

PROGRESS REPORT 2018

KRAFTWERKSSCHULE E.V.
KNOWLEDGE WORKMANSHIP SAFETY



Foreword

The current Progress Report of KRAFTWERKSSCHULE E.V. (KWS PowerTech Training Center) informs members about basic and advanced training events conducted, related activities and projects as well as covering panel work during the report period from January 1st, 2018 to December 31st, 2018. Many members continue to face the challenges brought about by political decisions affecting Germany's power industry. Approx. 60 percent of the country's power generation came from fossil and nuclear sources and roughly 40 percent from renewables, facilitating an environmentally friendly, affordable and secure energy supply.

During the report period, enrollment in plant attendant, power plant operator and power plant shift supervisor courses in the field of conventional power plant technology was high. Continued increasing demand for on-site training measures for individual facility operators was met.

In 2018, simulators for lignite, hard coal and CCGT power plants were once again used for conducting hands-on basic and advanced personnel training. Training includes introductory and basic courses as well as consolidation and enhancement courses. In addition, customer-specific training was conducted. In accordance with customer needs, topics were selected from KWS' training module pool and arranged in an individualized curriculum. A simulator was installed on-site at the Les Awirs power plant in Belgium for four weeks for shift personnel and novice engineer instruction. This former coal-fired plant has been converted to biomass incineration; the training courses prepare crews for the new mode of operation. EnecoGen, a Dutch company, has pledged post-blackout grid reconstruction to the system operator in charge. Thanks to KWS's simulators, this as yet infrequent occurrence can be rehearsed safely.

In nuclear technology seminars, our activities focused on teaching fundamentals, operations management, skill retention and radiation protection.

In the field of renewable energies, courses for wind energy and hydropower installation personnel were conducted. An important milestone has been reached in our new "Empower Refugees" effort. 12 young male refugees from Syria and Iran have been participating in the first training module since March 2018. In mid-August, all participants cleared the first hurdle by successfully completing this part of the project, a

five-month advanced training measure that prepared them for electrotechnology training with a specialization in wind power installations.

Overall training demand in the area of thermal waste treatment was satisfyingly high. Basic and advanced training demand in this branch of the industry is particularly high, therefore KWS is currently developing specific courses at the supervisor level and below in close coordination with the respective inter-trade organization and CCI Essen, Germany. An initial "Plant Operator Thermal Waste Treatment (TWT)" pilot course has already been conducted during the fourth quarter of 2018.

Various member companies react to market demands by conducting adjustment and optimization measures. KWS accompanies these measures at the plant and the shift crew level with Best Practice Workshops in the areas of social, methodical and personal skill development, for example. Such workshops focused on the workplace behavior of staffers, on teamwork, communication, decision making as well as on control and supervisory activities.

Compared with an exceptionally good previous year, international activities were down in 2018.

Particularly worthy of mention are operating personnel training measures conducted in the United Kingdom, Turkey, Russia and Sudan.

The DIN EN ISO 9001:2015 recertification audit of the quality management system yielded an outstanding result in verification and effectiveness without any deviations from standard or flaws.

The first monitoring audit of our AZAV (German acronym for "Akkreditierungs- und Zulassungsverordnung Arbeitsförderung", a Federal German ordinance for ensuring training provider quality) certificate went very well. On the basis of this certificate, we received our first license for a training coupon measure from the Federal Employment Agency.

In conclusion, we would like to express our heartfelt gratitude for your trust vested in us. Today and tomorrow, we continue to be your competent service provider for basic and advanced training of operating personnel, for organizational counseling and human resource development as well as for the construction and development of power plant simulators.

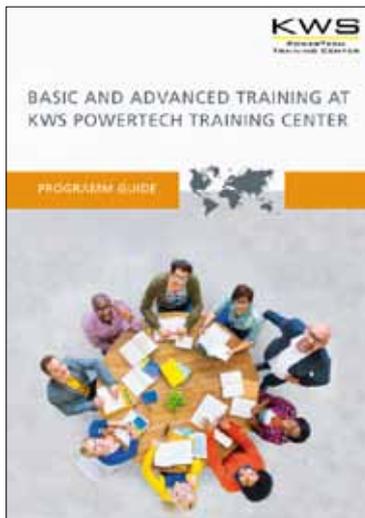


Ernst Michael Züfle
Managing Director

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Program Guide



(QR-Code valid until end of 2019)



Performance in 2018

Services of KWS PowerTech Training Center: An overview

The range of KWS's services are best described with the terms basic and advanced training, qualification and counseling. KWS's basic training offerings meet the legal framework of Germany's Vocational Training Act, Occupational Safety Act and Atomic Energy and Radiation Protection Law. Plant Attendant, Power Plant Operator and Power Plant Shift Supervisor courses are unequivocally designed to provide the entire power industry with qualified and certified personnel of the highest order. The wide range of KWS's advanced training offerings enables companies to maintain, adapt or enhance the professional skills of its operating personnel. This area of services comprises certified training courses, officially approved courses, but also customized instruction measures. KWS's comprehensive training simulator pool permits offering companies a wide range of in-depth training options for power plant operating personnel. Counseling is the latest addition to KWS's training offerings and concerns itself with the topics of management consultation and human resources development.

NUMBER OF PARTICIPANTS, COURSES CONDUCTED, TRAINING MEASURES AND PARTICIPANT DAYS: ALL DEPARTMENTS

January 01 – December 31, 2018	Courses conducted	Number of Participants	Number of Participant Days
Conventional Power Plant Technology	107	1.203	28.746
Nuclear Technology/Radiation Protection	55	702	1.708
Simulator Training	116	570	3.778
Organization Development	14	34	113
Renewable Energies	6	60	323
International Activities	12	149	1.113
Total	310	2.718	35.781

Conventional Power Plant Technology

Basic and advanced theoretical training comprises all instruction measures designed to amplify, expand or renew the professional knowledge and skills of employees who have already completed a first stage of vocational training. Qualification demands on each individual power plant employee increase, with regard to both technical and social skills. The concept of lifelong learning is part of working life, especially in a complex technical environment like a power plant.

NUMBER OF PARTICIPANTS, COURSES CONDUCTED AND PARTICIPANT DAYS: POWER PLANT OPERATORS, POWER PLANT SHIFT SUPERVISORS AND CUSTOMER-SPECIFIC ADVANCED TRAINING MEASURES

January 01 – December 31, 2018	Courses conducted	Number of Participants	Number of Participant Days
Power Plant Operators	15	253	10.580
Power Plant Shift Supervisors–Production	14	216	12.835
Power Plant Shift Supervisors– Production Electrical and Control Engineering	6	82	2.016
Thermal Waste Treatment	3	37	1.041
Advanced Training Measures	20	214	1.396
Customer-Specific Advanced Training Measures	49	401	878
Total	107	1.203	28.746

Among others, the following courses were held during the report period:

Plant Attendants

17th training course

Module Basic with 17 participants

Module Steam Generation with 17 participants

Module Turbines with 13 participants

18th training course

Module Basic with 23 participants

Module Dampferzeuger with 24 participants

Module Turbinen with 23 participants

Plant Operator TWT

Pilot course with 8 participants

Power Plant Operators

116th training course with 42 participants

117th training course with 21 participants

118th training course with 46 participants

KWS-certified Operator Production for EEW Energy from Waste GmbH

05th training course with 8 participants

Power Plant Shift Supervisors–Production

135th training course with 15 participants

136th training course with 28 participants

Power Plant Shift Supervisors–

Production Electrical and Control Engineering

48th training course with 6 participants

Nuclear Technology/Radiation Protection

Nuclear Technology training is three-pronged:

1. Nuclear power plant personnel training
2. Nuclear power plant personnel skill retention and instruction, respectively
3. Radiation protection training

The training lineup comprises officially approved courses for qualification acquisition of responsible shift personnel and officially approved courses for qualification acquisition and updates in radiation protection. Instruction measures for personnel otherwise employed in nuclear power installations follow the respective guideline of Germany's Federal Environment Ministry. In addition to skill acquisition courses, KWS's training measures also include a wide range of skill retention training options.

