

# Energy in good hands

STEAG Energy Services





# The world needs energy!

Viewed from space at night, our planet offers us a fascinating spectacle: pools of light in which the world's major cities are immersed. These pools of light burn ever brighter, becoming larger and more numerous. For more and more people aspire to a western standard of living. That requires more and more energy. At the same time, the reserves of raw materials are becoming scarcer and scarcer.



If we are to master the future, we need technical progress. The central question is how we are to make more energy available with fewer resources, without putting an unbearable strain on the environment.

Scarce goods are expensive, and that also applies to energy. That is why we have to use the available resources as efficiently and sparingly as possible, and at the same

time search for alternative, affordable forms of energy. For us, both of these approaches have maximum priority. We are confronted by serious challenges, which we as a global energy service provider intend to face up to and work on solutions. We consider ourselves under an obligation to future generations.



# Our know-how for your energy

The variety of our services reflects the complexity of a power plant. They include design, construction-related services, operation and optimization of energy generation facilities of all kinds. We benefit especially from the decades of experience we have gained worldwide in the operation of our own power plants and plants owned by third parties.

The design engineer with operating experience is our global trademark. Our portfolio comprises the full range of power plant related services, from efficient project management to IT solutions for optimization of costs and processes. Our workforce covers the entire value chain from project planning through construction to operation of a wide variety

of energy generating facilities. This unique range of experience on the one hand gives us a competitive edge on the global energy markets, and on the other hand provides us with a strong foundation on which to develop sustainable, innovative products.



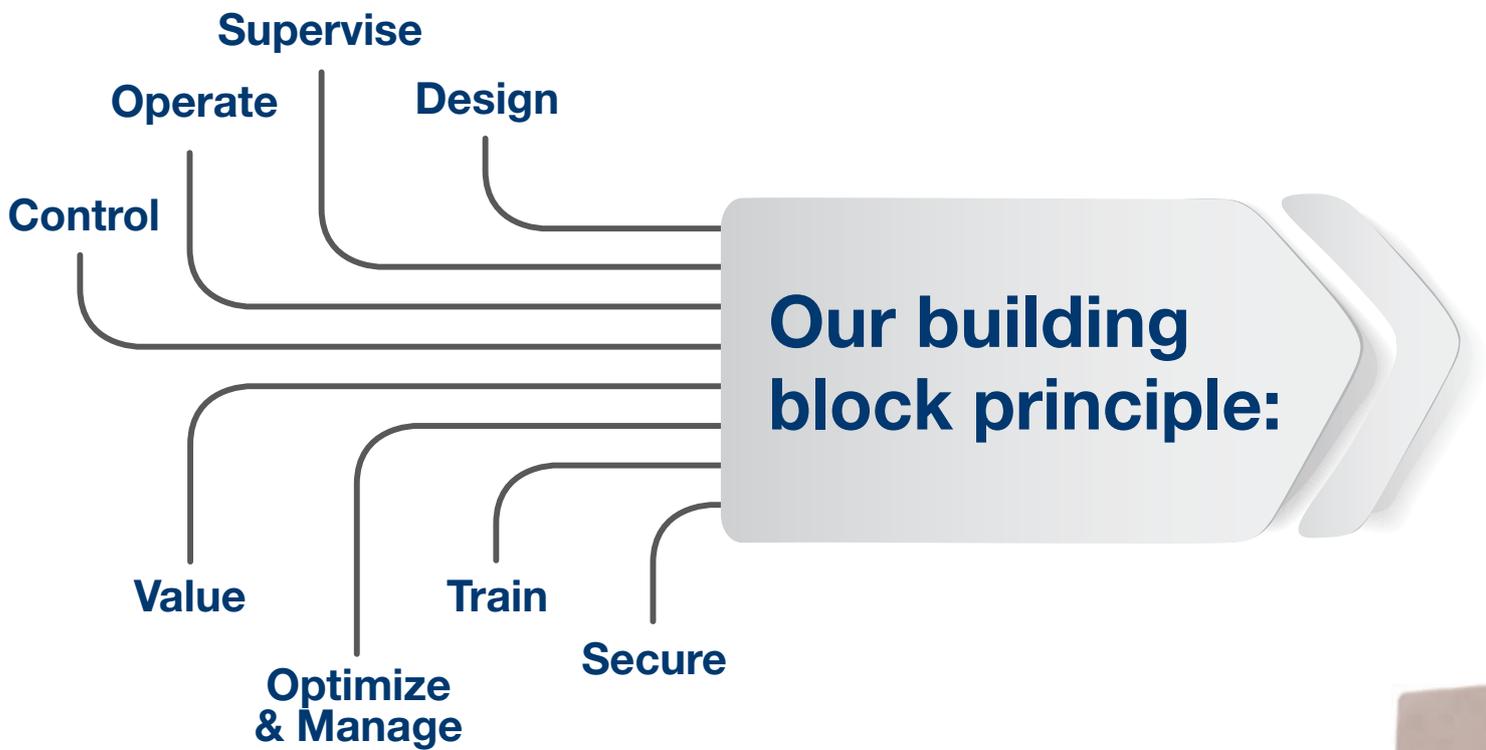
**We are your energy service provider – always near you throughout the world!**

