF SUEZ - ELECTRABEL, Brussels/Belgium
Gebr. Lang GmbH Papierfabrik, Ettlingen/Germany
GECOL - General Electric Corporation of Libya, Tripoli/Libya
Gemeinschaftskraftwerk Veltheim GmbH, Porto-Westfalica/Germany
Gemeinschaftskraftwerk Weser GmbH & Co. OHG, Emmerthal/Germany
Gemeinschafts-Müll-Verbrennungsanlage Niederrhein GmbH, Oberhausen/Germany
GFA – Gemeinsames Kommunalunternehmen für Abfallwirtschaft, Oelching/Germany
GKS Gemeinschaftskraftwerk Schweinfurt GmbH, Schweinfurt/Germany
Glunz Holzwerkstoffproduktion GmbH, Horn-Bad/Germany
Grace GmbH & Co. KG, Worms/Germany
Grosskraftwerk Mannheim AG, Mannheim/Germany
Gunvor Raffinerie Ingolstadt GmbH, Ingolstadt, Germany
Heizkraftwerk Pfaffnau der Universität Stuttgart, Stuttgart/Germany
Heizkraftwerk Pforzheim GmbH, Pforzheim/Germany
Heizkraftwerk Würzburg GmbH, Würzburg/Germany
Heizkraftwerksgesellschaft Cottbus GmbH, Cottbus/Germany
Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Berlin/Germany
Helsingin Energia, Helsinki/Finland
HIM GmbH, Biebesheim/Germany
HSE HEAG Südhessische Energie AG, Darmstadt/Germany
INEOS Manufacturing Germany GmbH, Cologne/Germany
Infraroc GmbH, Marl/Germany
InfraServ GmbH & Co Höchst KG, Frankfurt a.M./Germany
InfraServ GmbH & Co. Gendorf KG, Burgkirchen/Germany
InfraServ GmbH & Co. Wiesbaden KG, Wiesbaden/Germany
Iskenderun Enerji Üretim Ve Tic. A. S., Ankara/Turkey
Jungbunzlauer Ladenburg GmbH, Ladenburg/Germany
Jyväskylän Energia Oy, Jyväskylä/Finland
K+S Aktiengesellschaft, Kassel/Germany
Karlsruher Institut für Technologie (KIT), Karlsruhe/Germany
KELAG-Kärntner Elektrizitäts-AG, Klagenfurt/Austria
Kernkraftwerk Gösgen-Däniken AG, Däniken/Switzerland
Kernkraftwerk Leibstadt AG, Leibstadt/Switzerland
KNG Kraftwerks- und Netzgesellschaft mbH, Rostock/Germany
Kommanditgesellschaft Deutsche Gasrußwerke GmbH & Co., Dortmund/Germany
Kraftwerk Obernburg GmbH, Obernburg/Germany
Kraftwerk Schwedt GmbH & Co. KG, Schwedt (Oder)/Germany
Kraftwerke Gera GmbH, Gera/Germany
Kraftwerke Mainz-Wiesbaden AG, Mainz/Germany
KUNZ Unitherm Baruth GmbH, Baruth/Mark/Germany
Laborelec S. A. (for the GDF Suez Group), Linkebeek/Belgium
Lahti Energia Oy, Lahti/Finland
Lappeenrannan Lämpövoima Oy, Lappeenranta/Finland
Lech-Elektrizitätswerke AG, Augsburg/Germany
Lenzing AG, Lenzing/Austria
Linz Strom GmbH für Energieerzeugung, -verteilung und Telekommunikation, Linz/Austria
Mainova AG, Frankfurt am Main/Germany
Mälarenenergi AB, Västeras/Sweden
Mark-E Aktiengesellschaft, Hagen/Germany
Martinwerk GmbH, Bergheim/Germany
Mátrai Erőmű Zrt, Visonta/Hungary
MAYRMELNHOF KARTON GmbH, Frohnleiten/Austria
Membrana GmbH, Wuppertal/Germany
Meridian Energy Australia Pty Ltd., Chatswood NSW/Australia
MHB Hamm Betriebsführungsgesellschaft mbH, Hamm/Germany
MIBRAG mbH, Zelt/Germany
MIRO Mineralöleffnerie Oberrhein GmbH & Co. KG, Karlsruhe/Germany
Mondi Neusiedler GmbH, Ulmerfeld/Austria
Moritz J. Weig GmbH & Co. KG, Mayen/Germany
Müllheizkraftwerk Kassel GmbH, Kassel/Germany
Müllverbrennungsanlage Bielefeld-Herford GmbH, Bielefeld/Germany