NUMBER OF PARTICIPANTS, COURSES CONDUCTED AND PARTICIPANT DAYS: NUCLEAR TECHNOLOGY / RADIATION PROTECTION

January 01 – December 31, 2018	Courses conducted	Number of Participants	Number of Participant Days
Skill Acquisition in Radiation Protection	2	13	244
Updating Expert Knowledge in Radiation Protection	16	221	273
Other Courses on Radiation Protection	3	13	133
Skill Acquisition for Responsible Personnel	1	6	24
Skill Retention for Responsible Personnel	24	377	838
Knowledge Acquisition/Knowledge Retention	6	53	118
Dismantling	1	8	24
Customized Measures	2	11	54
Total	55	702	1.708

Simulator Training

Simulator training permits risk-free and efficient rehearsal of normal and abnormal operational power plant conditions. Apart from learning to handle installations safely, trainees also gain insight into plant technology interaction. Rehearsing critical plant conditions inspire operating personnel confidence when confronted with such situations. Beside operations training, social skills like teamwork, leadership, and decision-making are established, which enables a continuous improvement process in power plant operations.

NUMBER OF PARTICIPANTS, TRAININGS CONDUCTED AND PARTICIPANT DAYS: SIMULATOR TRAINING

January 01 – December 31, 2018	Trainings conducted	Number of Participants	Number of Participant Days
Hard Coal/Lignite/Gas/Oil 300 MW (FOKS)	9	36	156
Lignite 600/1100 MW	56	328	2.945
Hard Coal 800 MW	39	157	489
CCGT 750-S/D (SPPA-T2000)	10	42	153
CCGT 750-3 (SPPA-T3000)	2	7	35
Total	116	570	3.778

Construction Committee “Simulator for Lignite-Fired Power Plants”

The committee was set up for the purpose of realizing the simulator for lignite-fired power plants in order to assist KWS in the implementation of the simulator construction project. Since the commissioning of the simulator, the committee has been counseling KWS on the evolution of the different simulator variants.

The committee convened once during the report period:
June 14th, 2018

The Construction Committee concerned itself with the following topics:

- Upgrade of the automation code of the Niederaußem power plant block unit G, 600 MW variant to the current state of reference plant development,
- Upgrade of the automation code of the Neurath power plant block unit G, 1100 MW variant to the current state of reference plant development,
- Upgrade of the simulator to the current version of the power plant control engineering system SPPA- T3000 Cue. and
- Devising a cooperation agreement for conducting simulator training in the coming years.

Organization Development

Various member companies address market challenges by conducting change and optimization measures. KWS accompanies such measures at the company and shift crew level with Best Practice workshops in the fields of social, methodical and individual skills development. Here, the focus was on employee workplace behavior, teamwork, communication, decision-making as well as control and supervision assignments. It is not easy to determine whether workplace processes and interaction function optimally or not because many parameters are involved. With the help of the staffers involved, workplace processes and interaction within as well as beyond shifts and departments are analyzed and potential improvements identified. Best Practice workshops help open creative opportunities, enabling an informal transfer of knowledge and experience among shift crews and generations that involves and conveys responsibility to all staffers. Optimization standards transcending shift crews and department are developed in cooperation with seasoned power plant operatives because nobody knows a place of business and its peculiarities better than the people who work there. As a result, each individual location comes up with its specific best possible solutions for operational excellence.

NUMBER OF PARTICIPANTS, COURSES CONDUCTED, MEASURES AND PARTICIPANT DAYS: ORGANIZATION DEVELOPMENT

January 01–December 31, 2018	Courses conducted	Number of Participants	Number of Participant Days
Organization Development	14	34	113

Renewable Energies

Growth in renewable energies is still strong and is expected to continue, both in terms of installed capacity and electricity generation. Wind power development is particularly fast-paced with more than 26,000 windpower installations in Germany alone that need to be serviced, maintained and operated. Even today, the industry is faced with a significant shortfall in skilled personnel. Given the ongoing expansion of wind power and demographic change, this shortfall is likely to increase. A crucial remedy is practice-oriented personnel qualification tailored to market needs. In cooperation with its partners, KWS is already offering a comprehensive range of training measures, from climbing instruction to CCI-certified wind power installation service technician training.

Bio-energy, be it biomass or biogas, is also seeing stable growth. Apart from a multitude of smaller facilities, industrial applications are becoming increasingly important. The know-how necessary to operate and maintain such installations is available from KWS in training courses designed for operations such as Plant Attendant training.

The use of hydropower plants has a long tradition in Germany and Austria. For the purpose of skill retention, KWS offers three complementary training courses that cover market demand in this area almost completely.

NUMBER OF PARTICIPANTS, COURSES CONDUCTED AND PARTICIPANT DAYS: RENEWABLE ENERGIES

January 01 – December 31, 2018	Courses conducted	Number of Participants	Number of Participant Days
Renewable Energies	6	60	323

International Activities

KWS is capable of providing international customers with virtually all of the offerings from the aforementioned areas of expertise. Additionally, training requirement and workforce potential analyses consisting of written exams, group and individual exercises and an expert interview may be employed by customer request to compare existing staffer skills with German standards. The results of such analyses may be used to conceive target group-specific instruction plans. In 2018, training measures were conducted in Egypt, India, Russia, Saudi Arabia, Sudan and Turkey and as well as in various European countries.

NUMBER OF PARTICIPANTS, COURSES CONDUCTED, MEASURES AND PARTICIPANT DAYS: INTERNATIONAL ACTIVITIES

January 01 – December 31, 2018	Courses conducted	Number of Participants	Number of Participant Days
International Activities	12	149	1.113



Soma Kolin power plant, Turkey

Organization

Board of Directors

According to the statutes of KWS, KWS's Board of Directors implements resolutions made by the General Assembly and is obligated to do anything that is beneficial to the goals of the association. Its main tasks are the issue of the annual Progress Report, approval of annual accounts, preparation of the General Assembly and submission of the investment, finance and business plan. Furthermore, the Board of Directors is tasked with appointing, dismissing and supervising the management.

The Board of Directors convened four times during the report period:

93 rd meeting	February 22 nd , 2018
94 th meeting	April 24 th , 2018 (conference call)
95 th meeting	June 27 th , 2018
96 th meeting	December 19 th , 2018 (conference call)

Altmann, Hubertus, (Chairman)
Member of the Board of Directors
of Lausitz Energie Kraftwerke AG/
of Lausitz Energie Bergbau AG, Cottbus/Germany

Gruber, Karl Heinz, Dipl.-Ing., Dr. (Deputy Chairman)
Member of the Management of VERBUND Hydro Power AG,
Vienna/Austria

Bockamp, Stefan, Dr.
Director Operations Steam & Biomass
Uniper Kraftwerke GmbH, Düsseldorf/Germany

Breidenbach, Norbert
Member of the Board of Directors of Mainova AG,
Frankfurt am Main/Germany

Giesen, Ralf
Member of the Board of RWE Power AG and
Chief Human Resources Officer (CHO),
RWE Power AG, Cologne/Germany
(from August 2018)

Müller, Karl-Heinz
Member of the Management of
EEW Energy from Waste GmbH, Helmstedt/Germany

Reinhard, Volker
Head of HR Production Department (P-AE),
EnBW Energie Baden-Württemberg AG, Stuttgart/Germany

Vermeyen, Raf
Managing Director of ENGIE

Winkel, Erwin
Member of the Board of Directors
of RWE Generation SE/of RWE Power AG, Cologne/Germany
(since July 2018)

Management

Ernst Michael Züfle

Financial and Legal Committee

The Financial and Legal Committee of KWS PowerTech Training Center assists and advises the Board of Directors and the management in all financial and legal matters.

The committee discussed the audit report which was compiled by BDO AG Wirtschaftsprüfungsgesellschaft, Zweigniederlassung Essen branch office, on the financial statement for 2017, the review of operation including the attachment and recommended that the board approve KWS's financial statement for 2017 as is. Consultation of the economic, investment and financial plans for the business year 2019 was carried out by the Financial and Legal Committee. It recommended to the board that it submit them in the General Assembly in 2018.

