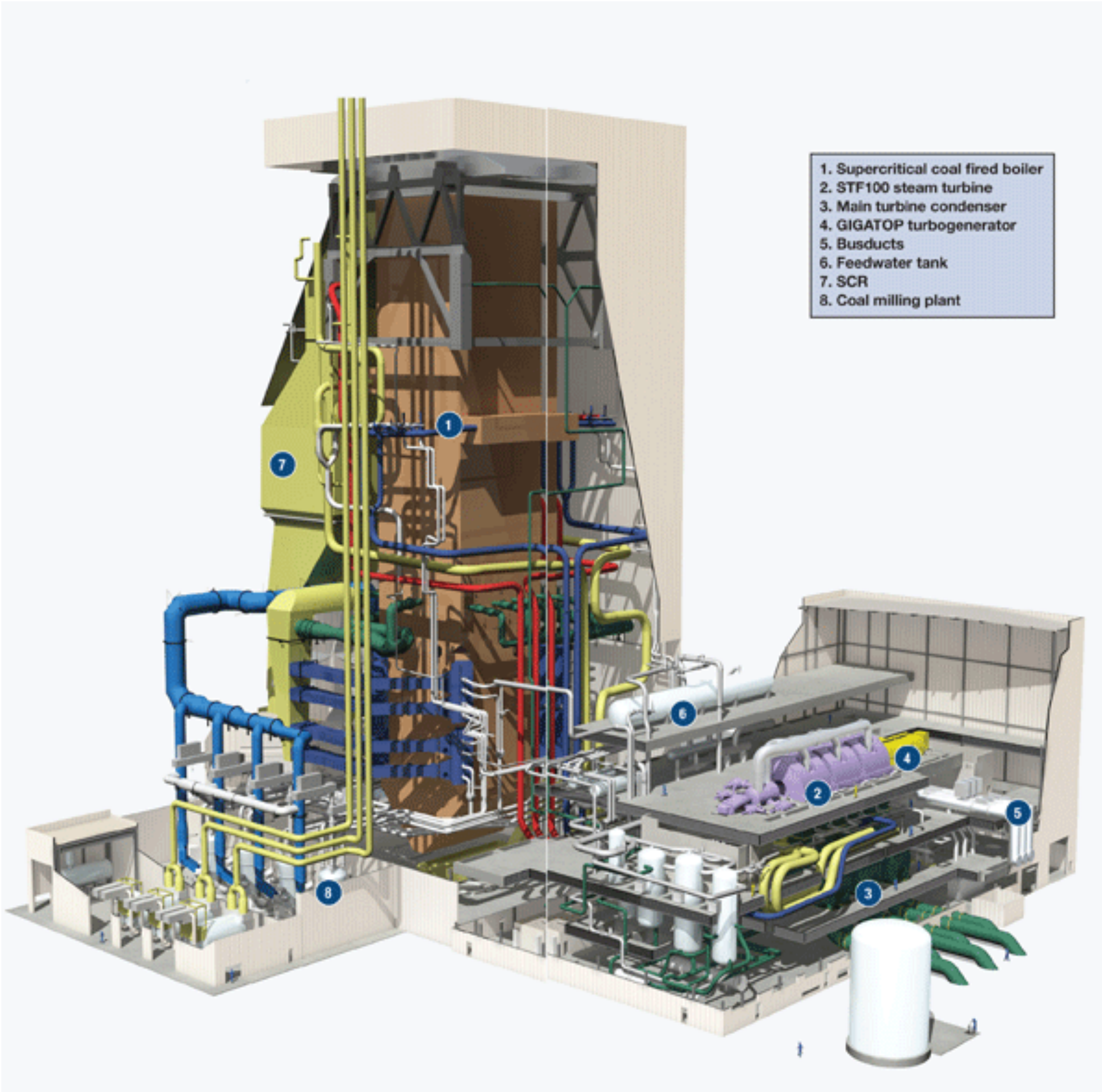
RDK 8's three little words: Efficient, reliable and flexible

Last year, Dena, the German Energy Agency, issued a stark warning: the country faced a 12 GW power shortfall by 2020 without investment in modern, high efficiency fossil fuel fired power stations. RDK 8, latest of a new breed of large ultra-supercritical steam power plants, could point the way to a solution. So say Alstom and its customer, Energie Baden-Württemberg AG (EnBW). PEi considers what the Karlsruhe plant has to offer.