Müllverbrennungsanlage der Stadt Solingen, Solingen/Germany
MVV Energie AG, Mannheim/Germany
N.V. Delta Nutsbedrijven, Middelburg/Netherlands
National Thermal Power Corporation Ltd., Distt. Gautam Budh Nagar/India
Nehlsen Heizkraftwerke GmbH & Co. KG, Stevenhagen/Germany
N-ERGIE AG, Nuremberg/Germany
Nettingsdorfer Papierfabrik AG & Co KG, Haid bei Ansfelden/Austria
Nokian Lämpövoima Oy, Vaasa/Finland
Nucleoelectrica Argentina SA, Buenos Aires/Argentina
Nuon Energie & Service GmbH, Heinsberg/Oberbruch/Germany
NUON Energy Power, Heat & Services, Utrecht/Netherlands
Nuon Power Buggenum, Buggenum/Netherlands
Oil Refineries Ltd., Haifa/Israel
OMV Germany GmbH, Burghausen/Germany
OMV Power International GmbH, Vienna/Austria
OMV Refining & Marketing GmbH, Vienna/Austria
ÖREBRO ENERGI AB, Örebro/Sweden
OXEA GmbH, Oberhausen/Germany
Paks AG, Paks/Hungary
Papierfabrik August Koehler SE, Oberkirch/Germany
Papierfabrik Meldorf GmbH & Co. KG, Tornesch/Germany
PERM GRES, Dobrjanka Perm/Russia
Pfeifer & Langen GmbH & Co. KG, Cologne/Germany
Public Power Corporation S. A., Athens/Greece
Punjab State Electricity Board, Patiala/India
PVO-Lämpövoima Oy, Vaasa/Finland
RAG Anthrazit Ilbenbüren GmbH, Ilbenbüren/Germany
REMONTDIS Production GmbH, Lünen/Germany
Reno De Medici Arnsberg GmbH, Arnsberg/Germany
RheinEnergie AG, Cologne/Germany
Romande Energie SA, Morges/Switzerland
ROMONTA GmbH, Seegbiet Mansfelder Land/Germany
RWE Power AG, Essen/Germany
RWTH Aachen, Aachen/Germany
S.C. Electrocentrale Bucuresti S.A., Bucharest/Romania
S.C. Termoelectrica S.A., Bucharest/Romania
Sachtleben Chemie GmbH, Duisburg/Germany
Salzburg AG, Salzburg/Austria
Salzgitter Flachstahl GmbH, Salzgitter/Germany
Sappi Austria Produktions-GmbH Co. KG, Gratkorn/Austria
SCA Hygiene Products GmbH, Mannheim/Germany
SCA Packaging Containerboard Germany GmbH, Aschaffenburg/Germany
Schluchsee werk AG, Laufenburg/Germany
SEO Société de l’Our Centrale de Vian den, Vian den/Luxembourg
Smurfit Kappa Herzberger Papierfabrik GmbH, Herzberg am Harz/Germany
Smurfit Kappa Zülpich Papier GmbH, Zülpich/Germany
Solvay Acetow GmbH, Freiburg/Germany
SOLVAY Infra GMBH, Rheinberg/Germany
SRS EcoTherm GmbH, Salzbergen/Germany
Städtische Werke Energie + Wärme GmbH, Kassel/Germany
Stadtreinigung Hamburg, Hamburg/Germany
Stadtw erke Augsburg Energie GmbH, Augsburg/Germany
Stadtw erke Bielefeld GmbH, Bielefeld/Germany
Stadtw erke Bochum Holding GmbH, Bochum/Germany
Stadtw erke Craulsheim GmbH, Craulsheim/Germany
Stadtw erke Duisburg AG, Duisburg/Germany
Stadtw erke Düsseldorf AG, Düsseldo r/Germany
Stadtw erke Flensburg GmbH, Flensburg/Germany
Stadtw erke Hannover AG, Hanovo r/Germany
Stadtw erke Karlsruhe GmbH, Karlsruhe/Germany
Stadtw erke Leipzig GmbH, Leipzig/Germany
Stadtw erke Münster GmbH, Münster/Germany
Stadtw erke Rosenheim GmbH & Co. KG, Rosenheim/Germany
Stadtw erke Rostock AG, Rostock/Germany
Stadtw erke Saarbrücken AG, Saarbrücken/Germany
Starkraft, Oslo/Norway
STEAG GmbH, Essen/Germany
STEAG Power Saar GmbH, Saarbrücken/Germany
Stora Enso Maxau GmbH, Karlsruhe-Maxau/Germany