The Financial and Legal Committee also concerned itself with medium-term business planning designed for a five-year period and with the impact of the ongoing consolidation measures.

The following activities took place during the report period:

60 th meeting	April 19 th , 2017
61 st meeting	September 27 th , 2018

Eck, Jens, Dr. (Chairman)
Lausitz Energie Kraftwerke AG/
Lausitz Energie Bergbau AG, Cottbus/Germany

Bartels, Monika
RWE Power AG, Essen/Germany
(from February 2018)

Frey, Rainer, Magister
VERBUND-Hydro Power GmbH, Vienna/Austria

Ketterer, Marcel
EnBW Energie Baden-Württemberg AG, Karlsruhe/Germany
(from June 2018)

Wachter, Klaus
EnBW Energie Baden-Württemberg AG, Karlsruhe/Germany
(since June 2018)

Walth, Sébastien
Uniper Kraftwerke GmbH, Düsseldorf/Germany

Training Committee

The KWS Training Committee advises and assists the Board of Directors and management in their task, such as determining admission criteria for training courses, admission to courses (if so determined in the admission criteria), collaboration during examinations conducted by KWS with regard to examination regulations. Other activities of the committee involve filing applications to the incorporated society upon which KWS is legally based for the procurement of instruction materials and equipment as well as managing various other school- and training-related affairs. In its sessions during the report period, the Training Committee concerned itself with the results of the admission exams for the 137th and 138th Power Plant Shift Supervisor–Production training course and those of the 49th Power Plant Shift Supervisor–Production Electrotechnology/Control Engineering training course.

Other consultations topics during sessions were

- KWS reports on current training activities and new projects,
- Exchange of basic and advanced training program information and experience,
- Quality control of power plant shift supervisor training .

The Training Committee convened twice during the report period:

120th meeting July 12th, 2018

130th meeting December 12th, 2018

Bieder, Markus (Chairman)
Stadtwerke Münster GmbH, Münster/Germany

Hark, Guido (Deputy Chairman)
RWE Power AG, Eschweiler/Germany

Ahrens, Carsten
PreussenElektra GmbH, Grohnde Nuclear Power Plant,
Emmerthal/Germany
(from February 2018)

Erland Christensen
VGB PowerTech e.V., Essen
(since June 2018)

Hager, Frank, Deputy Assistant Under-Secretary
Ministry for the Economy, Innovation, Digitization
and Energy of the State of Northrhine-Westphalia,
Düsseldorf/Germany

Jedamzik, Bernd
EnBW Energie Baden-Württemberg AG, Karlsruhe/Germany

Kirstein, Klaus-Dieter
KDK Consulting, Düsseldorf/Germany

Klein, Käthe
Chamber of Industry and Commerce, Essen/Germany/

Kurzmann-Friedl, Christof, DI
VERBUND Thermal Power GmbH & Co KG,
Dürnrrohr Location, Zwentendorf/Austria

Lang, Martin, Prof. Dr.-Ing.
University Duisburg-Essen/Germany

Palm, Torsten
Lausitz Energie Kraftwerke AG, Lippendorf Power Plant,
Neukieritzsch OT Lippendorf/Germany

Paus, Christoph
UNIPER SE, Essen/Germany

Schletter, Gert
Lausitz Energie Kraftwerke AG,
Jänschwalde Power Plant, Peitz/Germany

Schuknecht, Michael, Dr.-Ing.
TÜV NORD Systems GmbH & Co KG, Essen/Germany

Tschersich, Conrad
AWG Abfallwirtschaftsgesellschaft mbH Wuppertal,
Wuppertal/Germany
(from February 2018)

Wiegel, Michael
RWE Generation SE, Gersteinwerk Power Plant,
Werne/Germany

Ernst Michael Züfle
KRAFTWERKSSCHULE E.V., Essen/Germany

Consultant:
Nina Woydack
KRAFTWERKSSCHULE E.V., Essen/Germany

Facts and Figures

Members

Membership of the KRAFTWERKSSCHULE E.V.

The KRAFTWERKSSCHULE E.V. is a joint association of power plant operators and pursues exclusively and directly not-for-profit aims within the framework of vocational training by means of programs for training and advanced training of skilled workers for power plants, maintenance of facilities for these activities, responsibility for holding examinations as well as maintaining the accommodation and catering facilities for the training participants.

The work of the KWS focuses on the training requirements of their ordinary members, the power plant operators.

In order to ensure that the KWS can continue to serve in the long-term it is necessary that all power plant operators and other interested organizations support them by becoming members.

According to the KWS' statutes it differentiates between ordinary members, affiliated members and sponsoring members.

The KWS would be pleased to assist you in any questions regarding the organization and membership as well as its statutes and subscription fee regulations. Further information can be found on the internet at "www.kraftwerksschule.de".

Ordinary Members

3M Deutschland GmbH, Wuppertal

Abfallwirtschaftsbetrieb des Landkreises Neu-Ulm, Weißenhorn

Abfallwirtschaftsgesellschaft mbH Wuppertal, Wuppertal

AGR Betriebsführung GmbH, Herten

AHLSTROM-MUNKSJÖ PAPER GMBH, Aalen

Allessa GmbH, Werk Cassella-Offenbach, Frankfurt

AMK Abfallentsorgungsgesellschaft des Märkischen Kreises mbH, Iserlohn

AVEA Entsorgungsbetriebe GmbH & Co. KG, Leverkusen

AVG Abfallentsorgungs- und Verwertungsgesellschaft Köln mbH, Cologne

AVG Abfall-Verwertungs-Gesellschaft mbH, Hamburg

B+S Papenburg Energie GmbH, Papenburg

Basell Polyolefine GmbH, Werk Wesseling, Wesseling

BASF SE, Ludwigshafen

Bayer AG, Bergkamen

Bayer AG, Berlin

Berliner Stadtreinigungsbetriebe,

Abfallbehandlungswerk Nord, Berlin

Biopower SKW GmbH, Eberhardzell

Boehringer Ingelheim Pharma GmbH & Co. KG, Ingelheim

Bremerhavener Entsorgungsgesellschaft mbH, Bremerhaven
BS|Energy Braunschweiger Versorgungs-AG & Co. KG,
Braunschweig