- We represent the entire energy mix.
- We draw on our own operating experience – only few companies have this decisive feedback.
- We design, supervise, operate, maintain and optimize all types of energy generation facilities and thus combine engineering know-how, operating experience and IT knowledge in a single company.
- We are partners to municipal utilities, commerce and industry.
- With our international subsidiaries, power plants and projects, we are optimally positioned to serve the global energy market.

# Energy for creative

## The problem:

How can we manage to provide enough affordable energy for currently over seven billion people, and more in future?



# solutions

## **The background:**

Fossil fuels are finite, and more and more stringent emission regulations have to be complied with to protect the environment.

## **The solutions:**

In the medium term, it will only be possible to secure energy supplies on the basis of a mixture of fossil fuels and renewable energy sources. This requires an intelligent, complex energy services kit that provides efficient tools on a project-specific basis for nearly all the demands in the field of energy.





## Customer-oriented, flexible and expert

### **We plan and supervise the construction of power plants**

We plan and supervise the construction of power plants of all kinds. For modern coal-fired power plants, combined cycle systems or facilities using renewable energy sources, our engineers and industrial architects implement highly complex projects on time and within the budget at a high level of quality and with due regard to the local technical conditions. The benefit for our customers is derived from our expertise and our project management: As architect-engineer, we provide dependability down to the smallest detail, from the conceptual design phase to commissioning.

### **We operate power plants**

We have been operating power plants for decades, and now offer this unique know-how as a service to our external customers. Our involvement extends from consultancy support to increase the efficiency of power plant operation, through the deployment of our specialists to assist in operation, to the complete assumption of all operation and maintenance functions, both technical and commercial.



### **We control power plants**

Increasing generation from volatile energy sources means that spontaneous load fluctuations in power supply occur, making planning more difficult. This leads to new requirements for primary and secondary control systems in power plants, which have to react rapidly and flexibly to increasing rates of load change and larger load windows, from the lowest light loads to temporary overloads. We therefore implement state of the art instrumentation and control strategies which ensure technically and commercially optimum plant operation with a high degree of automation.

With the aid of our I&C solutions, the output of Unit 9 of the Walsum combined heat and power plant, for example, can be stably controlled with an exported active power ranging from 85 MW to 370 MW while also ensuring the required levels of steam extraction.

### **We assess power plants**

If a power plant is to be successfully optimized, it has to be accurately assessed. Together with our engineering know-how as a designer and operator, we have 30 years of experience in the inspection and evaluation of control measurements and of evaluated data from the plant suppliers. The findings obtained for our customers can then be directly used in the performance of refurbishment, retrofitting or optimization work.

One example of this is the comprehensive retrofit of the 500 MW Herne 4 unit with numerous individual measures including furnace conversion, retrofitting of a high pressure turbine and replacement of the I&C system.

Furthermore, we are increasingly using this know-how for buyers, sellers and banks in the context of due diligence processes related to power plant sales transactions.



### **We optimize and manage power plants**

With the complex technology of modern energy generation facilities, power plants today can only be run with highly specialized software. Our IT engineers have developed specialized solutions for a broad variety of requirements. With design tools for power plants (EBSILON®*Professional*), monitoring and optimization tools (SR::EPOS), systems to monitor soot-blowing (SR::BCM) and software for statistical evaluation of raw data from operating measurements (SR::SPC), we supply monitoring and optimization services worldwide and train the users of those systems. Where commercial aspects are relevant to operation and maintenance, we take these into account with our O&M management systems SI® and SI®/PAM, which are successfully deployed in STEAG power plants and in our customers' plants in Germany and abroad.