SWB Energie- und Wasserversorgung Bonn/Rhein-Sieg GmbH, Bonn/Germany
swb Entsorgung GmbH & Co. KG, Bremen/Germany
swb Erzeugung GmbH & Co. KG, Bremen/Germany
SWB Verwertung MVA Bonn GmbH, Bonn/Germany
SWM Versorgungs GmbH, Munich/Germany
SWN Stadtw erke Neumünster GmbH, Neumünster/Germany
SWU Energie GmbH, Ulm/Germany
Tampere Energy Production Ltd, Tampere/Finland
TAURON Wytwarzanie S.A., Katowice/Poland
Technische Hochschule Lund, Lund/Sweden
Technische Universität München, Forschungsneutronenquelle Heinz Maier-Leibnitz [FRM II], Garching/Germany
Technische Werke Ludwigshafen AG, Ludwigshafen am Rhein/Germany
Teodisuuden Voima Oyj, Eurajoki/Finland
TERMINELEKTRARNA SOSTANJ d.o.o., Sostanj/Slovenia
TERMINELEKTRARNA TOPLARNA LJUBLJANA, Ljubljana/Slovenia
TheIsraelElectricCorporation Ltd., Haifa/Israel
Thyssen Krupp Steel AG, Duisburg/Germany
TIWAG-Tiroler Wasserkraftwerke AG, Innsbruck/Austria
Transitgas AG, Zürich/Switzerland
Trianel Gaskraftwerk Hamm GmbH & Co. KG, Aachen/Germany
Trianel Kohlekraftwerk Hamm GmbH & Co. KG, Lünen/Germany
UPM GmbH, Augsburg/Germany
UPM-Kymmene Austria GmbH, Steyrermühl/Austria
Vantaan Energia Oy, Vantaa/Finland
Vaskiluodon Voima Oy, Vaasa/Finland
Vattenfall A/S Generation Nordic, Copenhagen/Denmark
Vattenfall AB ELPRODUKTION Kraftwerk Ringhals, Stockholm/Sweden
Vattenfall Europe Generation AG, Cottbus/Germany
Vattenfall Europe New Energy GmbH, Hamburg/Germany
Vattenfall Europe Nuclear Energy GmbH, Hamburg/Germany
Vattenfall Europe Wärme AG, Berlin/Germany
Vattenfall Värmekraft, Stenungsund/Sweden
Vattenfall Wärme Hamburg GmbH, Hamburg/Germany
VERBUN D Hydro Power AG, Vienna/Austria
VERBUN D Thermal Power GmbH & Co. KG, Graz/Austria
voestalpine Stahl GmbH, Linz/Austria
Voigt & Collegen GmbH, Düsseldo r/Germany
Vorarlberger Illwerke AG, Schruns/Austria
VSE AG, Ensdorf/Germany
VW Kraftwerk GmbH, Wolfsburg/Germany
Wels Strom GmbH, Wels/Austria
werp Wärme-, Energie- und Prozesstechnik GmbH, Hückelhoven/Germany
WIEN ENERGIE GmbH, Vienna/Austria
WindMW GmbH, Bremerhaven/Germany
WindStrom Betriebs- und Verwaltungsgesellschaft GmbH, Edemissen/Germany
Windtest Grevenbroich GmbH, Grevenbroich/Germany
WKU Windkraft Union AG, Hamburg/Germany
WSW Energie und Wasser AG, Wuppertal/Germany
Zellstoff Pöls AG, Pöls/Austria
Zellstoff Stendal GmbH, Arneburg/Germany
Zweckverband Abfallverwertung Südostbayern, Burgkirchen/Germany
Zweckverband für Abfallwirtschaft Südwestthüringen, Zella-Mehlis/Germany
Zweckverband Müllverwertung Schwandorf, Schwandorf/Germany
Zweckverband Müllverwertungsanlage Ingolstadt, Ingolstadt/Germany
Zweckverband Restmüllheizkraftwerk Böblingen (RBB), Böblingen/Germany

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ALL-RUSSIA THERMAL ENGINEERING INSTITUTE, Moskva/Russia
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EKONERG, Zagreb/Croatia
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ELFORSK, Stockholm/Sweden
epro Elektronik & Systemtechnik GmbH, Gronau/Germany
FORCE Institutes, Broendby/Denmark
Fachverband Dampfkessel-, Behälter- und Rohrleitungsbau e.V., Düsseldorf/Germany