CURRENTA GmbH & Co. OHG, Leverkusen

Daimler AG, Sindelfingen

DREWAG Stadtwerke Dresden GmbH, Dresden

DSM Nutritional Products GmbH, Grenzach-Wyhlen

DS Smith Paper Deutschland GmbH, Aschaffenburg

DS Smith Paper Deutschland GmbH, Witzenhausen

EBE Holzheizkraftwerk GmbH, Emlichheim

EDF Direction Production Ingenierie, Saint-Denis-Cedex/
France

EDF Luminus, Centrale Ringvaart, Ghent/Belgium

EEW Energy from Waste Helmstedt GmbH, Helmstedt

Egger Holzwerkstoffe Brilon GmbH & Co. KG, Brilon

EGK Entsorgungsgesellschaft Krefeld GmbH & Co. KG, Krefeld

Electrabel NV/SA SCAP, Brussels/Belgium

EnBW Energie Baden-Württemberg AG, Stuttgart

EnBW Kernkraft GmbH, Obrigheim

enercity AG, Hanover/Germany

Enecogen V.O.F., Oostvoorne/Niederlande

Energie AG Oberösterreich Kraftwerke GmbH, Linz/Austria

Energie Anlage Bernburg GmbH, Bernburg

EnergieSaarLorLux AG, Heizkraftwerk Römerbrücke,
Saarbrücken

Energieservice Westfalen Weser GmbH, Kirchlingern

Energie und Wasser Potsdam GmbH, Potsdam

Energieversorgung Oberhausen AG, Oberhausen

Energieversorgung Offenbach AG, Offenbach

Ernertec Hameln GmbH, Hameln

ENGIE, Zwolle/Netherlands

ENGIE Kraftwerk Farge GmbH & Co. KGaA, Bremen

ENGIE Kraftwerk Zolling GmbH & Co. KGaA, Zolling

Entsorgung + Recycling Zürich, Zürich/Switzerland

Erlanger Stadtwerke AG, Erlangen

Essity Operations Mannheim GmbH, Mannheim

EVI Abfallverwertung B.V. & Co. KG, Laar

EVN AG, Maria Enzersdorf/Austria

Evonik Industries AG, Marl

Evonik Industries AG, Worms

Fernwärme Ulm GmbH, Ulm

FES Frankfurter Entsorgungs- und Service GmbH, Frankfurt

Freudenberg Service KG, Weinheim

FunderMax GmbH, St. Veit a.d. Glan/Austria	Linz Strom Gas Wärme GmbH für Energiedienstleistungen und Telekommunikation, Linz/Austria
GfA Gemeinsames Kommunalunternehmen für Abfallwirtschaft, Olching	MAINOVA AG, Frankfurt am Main
Gemeinschaftskraftwerk Bergkamen A OHG, Bergkamen	Mark-E AG, Hagen
Gemeinschaftskraftwerk Schweinfurt GmbH, Schweinfurt	Merck KGaA, Darmstadt
Gemeinschafts-Müllverbrennungsanlage Niederrhein GmbH, Oberhausen	MHB Hamm Betriebsführungsgesellschaft mbH, Hamm
Grosskraftwerk Mannheim AG, Mannheim	MIBRAG Mitteldeutsche Braunkohlegesellschaft mbH, Zeitz
Hamburger Hungária Kft., Dunaújváros/Hungary	Mohn media Mohndruck GmbH, Gütersloh
Hamburger Stadtentwässerung AöR, Hamburg	Moritz J. Weig GmbH & Co. KG, Mayen
HEB GmbH, Hagener Entsorgungsbetrieb, Hagen	Müllheizkraftwerk Kassel GmbH, Kassel
Heizkraftwerk Pfaffenwald der Universität Stuttgart, Stuttgart	Müllheizkraftwerk Rothensee GmbH, Magdeburg
Heizkraftwerk Pforzheim GmbH, Pforzheim	Müllverbrennung Kiel GmbH & Co. KG, Kiel
Heizkraftwerk Würzburg GmbH, Würzburg	Münchener Stadtentwässerung, Munich
Heizkraftwerksgesellschaft Cottbus mbH, Cottbus	MVV Umwelt O&M GmbH, Mannheim
Helmstedter Revier GmbH, Kraftwerk Buschhaus, Büddenstedt	N-ERGIE Aktiengesellschaft, Nuremberg
Henkel AG & Co. KGaA, Düsseldorf	Norske Skog Bruck GmbH, Bruck at the Mur/Austria
IHKW Industrieheizkraftwerk Andernach GmbH, Andernach	OMV Refining & Marketing GmbH, Vienna/Austria
Indaver Deutschland GmbH, Biebesheim	Oxea Produktions GmbH, Werk Ruhr Chemie, Oberhausen
Group Membership for	Papierfabrik Julius Schulte Söhne GmbH & Co. KG, Düsseldorf
AVG Abfall-Verwertungs-Gesellschaft mbH, Hamburg	Papierfabrik Palm GmbH & Co. KG, Wörth
HIM GmbH, Biebesheim	Pfeifer Holz Lauterbach GmbH, Lauterbach
InfraServ GmbH & Co. Gendorf KG, Burgkirchen	PreussenElektra GmbH, Hanover
InfraServ GmbH & Co. Höchst KG, Frankfurt am Main	psm Nature Power Service & Management GmbH & Co. KG, Erkelenz
InfraServ GmbH & Co. Wiesbaden KG, Wiesbaden	RAG Anthrazit Ibbenbüren GmbH, Ibbenbüren
IWB, Basel/Switzerland	Raubling Papier GmbH, Raubling
Jülicher Entsorgungsgesellschaft für Nuklearanlagen mbH (JEN), Jülich	REMONDIS Thermische Abfallverwertung GmbH, Staßfurt
K + S Kali GmbH, Philippsthal	R.D.M. Arnsberg GmbH, Arnsberg
K + S Kali GmbH, Werk Neuhof-Ellers, Neuhof	RheinEnergie AG, Cologne
Kabel Premium Pulp & Paper GmbH, Hagen	Rhodia Acetow GmbH, Freiburg
Kämmerer Energie GmbH, Osnabrück	RKB Raffinerie-Kraftwerks-Betriebs GmbH, Essen
Kernkraftwerk Gösgen-Däniken AG, Däniken/Switzerland	RWE Power AG, Essen
Knapsack Power GmbH & Co. KG, Düsseldorf	Group Membership for
KNG Kraftwerks- und Netzgesellschaft mbH, Rostock	RWE Generation SE
Kraftwerke Mainz-Wiesbaden AG, Mainz	RWE Nuclear GmbH
Kraftwerk Mehrum GmbH, Hohenhameln	RWE Generation NL B.V., Netherlands
Kraftwerk Obernburg GmbH, Obernburg	RWE Generation UK plc, Didcot B CCGT Power Station, Oxfordshire/Großbritannien
Kraftwerk Schwedt GmbH + CO. KG, Schwedt	Salzburg AG, Salzburg/Austria
Kreis Weseler Abfallgemeinschaft mbH & Co. KG, Kamp-Lintfort	Salzgitter Flachstahl GmbH, Salzgitter
Lausitz Energie Kraftwerke AG, Cottbus	Sappi Alfeld AG, Alfeld

Sappi Austria Produktions-GmbH & Co. KG,
Gratkorn/Austria
Sappi Ehingen GmbH, Ehingen
Schluchseewerk AG, Laufenburg
SchwörerHaus KG, Hohenstein
Solvay Chemicals GmbH, Hanover
Sonae Arauco Beeskow GmbH, Werk Beeskow, Beeskow
Spreerecycling GmbH & Co. KG, Spremberg
SRS Eco Therm GmbH, Salzbergen
Stadtwerke Augsburg,
Elektrizitäts- und Fernwärmeversorgung,
Wärme- und Stromerzeugung, Augsburg
Stadtwerke Bielefeld GmbH, Bielefeld
Group Membership for
Stadtwerke Bielefeld GmbH, Bielefeld
MVA Bielefeld-Herford GmbH
Enertec Hameln GmbH
Stadtwerke Düsseldorf AG, Düsseldorf
Stadtwerke Duisburg AG, Duisburg
Stadtwerke Flensburg GmbH, Flensburg
Stadtwerke Heidelberg Netze GmbH, Heidelberg
Stadtwerke Karlsruhe GmbH, Karlsruhe
Stadtwerke Leipzig GmbH, Leipzig
Stadtwerke Münster GmbH, Münster
Stadtwerke Rosenheim GmbH & Co. KG
-Müllheizkraftwerk-, Rosenheim
Stadtwerke Rostock AG, Rostock
Stadtwerke Saarbrücken Netz AG, Saarbrücken
Stadtwerke Schwerin GmbH, Schwerin
Städtische Werke Energie + Wärme GmbH, Kassel
Statkraft Markets GmbH, Düsseldorf
STEAG GmbH, Essen
STEAG GmbH Kraftwerk Voerde
Steag Power Saar GmbH, Saarbrücken
Stora Enso Maxau GmbH, Karlsruhe
SWB Energie- und Wasserversorgung Bonn/Rhein-Sieg GmbH,
Bonn
swb Entsorgung GmbH, Müllheizwerk Bremen, Bremen
swb Erzeugung GmbH & Co. KG, Bremen
SWM Services GmbH, Munich
SWN Stadtwerke Neumünster GmbH, Neumünster

Technische Betriebe Solingen (TBS), Solingen
Thüringer Energie AG, Erfurt
Thyssen Krupp Steel Europe AG, Duisburg
T Power Site, Tessenderlo/Belgium
TWL Technische Werke Ludwigshafen AG, Ludwigshafen