With a gross output of 912 MW and up to 220 MW district heat extraction, RDK 8, Karlsruhe's newest coal fired power station, is set to make a significant contribution to securing power supplies while supporting one of Germany's most important industrial regions. Dr. Hans-Josef Zimmer, Chief Technical Officer at EnBW, marked the importance of the development at the foundation stone laying ceremony in September 2008, when he said: "Karlsruhe Rheinhafen has a long tradition as an important site for power stations, [and] the decision to construct RDK 8 is the latest chapter."



The new plant is significant for a number of key reasons. It is one of the first hard coal fired power plants in the world to run on steam at 600 °C to 620 °C, and the second contract awarded to Alstom for the power block of a large ultra-supercritical steam power plant in Germany after that at Neurath in North Rhine-Westphalia. This will also be the eighth ultra-supercritical steam turbine to be supplied by Alstom. With its high output and performance, an overall net plant efficiency exceeding 46 per cent, high reliability and operational flexibility, RDK 8 promises much from the Alstom stable for its

Karlsruhe-headquartered customer, EnBW.

Cutting-edge technology with ultra-supercritical steam parameters includes latest generation, high performance, high temperature tolerant materials, while a relatively modest physical footprint has led to an optimized arrangement of the plant at the Karlsruhe site. Dramatic reduction in carbon dioxide (CO_2) emissions to below 740 g/kWh make this, says Alstom, one of the cleanest hard coal plants delivered specifically for the climate aware age.

At the foundation stone laying, attended by Federal Minister Michael Glos and Baden-Württemberg's Prime Minister Günther Oettinger, EnBW CEO Hans-Peter Villis said the €1 billion fossil fuelled plant formed a key element in the company's commitment to "a future-oriented, safe and cost-effective energy mix".

His thoughts were echoed by Glos. "If we intend to maintain an equivalent level of security of supply to that which we have established in the past, we will need to expand our fleet of conventional power stations significantly, and coal will play a key role here as a source of energy," he told 300 guests attending the ceremony.

The occasion was one of three events in the European autumn of 2008 whose connection owed little to serendipity, and rather more to the German power sector's response to a growing sense of unease about its future ability to meet demand without conventional power plants – and coal in particular.

Another was VGB's Annual Congress 'Power Plants 2008' in Stuttgart, which dealt with the various challenges of implementing power strategies for Europe. The German market saw some significant changes in the year leading up to the event. Evidence emerged of an increase in the intensity of lobbying against fossil fuels, and efforts by companies such as Alstom to counter them and promote coal as a priority market to secure energy supply. The company outlined advanced coal technologies to reduce emissions and boost efficiency.

Keynote speakers examined the balance and relative economics of new power plants derived from the spectrum of energy sources from coal to renewables, the creation of a reliable energy supply and the protection of the environment. For Alstom, the company said, the Stuttgart event also represented an opportunity to showcase its capabilities to its major customers, among them ‘the big four’ generators - RWE, E.ON, EnBW and Vattenfall.

Alstom Power Sector President, Philippe Joubert, delivered a speech addressing the topics of ‘the growing energy demand, market trends and key drivers’. In it, he stressed the creation of an appropriate legal framework for carbon capture and storage (CCS) technologies and highlighted the importance of new plants such as Karlsruhe’s RDK 8 in the fight to reduce carbon emissions.

The new plant will be one of the first hard coal fired power plants in the world to run at such high steam parameters and power output, he said, making it super-efficient in its class.