### **We train and provide staff**

Internally and externally, we provide first-class, practical and customized training courses directly at our power plants. Our training on the job covers all the levels and

departments of a power plant. We have our own mobile power plant simulators to run through various exercise situations down to the finest detail. These have been used most recently in Egypt, Turkey, Nigeria, Libya, India, China, Mongolia, Argentina and Brazil.

In addition, we bring people and jobs together. Through our subsidiary OPUS Personaldienstleistungen, we second and place technical and management personnel who meet the customer's specific needs. As such, we are a reliable human resources partner for customers from the power industry, the plant construction industry and related sectors.

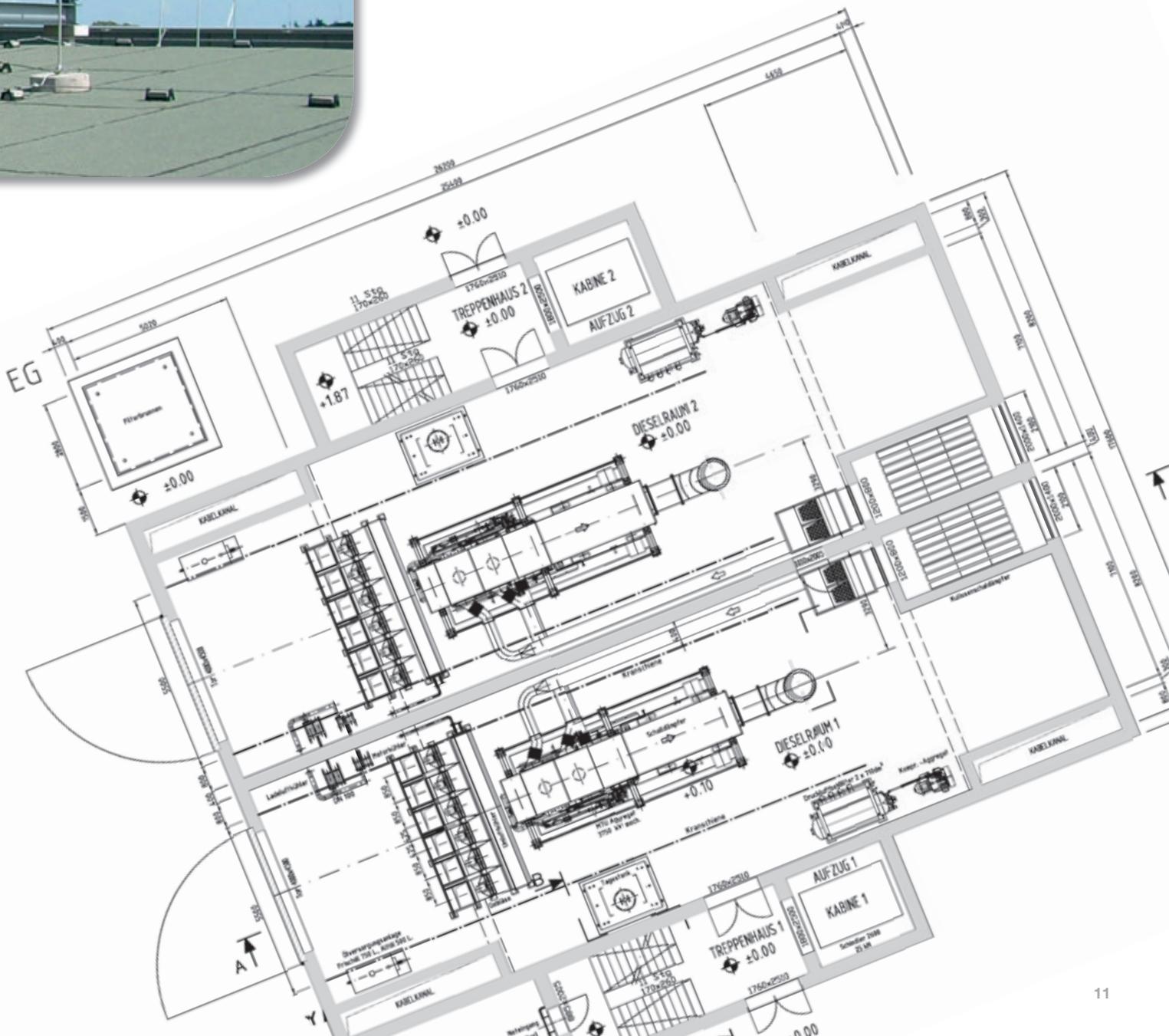
### **We ensure safety and security**

Our Nuclear Technologies division possesses proven expertise in the planning and construction of facilities for the storage and disposal of nuclear residues. There is great demand for our know-how in radiation protection calculations and safety strategies. We plan and consult in the decommissioning and dismantling of nuclear installations.