Uniper Benelux N.V., Rotterdam/Netherlands
Uniper Kraftwerke GmbH, Hanover
UPM-Kymmene Austria GmbH, Steyrermühl/Austria

Vattenfall Europe New Energy Services GmbH, Hamburg
Vattenfall Europe Nuclear Energy GmbH, Hamburg
Vattenfall Heizkraftwerk Moorburg GmbH, Hamburg
Vattenfall Wärme Berlin AG, Berlin
Vattenfall Wärme Hamburg GmbH, Hamburg
Vattenfall Wasserkraft GmbH, Berlin
Venator Germany GmbH, Duisburg
Veolia Industrieparks Deutschland GmbH, Heinsberg
VERBUND Hydro Power GmbH, Vienna/Austria
VERBUND Thermal Power GmbH & Co. KG,
Neudorf ob Wildon/Austria
VOEST-ALPINE STAHL LINZ GmbH, Linz/Austria
VSE AG, Saarbrücken
Vulkan Energiewirtschaft Oderbrücke GmbH, Eisenhüttenstadt
VW Kraftwerk GmbH, Wolfsburg

Wels Strom GmbH, Wels/Austria
WIEN ENERGIE GmbH, Vienna/Austria
WSW Energie & Wasser AG, Wuppertal
WUPPERVERBAND, Wuppertal

ZAK Energie GmbH -Müllheizkraftwerk Kempten-, Kempten
Zanders GmbH, Bergisch-Gladbach
Zweckverband Abfallverwertung Südostbayern, Burgkirchen
Zweckverband Abfallwirtschaft Saale-Orla, Pößneck
Zweckverband für Abfallwirtschaft in Nordwest-Oberfranken,
Dörfles-Esbach
Zweckverband für Abfallwirtschaft Südwestthüringen (ZAS),
Zehla-Mehlis
Zweckverband Müllheizkraftwerk Stadt und Landkreis Bamberg,
Bamberg
Zweckverband Müllverwertung Schwandorf, Schwandorf
Zweckverband Müllverwertungsanlage, Ingolstadt
Zweckverband Restmüllheizkraftwerk Böblingen (RBB), Böblingen

Affiliated Members
DAtF Deutsches Atomforum e.V., Berlin
DMT GmbH & Co. KG, Essen
FDBR e.V. – Fachverband Anlagenbau, Düsseldorf
FGW e.V. – Fördergesellschaft Windenergie
und andere Erneuerbare Energien, Berlin
GfS Gesellschaft für Simulatorschulung mbH, Essen

Technical University of Munich,
 FRM II: Research Neutron Source Heinz Maier-Leibnitz,
 Garching
 TUV Rheinland Arabia LLC, Jeddah/Saudi Arabien
 VGB PowerTech e.V., Essen
 VIK Verband der Industriellen Energie- und Kraftwirtschaft e.V.,
 Essen

Sponsoring Members

ABB AG, Power Systems Division, Mannheim
 Carl Duisberg Centren, Cologne
 DURAG process & systems technology GmbH, Hamburg
 EICHNER Industrieservice GmbH, Bergheim
 EWEX-Weber ENGINEERING GmbH, Pulheim
 GESTRA AG, Bremen
 Holter Regelarmaturen GmbH & Co. KG, Holte-Stutenbrock
 KONRAD Meß- & Regeltechnik GmbH, Gundremmingen
 Mitsubishi Hitachi Power Systems Europe GmbH, Duisburg
 OffTEC Base GmbH & Co. KG, Enge-Sande
 Rheinmetall Electronics GmbH, Bremen
 SalesEnergy International, Neusäß
 SCGP Excellence Training Center Co. LTD., Bangkok/Thailand
 Seiko Flowcontrol Ges.m.b.H., Stockerau/Austria
 Siemens AG, Erlangen
 Siemens AG, Essen
 Standardkessel Baumgarte GmbH, Bielefeld
 S.T.E.P. Consulting GmbH, Aachen
 Uniper Anlagenservice GmbH, Gelsenkirchen

Membership Development

On December 31st, 2018, the KRAFTWERKSSCHULE E.V. had 221 members, 193 of which were ordinary, nine were affiliated and 19 were sponsoring members.

Two companies joined KWS as ordinary members, one as an affiliated and one as a sponsoring member during the report period. Seven member companies were amalgamated in three new corporate memberships, three member companies left KWS; six memberships were revoked.

In accordance with the new membership contribution ordinance passed on September 13th, 2017, individual membership fees are assessed based on net nominal installed electrical capacity in megawatts as listed by the German Federal Network Agency.

The grand total capacity of all ordinary members during the report period stands at 111,777 MW.

29 member companies are based outside of Germany, namely:

- fifteen companies in Austria,
- four companies in Belgium,
- one company in France,
- one company in Hungary,
- four companies in the Netherlands,
- one company in Saudi Arabia,
- two companies in Switzerland,
- one company in Thailand.

The net nominal installed electrical capacity of the foreign member companies adds up to 22,583 MW or approximately 20% of the total amount of all ordinary members.

MEMBERS

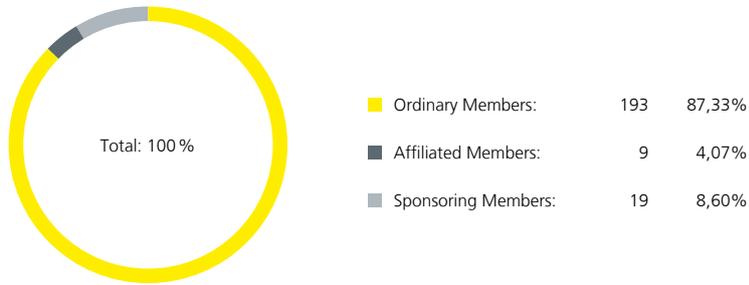
Listing of all members (As at December 31st, 2018)

Fig. 1

COMPOSITION OF THE GROUP OF ORDINARY MEMBERS

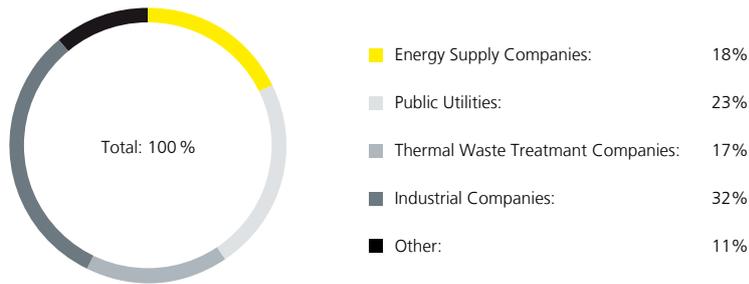
Listing of all ordinary members (As at December 31st, 2018)

Fig. 2

BREAKDOWN OF NET NOMINAL ELECTRICAL CAPACITY OF ALL ORDINARY MEMBERS:

	Ordinary Members		Net nominal electrical capacity	
	Number	Percentage %	MW	Percentage %
up to 250 MW	137	71,00	5.730	5,13
251–500 MW	15	7,77	5.184	4,64
501–1.000 MW	14	7,25	9.980	8,93
1.001–2.500 MW	19	9,84	26.438	23,65
2.501–5.000 MW	2	1,04	6.171	5,52
5.001–8.500 MW	3	1,55	22.103	19,77
above 8.500 MW	3	1,55	36.171	32,36
Total	193	100,00	111.777	100,00

KWS in General

New Methods of Training in the Field of Thermal Waste Treatment (TWT): Plant Operator TWT Pilot Course successfully completed

The first training course for the new "Plant Operator TWT" offering took place from October 1st to December 21st, 2018. This course, designed to meet specific industry needs, had been developed by a TWT project group consisting of representatives from thermal waste treatment installations and KWS during a time period from November 20th, 2017 to September 28th, 2018. A total of eight participants from plant operators in Germany and Austria completed some 386 classroom lessons at 45 minutes each, covering 11 subjects and taking part in 15 written exams. Both participants as well as instructors subsequently came up with suggestions for improvements that will be taken into account in future courses.