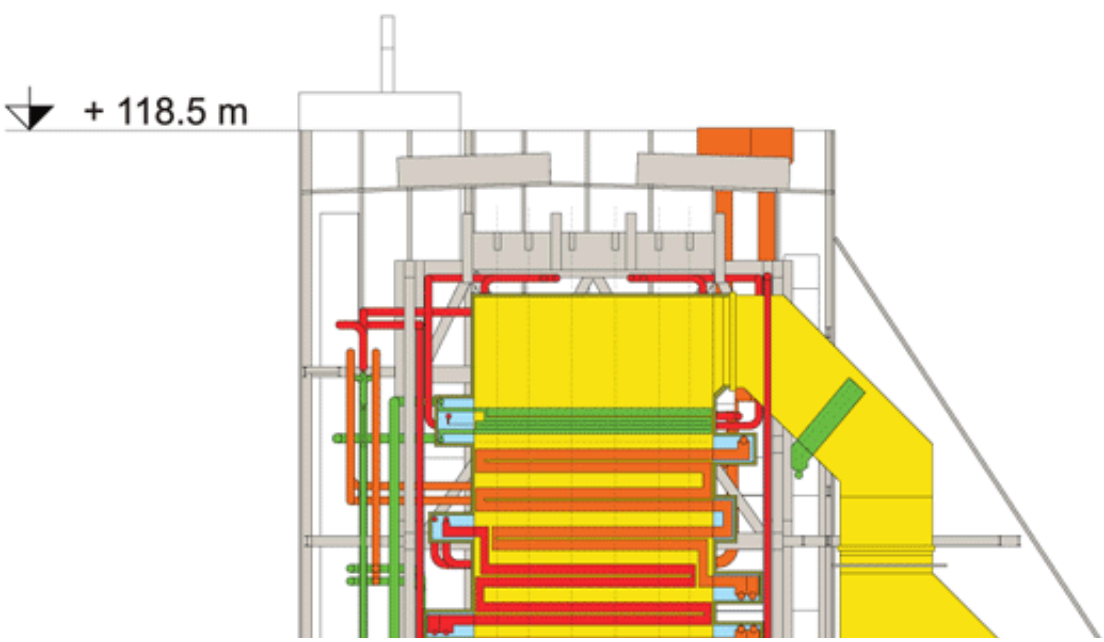
And the third major event underlining the importance of ‘conventional’ (i.e. fossil fuelled) power plants in the energy mix was the assertion by Deutsche Energie-Agentur GmbH (Dena) – the German Energy Agency – that a failure to invest in energy efficient plants would lead to catastrophic shortfalls by 2020.

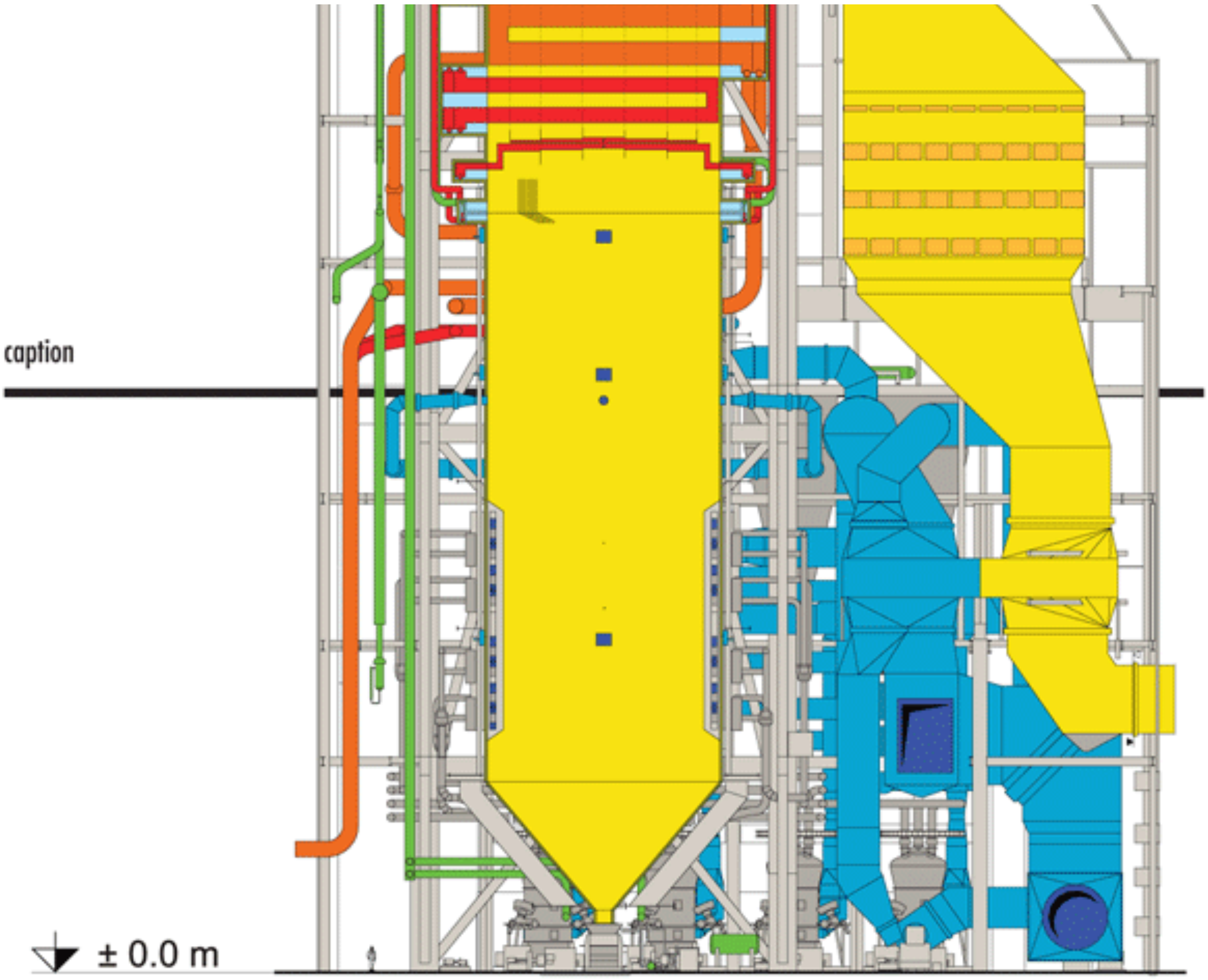
Dena was updating its ‘Brief analysis of power station planning in Germany to 2020’, a study first aired in 2008, last autumn. It warned that Germany continued to face a power gap because investment in modern fossil fuel fired power stations remained insufficient to meet annual peak loads to 2020 reliably, safely, economically and sustainably. It calculated that, even if power demand was to decline, the power gap for 2020 would still be around 10 600 MW, or as high as 14 200 MW if power demand remained at present levels.

