



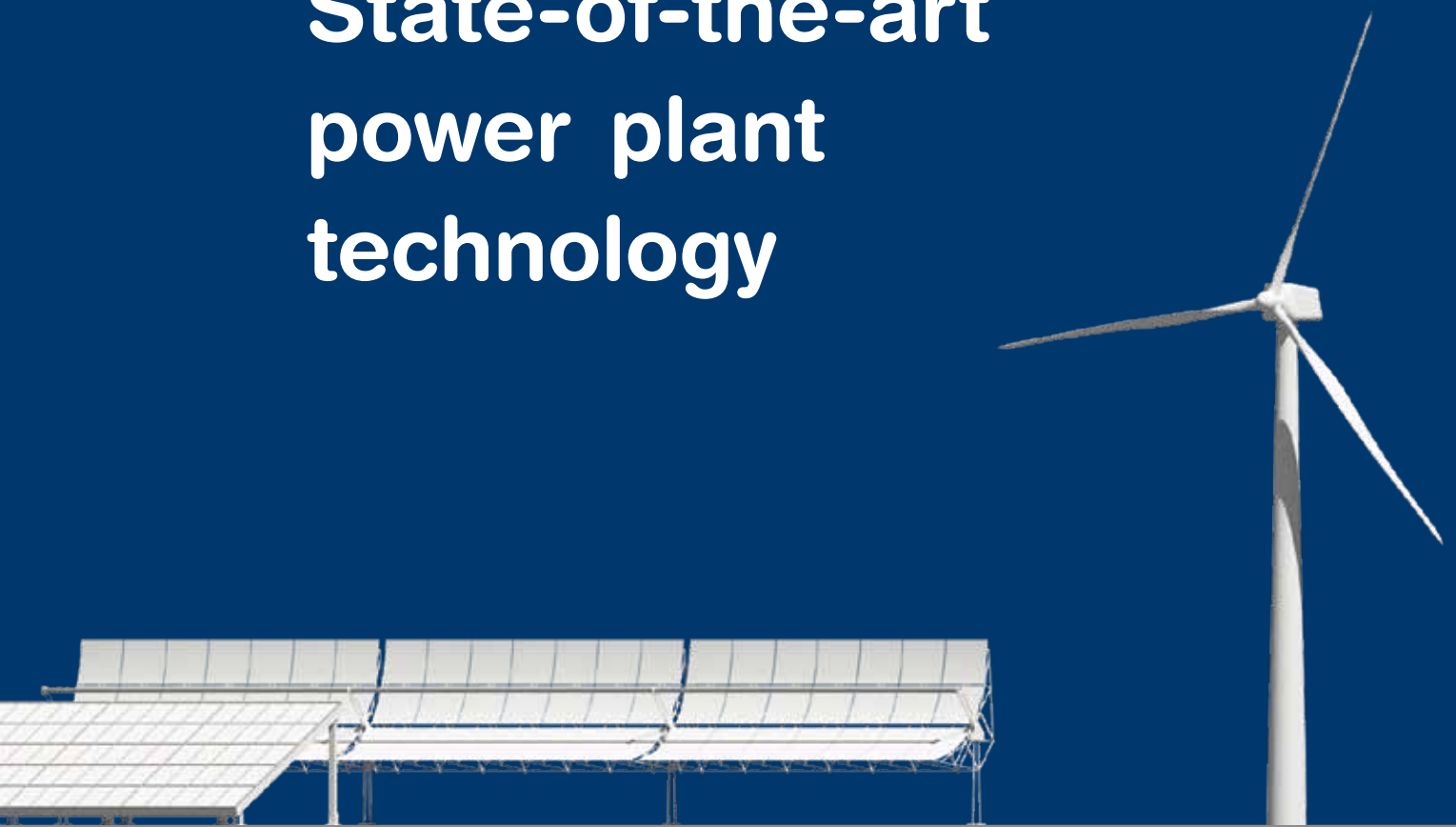
STEAG Energy Services

The Energy Technologies business unit is specialized in the planning, implementation and operation of power plants and energy and environmental protection installations.