Status of permits at Essen CCI

Efforts of Essen CCI (Chamber of Industry and Commerce) on approving the new vocational training degrees of "Power Plant Shift Supervisor TWT" and "Plant Operator TWT" are moving ahead. Based on the results yielded by the TWT project group, KWS assists these efforts by making concrete suggestions for instruction contents. Within the CCI, the Vocational Training Committee is the relevant governing panel. It assembles three times a year and issues specific statutory provisions.

With regard to the "Power Plant Shift Supervisor TWT" course, we presume that such provisions will be issued during the committee's spring gathering. Subsequently, an exams committee will be formed that will include specialists from thermal waste treatment businesses. The first shift supervisor course at KWS will commence in May 2019, the first final exam will take place in the summer of 2020.

A particular marginal condition applies to the "Plant Operator TWT" course. A CCI can only issue a statutory provision that is sufficiently different from existing standardized federal ordinances that apply in all of Germany. The challenge here is to come up with a provision that is appropriately at variance with federal German power plant operator training regulations.

Backup Reserve Training at Frimmersdorf Power Plant

In the course of Germany's efforts to reduce the power industry's CO₂ emissions, a number lignite-fired power plant block units with a total capacity of 2,700 megawatts are being inducted into a so-called backup reserve for four years each, after which they will be shut down completely.

This process began in 2016 and will continue through 2019. At Frimmersdorf, Germany, location, block units P and Q were inducted into the backup reserve on October 1st, 2017. Both 300 megawatt units were erected during the 1960s and feature a low degree of automation. While being part of the backup reserve, a skeleton operating crew is on hand all the time. Their job is to conduct the necessary trial runs and checks. In order to preclude a possible loss in their skills, crews need to undergo regular refresher training. This also applies to experienced staffers with interim assignments at the neighboring plant at Neurath who may be called upon to work at Frimmersdorf if necessary.

To ensure that a well-prepared crew is available when needed without delay, the respective power plant database has been used to devise a training program with the help of KWS PowerTech Training Center. All relevant processes and procedures for individual plant systems are dealt with, demonstrated on location and rehearsed in practice, plant conservation measures permitting.

Construction Committee for Lignite-Fired Power Plant Simulator celebrates 10th anniversary

On April 8th, 2008, the 1st session of the Construction Committee "Simulator for Lignite-Fired Power Plants" took place at Niederaußem, Germany.

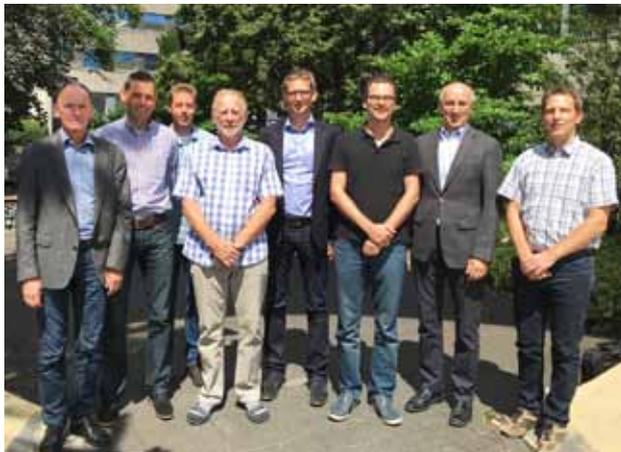
Its founding members were Messrs. Jurgeleit, Brucherseifer, Stürenburg, Dr. Wüllenweber, Niepel, Küppers and Blank (shown from left to right).

The topics discussed during that session were the simulator variants Niederaußem PP, block unit G, Neurath PP, block units F&G, and Niederaußem PP, block unit K.



April 8th, 2008: Members of the construction committee
“Simulator for Lignite-Fired Power Plants”

On June 14th, 2018, the committee convened for its 31st session. The participants of this gathering were Messrs. Küppers, Bung, Jurgeleit, Stürenburg, Dr. Fielenbach, Cremanns, Züfle and Knur. Current topics are simulator variants Niederaußem PP, block unit G, Neurath PP, block unit G and Neurath PP, block unit D.



June 14th, 2018: Members of the construction committee
“Simulator for Lignite-Fired Power Plants”

The committee has been fulfilling its important task for more than a decade now, achieving close and constructive cooperation between RWE AG’s lignite branch and KWS PowerTech Training Center. Thanks a lot to all parties involved.

Simulation Technology: Westfalen Power Plant, Block Unit E and Lignite Simulator

Conversion of the simulator for hard coal power plants from Westfalen block unit D to E

The conversion of the hard coal simulator variant Westfalen block unit D to E assigned by RWE in August 2016 was successfully completed by inspection and approval by a team from Westfalen power plant in November 2018. Several 10,000 control engineering signals were attached to the simulation model including the accommodation of the PPI designation of block unit E and the adaptation to the simulation environment. Also, current control engineering setups were directly imported from the power plant and tied in with the simulator for the first time, contributing substantially to the quality of subsequent training measures. Simulator evolution is part of KWS’ regular model upgrading efforts. Since the direct import of control engineering diagrams from the Westfalen power plant was successful, the possibility of adopting control engineering codes from other plants arises. This would provide KWS with more options to use the simulator. Initial test runs in December 2018 using control engineering from block unit A of the Eemshaven power plant in the Netherlands were promising.

Evolution of the lignite simulator

After the successful incorporation of the Neurath block unit D training variant in simulator training, an update of the control engineering code for the training variant of Niederaußem power plant’s block unit G was conducted. For that, it was necessary to install a new version of the control engineering software. Further improvements were achieved with this update, which had a positive impact on training quality. The simulator was tested in cooperation with a group of staffers from the Niederaußem power plant’s block unit G and released for training. The simulator is currently in use for instruction measures. Subsequently, work has begun to upgrade the simulator variant of block unit G of Neurath power plant by adopting the current control engineering code. The plant has seen recent process engineering alterations (e.g. injection cooling systems) and technical changes in the turbine control that are now being incorporated in the simulation model. Upgrade efforts are scheduled to be concluded during the first half of 2019.

Official Approval of Courses for Radiation Protection Expertise Acquisition and Update

Radiation Protection Officers in nuclear power plants must acquire their expert knowledge in accordance with Germany's guideline for radiation protection officer expertise in nuclear fission installations. This guideline was last revised on February 20th, 2014, for the purpose of adapting it to Germany's Radiation Protection Ordinance and to expand it to cover the decommissioning of nuclear power installations as well.

The guideline subdivides radiation protection training contents into 11 chapters that are to be taught in at least 160 instruction segments of 45 minutes duration each. KWS PowerTech Training Center has been offering this training for years already. However, KWS's training course "Expert Knowledge for Radiation Protection Officers in Nuclear Fission Installations" requires government approval. Such approval is granted following the successful completion of a screening process by the proper authority. For KWS, this authority is the Ministry for the Economy, Innovation, Digitization and Energy of the State of Northrhine-Westphalia. As a rule, government-approved radiation protection courses are time-limited to five years. Approval of KWS' radiation protection course mentioned above expires on December 31st, 2022.

Hydropower and Hydraulic Engineering Laboratory–Control Room Operator

At the suggestion of several members and VGB PowerTech, KWS PowerTech Training Center has conceived "Hydropower and Hydraulic Engineering Laboratory", a one-week seminar that was first successfully conducted in July 2018 and will be offered once a year from now on.

Since the necessary hands-on exercises require extensive lab equipment and the employment of expert instructors, KWS has found a top-class cooperating partner in the Chair of Hydraulics and Water Resources, headed by Professor Dr. Peter Rutschmann of Munich Technical University.

The week-long lab course does not take place in Essen, but in the greater Munich area, which means a shorter transit time for most participants. The location for the first half of the lab week is the Dieter Thoma Laboratory in Munich, while the second half is conducted at the Oskar von Miller Institute in Obernach at Walchensee. Training contents at Dieter Thoma Lab encompass design types, areas of application, characteristics and operational properties of water turbines. Training at Oskar von Miller Institute focuses on hydraulics,

particularly the behavior of power plant and weir systems in normal operations and during flood water situations as well as the impact on water bodies.