High efficiency power stations must be built, the study maintained, warning that the outlook for the construction of new fossil fuel fired power stations had worsened since its earlier report. It revealed, moreover, that against the background of current expansion of combined heat and power (CHP) capacity, their share of electricity generation would probably not achieve a preferred target of 25 per cent by 2020.

Especially damaging to the environment was the conclusion that a future without high efficiency power stations would mean that existing inefficient fossil fuel fired power stations with elevated CO_2 emissions would have to remain in operation for longer. Furthermore, power plant operators would be forced to purchase more emissions certificates and power would remain in short supply, raising the spectre of much higher prices.

The Dena report noted, ominously, that importing power from foreign countries was not a feasible option in filling the shortfall because European capacity is insufficient to meet Germany’s electricity demand.





BOILER TECHNICAL DATA (100% LOAD)	MAIN STEAM	REHEAT
Steam flow (t/h)	2347	1951
Pressure (bar)	285	59
Temperature (°C/°F)	603/ 1117	621/1150
Feedwater temperature (°C/°F)	305/581	
Fuel	Imported bituminous coal	
NOx emissions	100 mg/mN³ with SCR	
CO emissions	150 mg/Nm³	

The Dena report is important for plants such as RDK 8, which address the need for diversity and security of supply in an economic and sustainable environment. And Dena set out a five-point plan to nurture 'flexible and intelligent solutions', including: the provision of reliable and affordable new power generation capacity based on a combination of centralized and decentralized generation technologies; development of Germany's power grid for the transmission of power from the north to load centres in the industrial south; load management and storage measures; new technologies in conjunction with smart meters and smart grids for demand-side and supply-side system optimization; and, crucially for plants such as RDK 8, new construction of high efficiency fossil fuel fired power stations, along with further expansion of CHP capacity.

Alstom's Scope

In the RDK 8 project, Alstom's scope extends to a comprehensive engineering procurement construction (EPC) contract for an ultra-supercritical steam power block, including plant engineering, global procurement and logistics, erection, through to full commissioning of the installation.

The company's now well established 'Plant Integrator' concept brings together state-of-the-art plant technology and proven equipment at the RDK 8 site. This includes the STF100 steam turbine a highly efficient and reliable component and a two-pole GIGATOP turbogenerator, with advanced hydrogen/water-cooled technology. These are integrated in a turbine hall package, together with the main steam, condensate, feedwater heating and cooling water systems that, says Alstom, offer unrivalled high efficiency, outstanding reliability and simple maintenance.

The boiler house features a pulverized coal fired once-through, forced-flow steam generator, four bowl mills and a DeNOx plant. Component-related electrical and instrumentation and control equipment in the turbine hall and boiler house also come under Alstom's remit.

Alstom says its 'Plant Integrator' concept is designed to create more value for customers by bringing together its expertise at both component and plant levels, based on the company's experience as an equipment designer and manufacturer, and as an EPC contractor with proven worldwide references.