www.steag-energyservices.com

steag

State-of-the-art power plant technology



The core competencies of the Energy Technologies unit are comprehensive engineering services and other services covering all aspects of energy. We provide engineering services for the planning, construction and optimization of power plants and industrial facilities. Our technical know-how is complemented by state-of-the-art power plant technology, efficient project management and the use of effective tools. In supplying our services as planners, we draw on operating experience based on 9,000 MW power generation from STEAG plants and 5,000 MW for third parties. With our integrated range of services we have reliably provided optimum one-stop solutions for over 30 years. Worldwide.



If the earth is to support a population of several billion, an adequate amount of reasonably priced, environmentally friendly energy is essential. In the medium term, the energy supply can only be assured through a combination of fossil and renewable energy.

Especially in newly industrialized countries and developing countries, where expansion of electricity supply is a significant driving force behind economic growth, the majority of the rise in power demand has to be covered by new power plants fueled by fossil and renewable energy sources.

The industrialized countries in Asia, Europe and North America also need new fossil and renewables power plants to expand and modernize their existing power

generation facilities. In addition to this, the energy landscape has to be adapted to accommodate an increasing and in some cases highly fluctuating infeed of energy from renewables.

The adaptation of power plants and plant concepts to the requirements of the market, combined with the conservation of resources, repeatedly places new demands on energy technology. To us, this is not an „either ... or“ situation in the context of a system conflict; we see it rather as a „both ... and“ proposition in the form of an energy mix.

For decades, Energy Technologies as a unit of STEAG Energy Services has successfully been taking up this challenge in Germany and abroad.



Sun power

Energy Technologies is increasingly focusing on solar thermal power plants. Here too, we can draw upon our experience in power generation from thermal power plants of all types. Solar radiation is concentrated to generate heat which is supplied to a conventional steam-water cycle (**C**oncentrating **S**olar **P**ower). For this we are engaged in the Parabolic Trough, Linear Fresnel and Solar Tower technologies.

Energy Technologies has been able to demonstrate its expertise in this field in several solar thermal power plant projects worldwide. In addition, we develop concepts combining various technologies such as CSP with biomass combustion and seawater desalination, or fossil fueled power plants with integrated solar arrays (Solar Topping).

Our main services comprise location-specific studies for power plant and storage concepts, technical planning, calls for tenders and site supervision and commissioning of solar power plants.

Fair winds

We also benefit from our extensive experience in planning and realization of large generating plants for wind farms. Our expertise includes technical project development including site evaluation plus analysis of wind measurements, basic layout, power grid connection, infrastructure planning and feasibility studies, project planning, site supervision and commissioning.

Saving natural resources

Growing power needs, climate developments, rising prices for fossil sources of energy, and last but not least the aspiration for greater independence and stability of the energy supply, determine our actions.

Waste-to-energy and biomass

Energy Technologies is a specialist for the engineering of waste-to-energy facilities. We plan and build thermal plants for the treatment and disposal of residual waste, refuse-derived fuels, hazardous waste, and production residues. Waste whose recycling would be economically inefficient thus replaces primary energy sources.

This approach is pursued with involvement by STEAG Energy Services at the Lauta waste incineration plant, for example, and most recently at Industriepark Höchst.

We make systematic use of our waste treatment know-how for the purpose of generating energy from biomass.

In addition, we address issues of co-combustion, successfully combining our experience from different fields.

Building bridges

Conventional power plants, particularly in Germany, are required to make provision for the expansion of the renewables sector. That applies especially to coal-fired and combined-cycle plants.

Along with obtaining the largest possible amount of energy from fuels with state-of-the-art efficiency, efficiency enhancement and combined heat and power generation, these plants must feature a high degree of flexibility in terms of loads and fuels.

We take up this challenge to find the optimum solution for each individual project.