## We are industrial architects

Not only do our specialists use their excellent qualifications in our core business, but our engineers and industrial architects are also in demand, for example, when a chip-board factory is to be constructed in Radautz, Romania, or a senior citizens' home built in Bonn. Our specialists' range of services extends from project planning through project management to project implementation.





# We research for the future

For a technology service provider, research and development activities are key to survival. Our work focuses on the environmentally friendly design of the energy generation process, improvement of cost-effectiveness and ensuring maximum availability of energy.

We attach great importance to application-related developments and intensive research coupled with projects, guaranteeing continuous improvements. Over 250 patents document our innovative strength. The issues currently under consideration include further furnace optimization, separation of heavy metals from power plant waste water, the use of small-scale hydro power and methods of conditioning and using biomass.

There is a special focus on the networking capability of renewable energy sources such as wind, solar power and biomass – both with each other and with conventional electricity generation methods. The analysis of grid behavior in terms of stability, with the increasing share of feed-in from renewables and less spinning mass, represents a particular challenge and is therefore a focal area in our research.

In the course of the expansion of renewables, storage facilities of all kinds are also gaining in importance and are therefore a further focal area of our research and development activities, which address not only battery technology, but also the topics of power-to-gas and pumped storage.

Carbon capture is being examined, especially against the background of the potential use of the gas. In this field, we have developed a CO<sub>2</sub> absorption agent aimed at the reuse of CO<sub>2</sub> to a stage ready for patenting.

Materials are key to all kinds of development, and we therefore devote special attention to them. The findings on materials also play a major role in the flexibilization of existing power plants. In this context, we are intensively involved in local research groups and utilize the potential of the universities situated in the Rhine and Ruhr areas. In this way, we also support the young power engineers of tomorrow, who are particularly close to our hearts.

Each year, we invest a considerable proportion of the sales revenue of our System Technologies division in the development and updating of our software – so that our customers at home and abroad can operate their power plants as efficiently and safely as possible.

# Thinking about tomorr



Safe and clean energy is needed all around the globe to enable prosperity, growth and quality of life. STEAG Energy Services is aware of the requirements and supplies the solutions.

## **We use the sun**

The sun is our largest energy supplier, and so it makes sense to use that natural source. Our activities in this field are concentrated on solar thermal power plants which are erected at locations in the earth's sunbelt. In that context, we focus on the three technologies "parabolic trough", "linear Fresnel" and "solar tower", and also on hybrid systems with conventional power plants.

## **We catch the wind**

In the field of wind energy, we market our know-how as a project planner for large-scale generating facilities. Our portfolio extends from feasibility studies to commercial and

# ow, today



technical project development. We assess the site, analyze the wind measurements, establish the basic layout, create the grid connection and perform infrastructure planning, construction supervision and commissioning. At our WINDcenter, we monitor and analyze the operation of the wind farms and provide valuable advice on optimization of deployment and portfolios.

## **We transform biomass**

Recovery of energy from locally available biomass already makes an important contribution to the security of supply. That is why our biomass-to-energy specialists plan and construct thermal facilities for the use of biomass. Our

associated company STEAG New Energies operates reference plants at various German locations. Internationally, the focus is on countries like Brazil, India and Turkey with their high biomass potential. Apart from local use, we also engage in the treatment of biomass for export. Furthermore, our engineers plan and construct energy generation facilities using municipal waste, refuse derived fuels, industrial waste and hazardous waste.

### **We make water clean**

In many regions of the earth, water is a scarce commodity. We therefore provide solutions for water treatment and waste water conditioning which confer ecological and economic benefits. In particular, we are involved in water and cooling water treatment, desalination, water management, waste water treatment and biofouling management.

### **We provide heat**

Cogeneration, or combined heat and power, means parallel generation of electricity and heat. We use this technology to achieve a high level of exploitation of the input energy sources. Typical applications for CHP include highly available and reliable supply of heat to industry, or district heating. We are a strong partner to STEAG Fernwärme GmbH, and as such the engineering service provider to the largest district heating network in the German federal state of North Rhine-Westphalia, with a connected load of 1,250 MJ/s.