Andreas Lusch, Senior Vice President of Alstom Thermal Systems says that close collaboration with customers, enables them to meet their business objectives and serve their market more effectively. In the case of RDK 8, he says, the plant benefits from superior integration arising from the company's project management skills, EPC capabilities and state-of-the-art components.

Project Background

As stated, the Dena study into power availability in Germany by 2020 concludes additionally-secured capacity amounting to approximately 12 000 MW – a median figure – will be required by then to offset the nuclear phase-out scenario. The figure accounts for the contributions from existing power plants still in operation, together with a confirmed growth in secured capacity from power plants that are currently under construction or have been commissioned since 2005.

The figure also takes into consideration the capacity secured by power plants with a forward-looking, high probability of realization capacity secured through the expansion and repowering of renewable energy, and capacity secured by the additional expansion of CHP. Though in the case of the latter, the future of some CHP plants remains uncertain.

In addition, there are a number of drawbacks to the infrastructure in Baden-Württemberg, EnBW's region of operation, which result from the long transport routes for fuels, and local plant cooling conditions. Against this backdrop, system optimization such as that offered by plants such as RDK 8 gains the highest importance.

The steam generator operates on the once-through forced-flow operating mode, designed for ultra-supercritical steam parameters

RDK 8 is able to offer a high level of optimization arising from a comparatively high efficiency of more than 46 per cent in condensation mode using ‘best available technology’. Further optimization of the cold end is achieved by means of through-flow and discharge cooling for high cooling water inlet temperatures, the system concept of the largest single-train capacity size and from lower auxiliary power requirements of individual components.

High economic efficiency is realized by means of the best possible utilization of the scale effect, by increasing capacity to the design limits of the single-train system concept. This results in a reduction of the specific investment costs, as well as a reduction of the specific personnel and maintenance costs. Further efficiency-increasing measures are achieved in the areas of flow optimization for the flue gas ducts, high combustion, low flue gas temperature and low excess air, as well as in the control technology by using energy-saving control circuits, in particular for start up and shut down procedures.

RDK 8 Site

EnBW is the third largest and integrated power utility company in Germany, with an installed generating capacity of some 15 000 MW, centred in Baden-Württemberg. Among them is the Rhine Harbour steam power plant complex in Karlsruhe (RDK).

The RDK site consists of three decommissioned hard coal blocks with a total electrical capacity of 230 MW, in addition to a combined-cycle gas turbine block. The latter was commissioned in its new form in 1997 following a repowering project with a capacity of around 350 MW.

Blocks 5 and 6, which feature natural gas and heating oil units, were commissioned in 1967/1968, respectively, and account for approximately 175 MW each, but are currently held in cold reserve. Hard coal block 7 was commissioned in 1985 and has an electrical capacity of 505 MW, as well as a district heating capacity of 220 MW. The district heat is delivered to the Karlsruhe municipal works, which operates the city's district heating system.

RDK 8 therefore joins a number of existing installations with all the benefits of substantial existing local infrastructure. In addition, EnBW can draw on the know-how of experienced personnel and benefit in terms of coal logistics, offered by easy access to the River Rhine and utilization of existing delivery systems. The Rhine also provides cooling water. Moreover, the network in-feed is made through the connection to the adjoining transformer substation at Daxlanden, without additional network-enhancing measures in the downstream network.

Dr. Bubeck says the site itself provides adequate space for construction and assembly; and last but not least, the existing district heating system in Karlsruhe provides the opportunity for the newly constructed block to secure the established heat and power cogeneration at the location in the long-term, and therefore improve the utilization level and the cost-effectiveness of RDK.

RDK 8 Overview

Fired by imported hard coal, the new plant RDK 8 will provide a gross capacity of 912 MWe, using a consistent single-train system concept, along with a district heat extraction element of a maximum of 220 MWth. By using the best available technology, a net efficiency level of more than 46 per cent can be achieved. Accordingly, the steam parameters are 600 °C at the high-pressure turbine inlet, and 620 °C at the re-heat inlet, with a live steam pressure of 275 bar and 58 bar re-heat pressure. The condenser pressure, under design conditions, is 30 mbar(a).

For this plant, Alstom's activities focus on the steam generator and the turbine islands – collectively referred to as the power block. A global leader in the world of power generation, Alstom has supplied major equipment in 25 per cent of the installed base worldwide, gaining an unmatched level of expertise in steam generation and fuel combustion technology along the way, and having supplied more than 400 GWe of boilers around the world.