Efficient use of fuel



Fuels must be used efficiently. For this reason we develop plant concepts for all fuels, plan and build these plants, and offer environmental technology services. We come from the business of generating electricity from hard coal and also have concerned ourselves in the last few decades with a wide range of fuels including natural gas, biomass, waste and special fuels. Commercial-scale power generation from wind and solar energy also plays an increasingly larger part in our design concepts.

Power Plant Technology is the heart of Energy Technologies. It is responsible for energy conversion, in-plant power generation, and heat and power distribution, applying the basic principles of low power generation costs, good environmental compatibility, high power plant availability, high rate of utilization of energy sources, and long life. From the variety of possible fuels (along with coal: natural gas, refinery gas, refinery by-products, other special gases, biomass and waste) we select the optimum fuel. We provide services for everything ranging from engine-based CHP units with a few MW to large-scale power plants with up to 1,000 MW.

Energy Technologies can draw on decades of experience in STEAG's own power plants and from third-party projects. Another value-added service for our customers is

the close contact with STEAG's operations: we plan and design through the eyes of the engineer and operator. We focus attention not only on the cost of investment, but on future operating costs as well.

Attainment of highest efficiency, reflected in the parameters of each project, is our goal – for every fuel, whether natural gas, coal or biomass. For such projects we prepare the designs, evaluate the site development and perform the planning, the preparation of tendering and permit application documents, the project management, site supervision and commissioning.

In addition, we offer power plant evaluations, energy concept studies, special studies, expert assessments and performance tests subsequent to the commissioning of power plants.

Combined heat and power generation

For quite some time Energy Technologies has focused on the particularly efficient combined heat and power (CHP) cycle, which permits high rates of utilization of the employed source of energy through the parallel production of electricity and heat.

Typical CHP implementations are the intelligent supply of district heating or the high-availability, dependable supply of industrial steam. In addition, we prepare expert assessments and certificates as evidence of the sparing use of primary energy and the high efficiency of district heating supply.

Solutions for flue gas

Modern air pollution control is an essential factor in the economical and environmentally compatible operation of an energy system. It often requires the incorporation of efficient air pollution control systems into new plants or the extensive retrofitting of existing thermal power plants with such systems. This is the only way to meet the increasingly restrictive emission standards worldwide for oxides of sulfur and nitrogen, and for dust.

This is where the extensive know-how of our engineers in the field of design, construction and operation of flue gas cleaning systems for coal-fired power plants and combined-cycle plants, waste and biomass-fired plants and industrial power plants comes into play. We have developed many processes ourselves and have continuously optimized them. We offer solutions for flue gas particulate control, desulfurization and NO_x control (SCR/SNCR systems), NH_3 supply systems as well as solutions for dioxin, furan and heavy metal separation.







**Water – a precious
resource**

What is applicable to all natural resources also applies to water: it is becoming increasingly more valuable. We offer solutions which not only have ecological but also economic benefits.

One focal concern is water treatment and wastewater cleaning, including sludge and residue treatment. Our engineers make appraisals of all water systems and develop options for repeated water use employing systematic recirculation. We offer solutions for water and/or cooling water treatment, demineralization, water management, wastewater treatment and biofouling management,

making use of physical, chemical, mechanical and biological processes.

The latter is used, for example, at the Leuna plant in one of Europe's biggest reverse osmosis systems to produce demineralized water from surface water.

We plan, coordinate and manage the projects for our customers.

We can look back on a large number of reference projects in Germany and abroad for the handling of turnkey installations. In many cases our customers decide, for cost reasons, to procure components in lots directly from the manufacturer.

As the architectural engineer, we close the gaps between the contract lots, check for compliance with the stipulated technical design, and join the lots into a complete system.

Project management and control play a key part in the success especially of these complex multidisciplinary projects, and include time scheduling and expediting, technical claim management and quality control.



Planning,
coordinating,
managing.



Quality Assurance.

In both new-build and retrofit projects the suppliers and manufacturers are under great pressure with regard to time and costs, which may have a negative influence on the quality of a plant and its long-term operation.