### **We clean gases**

The emission limits for sulfur oxides, nitrogen oxides and dust are becoming more and more stringent. In consequence, global demand for modern flue gas treatment systems for coal-fired power plants, combined cycle plants, plants fueled by waste and biomass, and industrial power plants is rapidly rising.

Our specialized know-how in the reduction of flue gas emissions – electrostatic precipitations, desulfurization and DeNo<sub>x</sub> (SCR and SNCR systems), NH<sub>3</sub> supply systems and separation of heavy metals, dioxins and furans – therefore meets with great interest both in power plant retrofitting and in the new plant segment.



# Our energy moves

**STEAG SCR-Tech, Inc.:**  
Kings Mountain, Grover and  
Steele Creek, USA

**STEAG Energy Services GmbH:**  
Essen, Herne, Gelsenkirchen and  
Zwingenberg, Germany

**STEAG Powitec GmbH:**  
Essen and Ilmenau, Germany

**STEAG Energy Services  
Solar S.L.U.:** Seville, Spain

**STEAG Energy Services Schweiz GmbH:**  
Zurich, Switzerland

**STEAG Energy Services do Brasil Ltda.:**  
Rio de Janeiro, Brazil

**STEAG Energy Services  
Botswana (PTY) Ltd.:**  
Gaborone, Botswana

**Johannesburg, South Africa**

# the world!

- ★ Headquarters
- Subsidiary
- Branch office
- Permanent establishment

**OPUS Personaldienstleistungen GmbH:**  
Essen, Germany

**STEAG Ensida Energy Services Ltd.:** Ankara, Turkey

**Constanta, Romania**

**STEAG Energy Services India:**  
Noida, India

**Riyadh, Saudi Arabia**

Over 2,000 employees  
Over 1,000 projects each year worldwide  
Over 75 years of experience as a power plant operator  
Over 250 patents and references in over 60 countries worldwide  
Over 200,000 MW plant capacity engineered worldwide  
Over 3,000 MW plant capacity under contract for O&M

# Operating globally and acting locally

That is our motto for all our projects at home and abroad. Constructing a solar power plant in India, building a new coal-fired power plant in South Africa or acquiring a wind farm in Romania – each project has its own individual facets. Apart from technical aspects, these include the political, social, ecological and economic conditions in the local area.



**With our experience of over a thousand projects each year worldwide, we know how sensitive local conditions can be, and act accordingly. Our staff, totaling 2,000 people, have the know-how to assess every single project individually and implement it with due regard to the circumstances at site.**

**Whether at home in Germany, in our main export markets of the USA, Brazil, India, Turkey, South Africa, Spain and Switzerland where we are represented by subsidiaries, or in the rest of the world – we are the expert energy service provider. Power plant know-how “made in Germany” makes us a strong local partner, worldwide.**



### Brazil:

Brazil is one of the five BRICS countries which are experiencing annual growth rates of up to ten percent. According to a forecast by Goldman Sachs, Brazil could be one of the world's five largest economies in 2050. The hosting of major events such as the 2014 soccer World Cup and the 2016 Olympic Games illustrates the country's ambitions. The projects are correspondingly ambitious. Together with ENEVA, STEAG Energy Services do Brasil Ltd. is planning and constructing a combined cycle power plant in Parnáiba with a total capacity of around 3,700 MW<sub>el.</sub> Our functions there comprise project management, planning, contract

negotiations with suppliers, commissioning and handing-over of the plant for commercial operation. In future, STEAG Energy Services do Brasil Ltd. is to devote increasing attention to renewable energy sources e.g. by plant operation, project management or the implementation of STEAG software in addition to its involvement in the gas and steam turbine sector. The focal areas will be the use of biomass from sugar cane waste and wood, and wind energy, geothermal and solar power. With our projects, we have established a strong market presence in the region and are optimally positioned for the boom in South America's power sector.

### USA:

In the USA, we concentrate on serving the fast-growing market for environmental engineering. For the American power plants which use fossil fuels, we supply flue gas desulfurization and nitrogen oxide reduction (DeNO<sub>x</sub>) systems including selective non-catalytic NO<sub>x</sub> reduction with its ammonia systems and coarse ash screens.

With our bases at Kings Mountain, Grover and Steele Creek in North Carolina, we are located at the strategic focal point of the USA's coal-fired power plant industry. Around eighty percent of all plants in the country are within a radius of only 500 miles. At the west coast of the USA, we are also highly successful with our catalyst regeneration techno-

logy for biomass facilities. Our regeneration process ensures that customers save up to 50 percent of catalyst replacement investments while achieving the same catalyst performance. The further prospects are highly promising, as specialized engineering and related services for power plants are a growth market in the USA.