Germanischer Lloyd SE, Hamburg/Germany
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SOLIDO Bautenschutz GmbH, Steinfurt/Germany
The Government Implementing Agency ENERGY Authority, Ulaanbaatar/Mongolia
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TÜV Rheinland Industrie Service GmbH, Cologne/Germany
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ACE European Group Ltd., Cologne/Germany
Allianz Risk Consulting GmbH, Munich/Germany
Alpine Bau Germany AG, Dortmund/Germany
ALSTOM AUSTRIA GmbH, Vienna/Austria
ALSTOM Power Systems GmbH, Mannheim/Germany
ANDRITZ Energy & Environment GmbH, Raaba, Graz/Austria
Andritz Hydro GmbH, Ravensburg/Germany
Aon Jauch & Hübener GmbH, Mülheim an der Ruhr/Germany
ARCA Regler GmbH, Tonisvorst/Germany
Areva NP GmbH, Erlangen/Germany
Avalon GmbH, Rheine/Germany
AXA Corporate Solutions, Cologne/Germany
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Babcock Borsig Steinmüller GmbH, Oberhausen/Germany
Babcock Industry and Power GmbH, Oberhausen/Germany
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Barlage GmbH, Flechum/Germany
Barre, Ploemeur/France
Bechmann, Dr., Cologne/Germany
Bharat Heavy Electricals Limited, Hyderabad/India
BHK Aindling GmbH, Herten/Germany
Bilfinger Maschinenbau GmbH, Velbert/Germany
Bilfinger Piping Technologies GmbH, Essen/Germany
Bilfinger Rosink GmbH, Nordhorn/Germany
BK Giuliani GmbH, Düsseldorf/Germany
Böhler Schweisstechnik Germany GmbH, Hamm/Germany
Bopp & Reuther Sicherheits- und Regelarmaturen GmbH, Mannheim/Germany
Braun Industrieservice, Dortmund/Germany
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Burmeister & Wain Energy A/S, Kgs. Lyngby/Denmark
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CARMUSE, Louvain-la-Neuve/Belgium
CCI AG, Balterswil/Switzerland
Clyde Bergemann GmbH, Wesel/Germany
Conco Systems SPRL, Brussels/Belgium
Container Company GmbH & Co. KG, Krefeld/Germany
Daume Regelarmaturen GmbH, Isernhagen/Germany

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<table>
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<th>Company Name</th>
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<td>Institut für Studien und Entwürfe der Energiewirtschaft (ISPE), Bucharest, Romania</td>
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Lams, Hr., Edegem/Belgium
LISEGA SE, Zeven/Germany
Lloyd’s Register Quality Assurance GmbH, Cologne/Germany
LUTHARDT AG, Berlin/Germany
M+M Group GmbH, Stuttgart/Germany
Magaldi Power S.p.A., Salerno/Italy
Maintenance Partners Belgium N.V., Oberhausen/Germany
MAN Diesel & Turbo SE, Oberhausen/Germany
Marsh GmbH, Düsseldorf/Germany
MC-Bauchemie Müller GmbH & Co. KG, Bottrop/Germany
Metro Automation GmbH, Leverkusen/Germany
Metso Power, Vienna/Austria
MHI Engineering Vienna GmbH, Vienna/Austria
Minimax GmbH & Co. KG, Bad Oldesloe/Germany
MPG Mendener Präzisionsrohr GmbH, Menden/Germany
Müller-BBM GmbH, Planegg/Germany
Münchner Rückversicherungs-Gesellschaft AG, Munich/Germany
Nalco Germany GmbH, Frankfurt am Main/Germany
National Electric Coil (NEC), Ohio/U.S.A.