Consequently, effective quality assurance with the aim of recognizing quality problems as early as possible, assessing the possible consequences and initiating countermeasures, acquires central importance for successful project handling.

Energy Technologies creates quality assurance and quality control programs and applies them jointly with the client. We perform our own on-site inspections during manufacture, transport and construction, and perform expediting. Additionally, we assist external experts and third parties on behalf of the client.



Generating and distributing energy

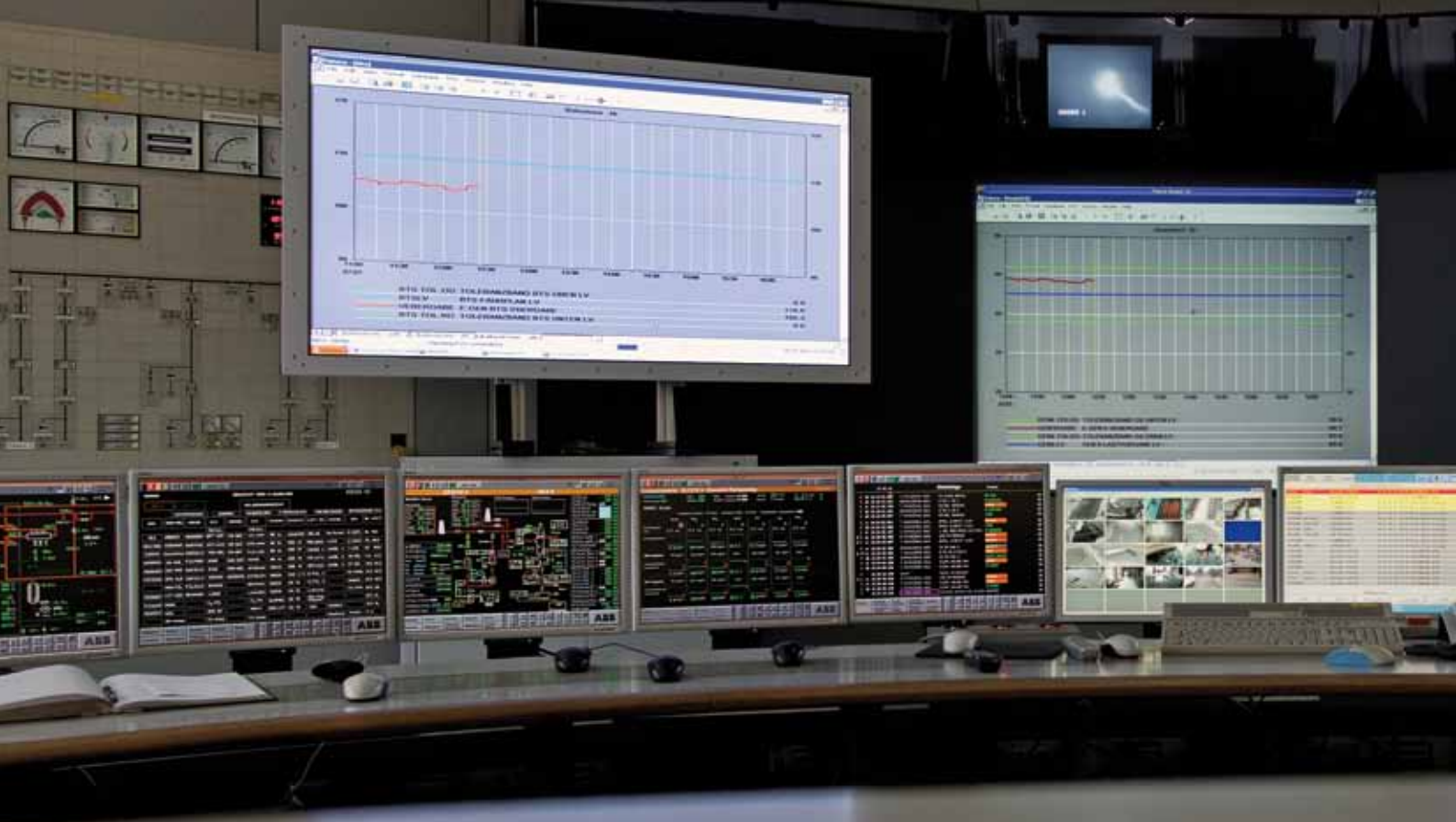
Our range of technical services includes the complete engineering of the auxiliary electric system of power plants and electricity distribution networks: from the conceptual design to project implementation. This might consist of individual job packages such as network and grid calculations and supplier-independent tender specifications for certain contract lots, or the comprehensive tasks of an architectural engineer, including site management and commissioning support.