The first such seminar was well-received and fully booked with 15 participants from 7 companies, ranging from control room operators to heads of production. Feedback, gathered verbally during the seminar and subsequently through our QM questionnaires, was unanimously positive and very encouraging. Apart from the good equipment used, correspondents particularly praised the expertise and the commitment of their instructors. KWS' chief instructors on location organized the event and made sure things ran smoothly. For the 2019 seminar, we will act on the suggestions received and optimize the event.



Training situation in the hydropower laboratory

"Empower Refugees" KWS-Project on Migrant Integration

They came to Germany as refugees and will be skilled wind power craftsmen in the future. Twelve young male refugees from Syria and Iran had been taking part in the first module of the "Empower Refugees" project since March 2018. In mid-August, all of them cleared the first hurdle by successfully completing this part of the project.

The participants were readied for training in electrotechnology with emphasis on wind power installations in a five-month advanced training measure conducted by KWS. A key component of this measure was a five-week internship in four wind power businesses to date where the participants got the chance to demonstrate the skills they had acquired so far. In another step, the trainees will get the opportunity to learn the trade of industrial electrician in production engineering

for wind power in a 16-month retraining. The highlight here is the fact that they can subsequently begin their careers immediately because all of them have been given job guarantees by the businesses involved even prior to the training measure. But first, the twelve male refugees had the pleasure of receiving their certificates of participation for the first stage of the training measure from the hands of Thomas Kufen, Mayor of Essen, Germany, on August 16th, 2018. In the presence of business representatives, emissaries from JobCenter Essen, EnergieAgentur NRW and Neue Arbeit Diakonie, the mayor congratulated the recipients on their success and expressly welcomed KWS' commitment: "Access to the labor market is a key ingredient of successful integration. In this respect, a standout project has been launched here in Essen that serves as a role model. This is the way to make stakeholders in society. On top of that, steady jobs are created in a booming industry urgently in need of skilled labor. Investment in training means investment in the future."



After handover of the certificates of participation

It was not easy initially to find suitable candidates for the qualifying initiative. For almost a year, the "Empower Refugees" project was advertised in German language courses for refugees as well as in volunteer and public institutions. In the end, approx. 130 candidates attended several KWS information events that detailed the project setup. The very specific entry prerequisites quickly whittled down the potential number of participants. Apart from being physically fit and having a head for heights—wind power installations stand approx. 100 meters tall and must often be ascended several times a day under one's own power—team spirit and an above normal willingness to travel are necessary. The biggest obstacle, however, was the level of proficiency in German required to ensure safe communication in a work crew.

A characteristic of all project modules is the close tie-in

between theory and practice and, consequently, the intense cooperation between the industry and KWS as well as the focus on wind power-specific job profiles. One standout feature is continuous counseling by social pedagogy experts so that the participants can fully concentrate on their training. Thanks to excellent and trustful cooperation between all institutions involved, this future-oriented project could be launched.

The successful pilot course has increased the public profile of the advanced training measures in Essen and neighboring cities so that more courses like it may follow.

A word on the significance of Northrhine-Westphalia for the wind power industry: The wind power industry in this state has been a growing market for years. More than 20,000 individuals are employed by the industry in Northrhine-Westphalia, particularly by suppliers. There is hardly a wind power installation anywhere in the world that does not use technology from Northrhine-Westphalia. Skilled labor is much in demand in this branch.

Flexpert Training for Flexible Operation of Coal Fired Power Plants in India

The Indo-German Energy Forum (IGEF) was established to boost cooperation between both countries in the fields of renewable energies, energy efficiency and energy service security as well as investment in energy projects. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH assists this energy partnership. KWS PowerTech Training Center has been recognized as a vital partner in the implementation of IGEF's goals.



Indian engineers and KWS staff during the visit of the KWS training center



Participants and trainer during “Flexible Operation of Coal-Fired Power Plants” training

A one-week training measure familiarizes Indian specialists with flexible power plant operations in theory and practice. This training course is designed to enable Indian instructors to effectively convey all requirements of flexible power plant operations to Indian power industry businesses on location in the country. Among other things, participants learn how to conduct unassisted advanced training measures on simulators. Training was carried out under the aegis of IGEF. Instruction events for Indian power plant operators are an important field of activity for IGEF in order to enable facilitate flexible power plant operations. Such flexibility is an essential prerequisite for the development and extension of renewable energy capacities in India.

Theoretical training, excursions and trading experience were at the heart of the flexibility training for 10 Indian energy experts from the power industry, the Ministry of Energy, GIZ as well as affiliated institutions. The event took place from December 10-14, 2018 in Essen, Germany, and had been organized jointly by KWS, the Indian Excellence Enhancement Center (EEC) and VGB PowerTech e.V. on behalf of GIZ.

The three-day theoretical training segment of the event focused on simulator instruction and lectures on current trends and developments in the European power industry. Here, participants were acquainted with quick load cycles, high load gradients, minimum load operations as well as their operational context and impact.

Theoretical training emphasized the following key aspects:

- Operations during load changes
- Minimum load operations
- Operations at the power plant load limit
- Impact of the flexible mode of operation on power plant efficiency
- Primary and secondary power and frequency control

- Voltage control function in various modes of plant operation and different grid situations
- Steam generator and turbine operations in isolated and auxiliary service mode
- Post-blackout grid reconstruction
- Adjustment of service and maintenance strategies

During their subsequent 2-day tours of the Herdecke pump-storage plant and the Neurath lignite-fired power plant, both operated by RWE, the Indian colleagues got some practical insight into flexible power plant operations. Visits to Uniper headquarters Düsseldorf and to Siemens’ steam turbine production facility in Mülheim an der Ruhr rounded out the practical training segment of the week-long event.

This measure under the motto “Train the Trainer” was described in a 2017 study conducted by KWS on behalf of GIZ and marks an important first step towards passing on relevant experience to Indian experts accompanying the changes already well under way in the Indian power industry.

Assignments Abroad

Egypt (Burullus, New Capital, Beni Suef)

Training of approx. 600 individuals of Egyptian power plant personnel from the Siemens “Mega Project–Egypt” was concluded in August 2018. KWS contributions were:

- 5-day HPO-Training for Maintenance Managers at KWS PowerTech Training Center
- 7-day “Basic Operational Training–Water Steam Cycle” for the Beni Suef location
- 5-day “Basic Operational Training–Steam Turbine” for the Burullus location



Beni Suef power plant, Egypt

United Kingdom (King's Lynn)

The modernization of the CCGT power plant at King's Lynn in Norfolk, Great Britain, also included a training assignment for the new components and skill retention for Siemens. KWS took over the 8-day "CCGT Plant Basic Operator Training". Training contents based on the curricula for plant attendants for steam generators and for gas and steam turbines in large power plants

Part 1 – 5 days *MODULE M*

1. Thermodynamics/Fluid Dynamics
2. Pumps and Valves/PID/Overview of a CCPP
3. Gas Turbine
4. Heat Recovery Steam Generator
5. Steam Turbine/Cooling System

Part 2 – 3 days *MODULE E*

1. Electrical Basics
2. Electrical Components & Supplies
3. Basics of C & I/Basics of Measurements



Siemens' new SGT5-4000F gas turbine at King's Lynn power station

Turkey (Soma Kolin)

Siemens Energy supplied two steam turbines as well auxiliary and subsidiary equipment for the Soma Kolin lignite-fired power plant in Turkey. Siemens' customer is Harbin Electric International Company Ltd. (HEI) from China, which erects the 510 megawatt installation ready-to-run for the Turkish company HİDRO-GEN ENERJİ İTHALAT İHRACAT DAĞITIM VE TİCARET A. Ş.

This assignment included component training. KWS' contribution was basic operational training, namely the segments of "Electrical and I&C" and "Steam Turbine-Mechanical" at 4 days duration each.



Soma Kolin power plant, Turkey

Russia (Grozny, Chechnya)

Siemens supplied gas turbines and generators for the two 180 megawatt block units of Gazprom's Grozny TPP.