Natus GmbH & Co. KG, Trier/Germany
Noakowski, Prof. Dr.-Ing., Düsseldorf/Germany
NUKEM Technologies GmbH, Alzenau/Germany
NV-EnergTech GmbH, Dinslaken/Germany
Oschatz GmbH, Essen/Germany
Outotec GmbH, Oberursel/Germany
PATIG GmbH, Philippsburg/Germany
PELZ GmbH & Co. KG, Moers/Germany
Pöyry Germany GmbH, Hamburg/Germany
Pöyry SwedPower AB, Nyköping/Sweden
Preller Gesellschaft für Leittechnik mbH, Adelsdorf-Aisch/Germany
Pro Novum Sp.z.o.o., Katowice/Poland
PUT GmbH, Stuttgart/Germany
RAFAKO S.A., Raciborz/Poland
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Schenck Process GmbH, Darmstadt/Germany
Schlackeverwertung Breisgau GmbH, Eschbach/Germany
Schukar GmbH, Hagen/Germany
SENSOPLAN GmbH, Hohentengen a.H./Germany
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Siemens Aktiengesellschaft, Erlangen/Germany
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Stell GmbH, Bocholt/Germany
StoCretec GmbH, Kriftel/Germany
Stork Technical Services GmbH, Essen/Germany
STRABAG AG, Düsseldorf/Germany
STRABAG Energy Technologies GmbH, Vienna/Austria
Taprogge Gesellschaft mbH, Wetter (Ruhr)/Germany
TECRCE GmbH, Lünen/Germany
THERMOPROCESS Wärmebehandlungsservice GmbH, Mülheim/Ruhr/Germany
TIG Group GmbH, Husum/Germany
TMS Turboschwingenservice GmbH, Bad Dürkheim/Germany
Turbo-Technik Reparaturs-Werk GmbH & Co. KG, Wilhelmshaven/Germany
UCC Europe GmbH, Essen/Germany
V & M Germany GmbH, Düsseldorf/Germany
VAG-Armaturen GmbH, Mannheim/Germany
Vallourec & Mannesmann Tubes, Boulogne-Billancourt/France
Vattenfall Europe PowerConsult GmbH, Vetschau/Spree/Germany
VINCI Energies Germany GmbH, Frankfurt a.M./Germany
Visser & Smit Hanab GmbH, Kaarst/Germany
VLEGASUNIE B.V., Culemborg/Netherlands
Voith Hydro GmbH & Co. KG, Heidenheim/Germany
Voith Industrial Services GmbH & Co. KG, Speyer/Germany
Voith Turbo GmbH & Co. KG, Crailsheim/Germany
VWS Germany GmbH, Celle/Germany
Wayss & Freytag Ingenieurbau AG, Frankfurt am Main/Germany
Weir Minerals Germany GmbH, Heilbronn/Germany
Weldotherm WTD GmbH, Heilbronn/Germany
Welland & Tuxhorn AG, Bielefeld/Germany
Wessel GmbH, Xanten/Germany
Westinghouse Electric Germany GmbH, Mannheim/Germany
Witzenmann GmbH, Pforzheim/Germany
Wood Group Gas Turbine Services GmbH, Mülheim/Germany
WSB Service GmbH, Dresden/Germany
ZERNA Planen und Prüfen GmbH, Bochum/Germany
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(Status: June 30, 2013)

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(1st Vice-Chairman)
Chief Executive Officer,
E.ON Generation GmbH, Hanover/Germany
Giger, François, Dr.
(2nd Vice-Chairman)
Manager Strategy,
EDF Fossil-fired Generation and Engineering,
Saint-Denis/France
Altmann, Hubertus, Dipl.-Ing.
Member of the Board of Directors,
Vattenfall Europe Generation AG, Cottbus/Germany
Gruber, Karl-Heinz, Dipl.-Ing. Dr.
Member of the Board of Directors,
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Lambertz, Johannes, Dr.
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RWE Power AG, Essen/Germany

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EURELECTRIC, Brussels/Belgium
Bergh-Hansen, Niels
Director, DONG Energy Power A/S, Frederica/Denmark
Brockmeier, Udo, Dr.
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Stadtwerke Düsseldorf AG, Düsseldorf/Germany
Czychon, Karl-Heinz, Dr.
Member of the Board of Directors,
Grosskraftwerk Mannheim AG, Mannheim/Germany
Dames, Brian
Chief Executive Officer,
Eskom, Johannesburg/South Africa
Dany, Gundolf, Dr.
Regional Senior Vice President,
Statkraft Markets GmbH, Hürth/Germany
Dub, Werner, Dr.
Member of the Board of Directors,
MVV Energie AG, Mannheim/Germany
Frense, Stephan
Chief Executive Officer (until March 2013),
E.ON Anlagenservice, Gelsenkirchen/Germany
Fübi, Michael, Dr.
Chief Executive Officer, RWE Technology GmbH
Essen/Germany
Gilgen, Ralf, Dr.
Member of the Board of Management
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Essen, August 2013