Examples of some of the projects we have successfully handled include the development of a master plan for the electrical network of a new chemical plant, the weakness analysis of a complex industrial power supply system, the integration of a new 110 kV incoming supply feeder in a plant, or the adaptation of the station service load system of a new power plant to the conditions at a site.

The connection of a combined-cycle plant, a wind farm or other plants to the power grid has manifold facets today. In addition to developing and implementing a suitable grid connection concept, we focus on consulting services in connection with grid connection contracts, as well as proof of compliance with the requirements of the grid regulations and standards (such as the TransmissionCode).

For instance, answers to the problem of controlling short circuits occurring close to a plant, so that they have no repercussions on operation, or to the problem of stable island operation following severe power system faults, can only be obtained and the effectiveness of defined measures verified by dynamic simulation. Only few firms are capable of making such simulations.



Customized I&C solutions

Instrumentation, automation, optimization, operation and monitoring.

Every technical process requires suitable instrumentation and control systems. Our engineers are familiar with the scope of the necessary specifications – both for the process engineering and I&C suppliers – from the large number of projects they have handled, and are able to define the scope – also from the viewpoint of a power plant operator – to suit your requirements.

Along with the physical equipment of plants, optimum programming plays a decisive role in modern I&C

systems, in both technical and commercial terms. For numerous power plant projects we have delivered the specifications for the software of different automation systems ourselves, based on VGB standards where desired.