KWS carried out the basic operational training segments of "Electrical and I&C" and "Gas Turbine" with a total of nine days of instruction for the Gazprom's shift crews.

Sudan (Khartum)

In Berlin, Siemens signed a contract with Sudanese Thermal Power Generating Company (STPGC), a public utility for the delivery of five SGT5-2000E-Class gas turbines including generators and SPPA-T3000 control engineering technology. The machines will supply a joint electrical capacity of approx. 850 megawatts.

KWS provided the power plant personnel training modules of

- "Basic Operational Training – Electrical and I&C" (7 days) and

- "Basic Operational Training – Gas Turbine" (8 days)

Instruction took place at Garri Power Station in the northern section of the Sudanese capital of Khartoum.



Participants of the training in Khartoum, Sudan

Cooperation between ITAD and KWS

Basic and advanced training demand is particularly high in thermal waste treatment installations. Therefore, KWS, in close coordination with a plant crew project group and Essen CCI, has been developing specific training courses at the supervisor level and below. An initial "Plant Operator TWT" pilot course was already conducted in the 4th quarter of 2018. A cooperation agreement between KWS and ITAD e.V., the thermal waste treatment trade association, has been reached so that training courses may be developed further for maximum benefit for companies operating TWU installations.

Quality management at KWS

Top-notch quality across the board is what we strive for every day. One vital component here is our quality management system that completely revamped in 2016 in order to meet the requirements of the DIN EN ISO 9001:2015 standard.

To make sure that the system addresses actual work processes and effectively supports them, KWS made an effort to come up with an in-house product. While the management set the framework by providing a concept and general specifications, a multitude of staffers worked out the individual process requirements. That way, the groundwork was laid for universal acceptance and effective use of the system.

The DIN EN ISO 9001:2015 recertification audit of the quality management system, which was conducted on November 7th and 8th, 2018, yielded an outstanding result in verification and

effectiveness without any deviations from standard or flaws. The first monitoring audit of AZAV (German acronym for "Akkreditierungs- und Zulassungsverordnung Arbeitsförderung", a Federal German ordinance for ensuring training provider quality) certificate on October 9th, 2018, also went very well. On the basis of this certificate, KWS received its first license for a training coupon measure from the Federal Employment Agency.

Public Appearances

Trade fairs are an important communication platform for exchanging information and one of the most vital marketing tools for a company. For KWS, trade fairs and conventions offer the opportunity to cultivate existing contacts, make new ones and get fresh impulses for its ongoing evolution.

During the report period, KWS PowerTech Training Center was present at the following trade fairs and conventions:

- VGB Conference "Steam Generators, Industrial and Cogeneration Plants 2018", Rostock/Germany
- IFAT 2018, Munich/Germany
- VGB Conference "KELI 2018", Electrical Engineering C&I and IT, Potsdam/Germany
- VGB Conference "Steam Turbines and Operation of Steam Turbines 2018", Koblenz/Germany
- Electrify Europe 2018, Vienna/Austria
- POWER-GEN Africa 2018, Johannesburg/South Africa
- VGB Congress 2018 "Power Generation in Transition", Munich-Unterschleißheim/Germany
- WindEnergy 2018, Hamburg/Germany
- Ghorfa "9th Arab-German Energy Forum", Cairo/Egypt
- 27. Windenergietage, Linstow/Germany

Delegations/Visitors

The increasing importance of KWS' overseas activities is spotlighted by the list of visitors to KWS PowerTech Training Center during the last report period:

On occasion of the compilation of POMBOK (Power Plant Operations & Management Body of Knowledge), a delegation of Japanese consultancy provider NIB gave KWS the honor of a visit in February 2018. NIB is a subsidiary of TEPCO, Japan's largest energy provider.

In August 2018, KWS welcomed visitors from Iran in the context of an iMove event. iMove is an initiative launched by Germany's Federal Ministry for Education and Research and pursues the goal of intensifying international cooperation in the field of basic and advanced vocational training.

Exchanging experience and gathering information regarding vocational training models in the field of hydropower was the purpose of a visit to KWS by a delegation of instructors from the Sichuan Water Conservancy Vocational & Technical College in October 2018. The event was conducted in cooperation with COBER Industrial Service Handels GmbH.



Visitors of the Sichuan Water Conservancy Vocational & Technical College with KWS staffers

By the end of November 2018, a delegation of instructors from state vocational training institutions in the People's Republic of China paid KWS a visit. Organized with assistance from the Carl Duisberg Society, the visit served the exchange of information in the field of power plant personnel training.

Simulator internship for secondary school students

From February 5–8, 2018, a total of 65 students from basic and advanced courses in technology paid KWS PowerTech Training Center a visit along with their teachers. Subdivided into groups of approx. 15 participants, the students were introduced to thermal power plant block unit operations on the simulators at KWS's training center in Essen-Kupferdreh. The students had the opportunity to conduct operator control actions on screen-based operating systems personally as part of their simulator internship.

Apart from Helmholtz High Secondary School in Essen, which has been visiting KWS regularly since 2007, Horkesgath Secondary School from Krefeld, Germany, took part in the simulator internship for the first time. Both high schools offer secondary school stage II technology basic and advanced courses with emphasis on thermal power plants, fuel cells and renewable energies, among other things. The visits to KWS are designed to attract students with an aptitude for technology to the field of power plant technology and thereby to college engineering degrees in energy technology and electrotechnology. Such internships routinely meet with great interest from both students and teachers.

Awarding the KWS Badge of Honor

The KRAFTWERKSSCHULE E.V. badge of honor is awarded to persons who have contributed in a voluntary capacity to the association or they have given the KWS long-term support through their influence and support in the area of teaching. This extraordinary effort can be honored with the honorary badge in bronze, silver or gold.

In 2018 the General Assembly of KWS awarded its **gold** badge of honor to:

Mr. Erwin Winkel
- Member of the Board of Directors,
KRAFTWERKSSCHULE E.V.
2005–2018

In 2018 the general assembly of KWS awarded its **silver** badge of honor to following ladies:

Birgit Juraschka
- Lecturer's activity since 1988
- Received the bronze badge of honor in 2004

Dr. Judith Pauli
- Lecturer's activity since 1992
- Received the bronze badge of honor in 2004

In 2018 the general assembly of KWS awarded its **bronze** badge of honor to following gentlemen:

Udo Eickhoff

- Lecturer's activity since 2005
- Member of Power Plant Shift Supervisor Exams Committee

Jürgen Endemann

- Lecturer's activity since 2001

Jawad Teuchler

- Lecturer's activity since 1995



Dr.-Ing. Judith Pauli, Nina Woydack, Jürgen Pasch, Jawad Teuchler, Ernst Michael Züfle (f.l.t.r)

Apartment Building

The apartment building with its 54 modern furnished apartments of approx. 21 square meters each enables residents to live and study in the immediate neighborhood of KWS's training center.

Generously equipped kitchens on each floor, gyms and leisure areas as well as group study chambers complete with audiovisual equipment round out accommodations on the premises.

Spacious outer premises offer plenty of diversion thanks to a variety of leisure time activity options.

An approximately 85 percent occupancy rate for 2018 proves that combining accommodation, relaxation and close proximity to the school is vital for studying at the KWS PowerTech Training Center.

Featuring an innovative energy concept, this architecturally successful object blends in perfectly with its Deilbachtal surroundings and complements the Energy-Campus Deilbachtal.



Apartment building of the KWS

KWS Conference Center

KWS has been offering all members an option of using the training center facilities as a convention center. Convention and seminar rooms are available for up to 130 participants and equipped with all modern media and optional videoconferencing. Meals may be supplied by the staff restaurant. During the report period, KWS's facilities were booked 185 times by external hosts of seminars or conventions.



Inside view of conference room

KRAFTWERKSSCHULE E.V.

Deilbachtal 199

45257 Essen, Germany

Phone: +49 201 8489-0

Fax: +49 201 8489-102

info@kraftwerksschule.de

international.kraftwerksschule.de

www.kraftwerksschule.de