### **India:**

Against the background of a booming economy and planned infrastructure investments by the Indian government, most of which is to be directed at the energy sector, the Indian energy market is an important future market for us.

We have responsibility for the entire operation and maintenance of the power plants at Hazira, Bathinda and Visakhapatnam. Over and above that, we provide engineering and consulting services and establish IT systems for O&M and power plant optimization. In addition, we train and qualify the skilled personnel in India in our own simulator which can reproduce all the processes of a power plant.

As an R&M (renovation and modernization) consultant, we are the market leader. We already have over 1000 full-time employees in India to support the country with our future-oriented technology and innovative power in the face of its rapid rise in energy demand.

### **Turkey:**

The energy sector in Turkey is on the way to deregulation. Privatization is in full swing, with a considerable number of facilities up for sale from the state-owned company EÜAS alone, and numerous investors are searching for opportunities.

The engineers at Energy Services have gained extensive experience, not least from their involvement in the Isken-derun coal-fired power plant, which still ranks as a flagship project in the Turkish power industry.

Reasons enough for us to intensify our long-established and successful business relationship with the Turkish engineering company ENSIDA. The company, registered as STEAG Ensida Energy Services Ltd. (SEES), became part of the STEAG Energy Services Group in September 2011.

This provides us with optimum access to the Turkish energy market, which offers enormous opportunities for growth.



**South Africa:**

South Africa, the country at the Cape of Good Hope, is Africa's largest economy and, as an up and coming newly industrialized country, a member of the G8+5. Rich in minerals, the country's constantly rising demand for energy is mainly covered by fossil fuels.

In consequence, the world's largest coal-fired power plant, Medupi Power Station with a total capacity of 4,800 MW, is currently being built there. In that project, STEAG Energy Services is assisting the country's largest power supply company ESKOM in all matters concerning the power plant process,

with a special focus on interdisciplinary engineering. STEAG engineers are also actively involved in ESKOM's energy efficiency program, in which all the coal-fired power plants with a total capacity of 38 GW are being examined.

Over and above this, our experts are working in various functions within the project management – in engineering management and as strategic and organizational consultants.

Apart from the engineering activities, South Africa also has great potential for services in the fields of operation and maintenance, and training.



### **Spain:**

Here, STEAG Energy Services is aiming to extend its portfolio to include the operation and maintenance of solar thermal power plants. Through a subsidiary, our parent company STEAG has therefore acquired 26 percent of the shares in the Spanish 50 megawatt solar thermal power plant at Arenales near Seville. In addition, our Spanish subsidiary SES Solar has secured the operation and maintenance contract for this facility, in order to contribute our many years of O&M experience and know-how to a major renewables project.

### **Switzerland:**

With the abandonment of its nuclear power plants at the end of the safe service life and the simultaneous expansion of hydro power, generation from renewables and electricity production from fossil fuels, Switzerland is an attractive future market. Our subsidiary, STEAG Energy Services Schweiz GmbH, is already an established and highly regarded company with numerous local references, especially from waste disposal projects and safety analyses. For the future, we are planning to extend our focus to cover the design of storage power plants, and to offer our range of services in the field of renewable energy sources.



**The management team of  
STEAG Energy Services:**

**Front row, left to right:** Dr. Ralf Schiele (CEO), Juracy Monteiro (Brazil), Ulrich Sigel (Director)

**2. row, left to right:** Heiko Schierenbeck (Intern. Business Development), Erik Hennig (Information Technologies), Dr. Jacob Verghese (India)

**3. row, left to right:** Hans Hartenstein (USA), Peter Krüger (System Technologies), Dr. Wolfgang Benesch (Energy Technologies), Michael Goth (South Africa)

**Back row, left to right:** Bilgehan Çeber (Turkey), Norbert Schröder (Nuclear Technologies), Anand Bansal (India), Achim Nietzsche (Plant Services), Thomas Schmukal (Commercial Department)





Design, construction supervision and commissioning of energy facilities

## **Energy Technologies**

Operation and maintenance of power plants, personnel services

## **Plant Services**

## **System Technologies**

IT solutions for optimization and monitoring of power plant operation, communications technology

## **Nuclear Technologies**

Design, construction, de-commissioning and disposal of nuclear facilities

# **steag**

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