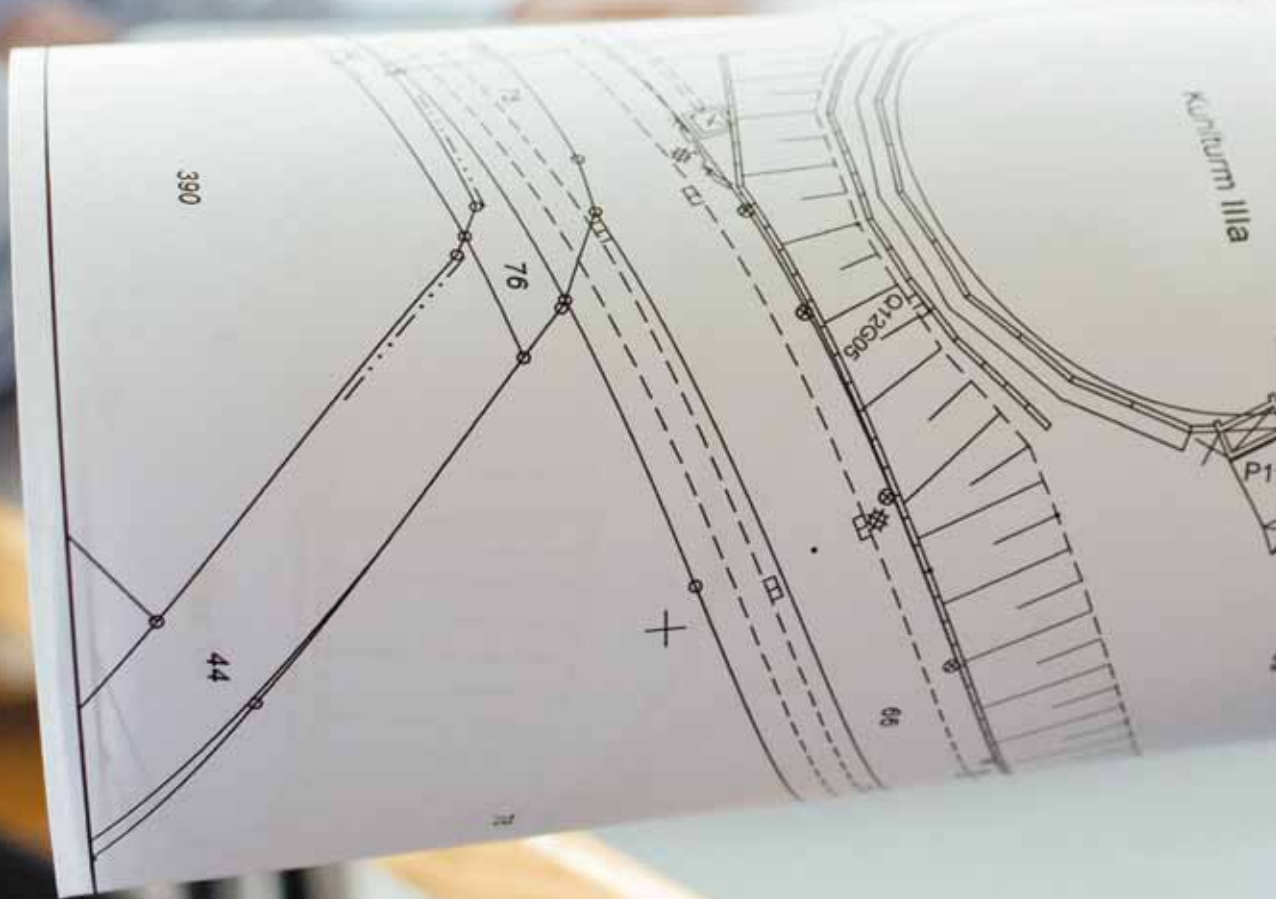
New market requirements such as the primary and secondary control capability of power generation systems, combined with highly flexible plant operation and reduced minimum load operation, call for sophisticated open and closed-loop control strategies which are developed by our



specialists and tested and optimized in our own plants before being introduced to the market.

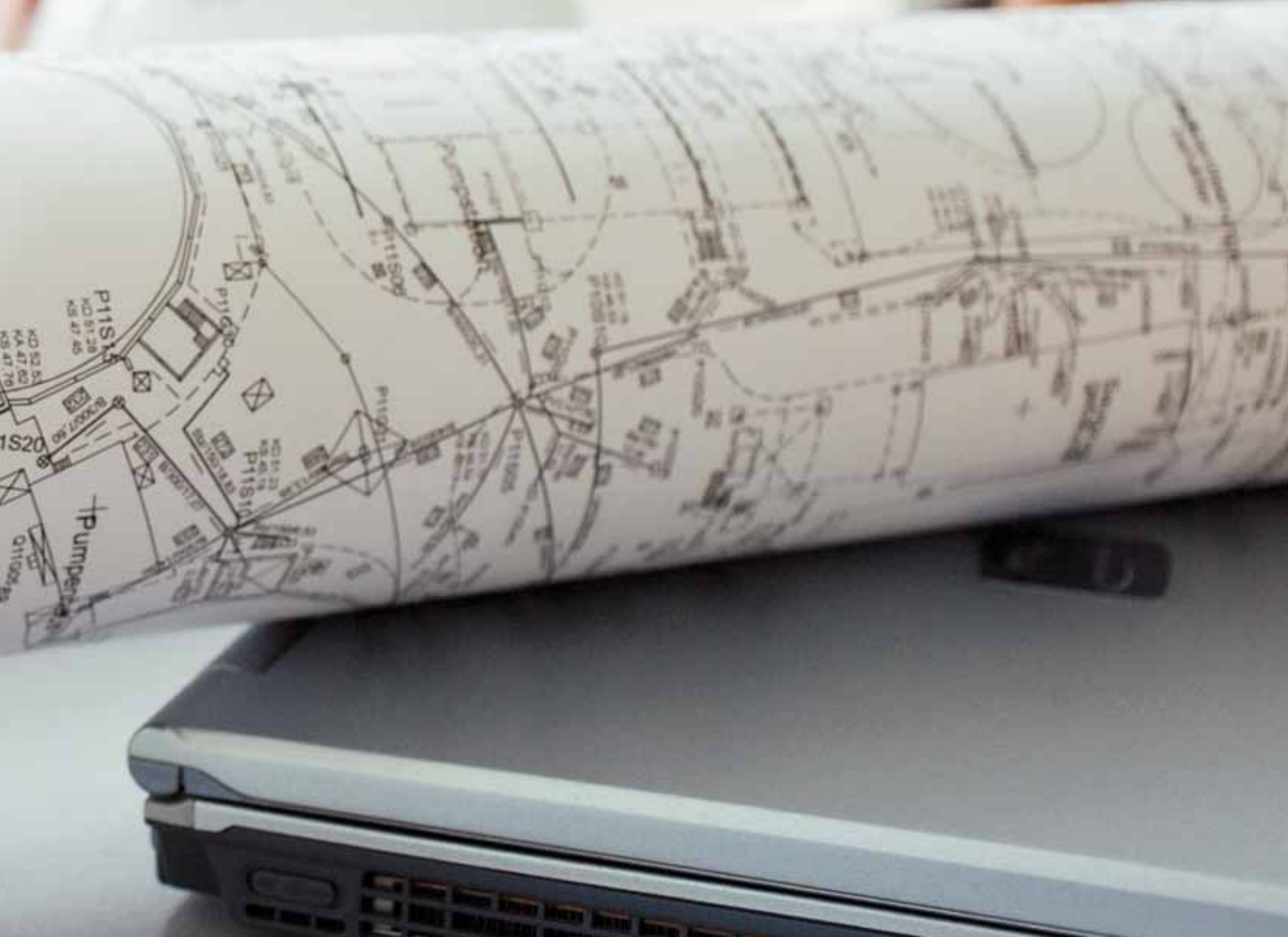
Through comprehensive data management – and networking with other systems, for example in energy distribution – we achieve an economically and technically optimized operating regime even for generating pools – indispensable for the integration of renewable energy with its highly dynamic availability rates, which call for suitable, dynamically flexible solutions.

All these hidden qualities of today's highly complex I&C technology become visible in up-to-date control rooms functionally equipped to our specifications with display, operator control and monitoring systems. Plant management, fault clearance and troubleshooting are practiced there with proven concepts and optimized staffing levels and ultimately lead to the commercial success of the plant as a whole.



Sound structures for modern technologies

Our civil engineers and industrial architects are also tightly integrated in the planning processes of all power plant projects. They always consistently seek to combine efficient structures with ambitious, up-to-date, but, above all, functional architecture.



In planning the construction of power plants and industrial structures one can never take a pre-existing blueprint because of the different site conditions and other factors unique to each location. Structures must be designed to suit the specific project location. Power plant construction, in particular, involves extremely heavy loads which have to be diverted into the foundation soil by means of the rising parts and the foundation structure.

The “intelligent” construction solutions from our engineers which serve this purpose simultaneously ensure optimum costs and deadlines.

Special structures like industrial stacks and cooling towers call for specialized know-how for the adoption of efficient building methods and the most suitable building materials. In all projects we seek to contribute to strong public acceptance through harmonious architectural adaptation of structures and plant parts to the urban surroundings and

local scenery. Industrial enterprises present themselves not only through their products, but also create trust and enhance their image by putting an aesthetic and innovative outer appearance forward to the public.

The services of our building engineers range from pure construction planning to full service for the whole project management. Our construction experts have, for example, taken part as architect engineers in the building of several woodworking plants. These are among the most up-to-date plants in Europe.

These experts have also handled production plants for the semiconductor and automotive supply industries and various office and factory buildings. Our planning and project management services are also in great demand for hotel and other commercial properties. Another relevant market segment is the dismantling of nuclear facilities.

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