The steam generation package also includes items such as all structural steelwork, coal feeding from bunker to the mills, dust firing (including bowl mills), a fresh air fan, an economizer, flue gas ducts, a regenerative air preheater and a DeNOx catalytic converter.

The steam generator operates on the once-through forced-flow operating mode and is designed for ultra-supercritical steam parameters. The furnace heating capacity is 1811 MWth at rated load using specified coal. The steam generator attains an efficiency level of around 95 per cent (nominal load and design coal), while nitrogen oxides (NOx) and carbon monoxide (CO) emissions are less than 100 mg/Nm3 and 150 mg/Nm3 respectively. The CO and NOx clean gas concentration is significantly lower than the values specified by law.

As far as fuel is concerned, this allows a wide range of international coals to be fired.

The components of the turbine island are located together with the turbo group in the compact machine building. The turbine package includes, along with the turboset, the condenser, water-steam circuit, district heat equipment, piping, cooling water in the turbine hall and compressed air and auxiliary steam generation.

The turbine itself is a five-casing steam turbine with intermediate reheating and six-flow LP exhaust steam – implemented in single-shaft design. The nominal capacity amounts to 912 MWe. The turbine features the latest technology of high-efficiency blade design. Unique welded rotor construction allows for short start-up times.

The steam cycle features nine-stage preheating and two 50 per cent electric feed pumps equipped with variable speed hydraulic couplings. All components of the steam cycle, together with the turbo group and its associated auxiliary system, have a compact arrangement in the machine building.

The 912 MW RDK 8 plant will be one of the first hard coal fired power plants in the world to run on steam at 600 °C to 620 °C

The layout, design and engineering of the complete power block by Alstom allow the most important technical process interfaces to be optimally coordinated.

Alstom's approach to the turbine block has been similar, yet on a bigger scale, to that employed at the vast Neurath power plant located near Cologne in West Germany. The steam turbine in Karlsruhe will be the largest in operation at any fossil power plant. Neurath will be world's largest ultra-supercritical lignite fired power plant with a net capacity of 2100 MW.

The steam turbines use the most modern generation of blading with flow-optimized three-dimensional blades and the longest final-stage blades that have been offered on the world market up to now. Alstom has designed an extremely compact four-cylinder turbine in this capacity class, which makes a decisive contribution to the reduction of construction costs and therefore to the overall cost effectiveness of the power plant.

The need to withstand steam temperatures in excess of 600 °C and a feedwater temperature of 305 °C calls for the use of special materials inside the 118-metre high boiler at RDK 8. Austenitic materials and P92 steel alloy, which are resistant to high temperature and pressure, will be used in the areas of the boiler that are subjected to the ultra-supercritical steam conditions, i.e. partly for the superheater and reheater tubing, as well as the thick-walled components – mainly the high pressure outlet headers and the main piping. Similar alloys will also be used at the inlets of the high-pressure and intermediate-pressure sections of the steam turbine – these include the valves, first few blading stages and the rotor.

RDK 8 is designed to burn a wide range of coals, predominantly imported hard coal. It has a sophisticated firing system that incorporates corner-mounted tangential tilting burners. The tangential firing introduces swirl in the combustion of the boiler. Air staging, a super position of axial and radial air staging, reduces NOx emissions and protects the furnace walls from corrosion. The tilting burners allow control of the reheater temperature to minimize the reheater-injection at continuous load over a wide load range at high efficiency.

RDK 8 cooling concept

The cooling consists of a combination of through-flow and discharge cooling, with a forced draught cooling tower. As long as the extraction temperature from the Rhine is less than 22.6 °C, the block can be operated using through-flow cooling only. Above this extraction temperature, the discharge cooler (cooling tower) is put into operation, and above a calculated mix temperature of 25 °C (following the heat discharge into the Rhine) operated at full load.

Statistical analysis resulted in figures showing that the discharge cooler will only be operated for a few 100 hours a year. EnBW says this cooling regime represents an optimum combination of energy efficiency, ecology and urban development and planning. The high efficiency results from virtually year-round continuous operation. The discharge cooler's mode of operation, which has a low impact on rivers, secures operation even at high temperatures in the Rhine, and the use of the fan cooling tower makes a construction height of only 85 metres possible, and therefore a much lower construction volume than a natural ventilation wet cooling tower, which would have a construction height of around 180 metres.

In addition, any potential plume discharge caused by the cooling tower will be reduced to the short period mentioned in which Rhine temperatures are high, when the formation of plumes is not expected to be frequent because of the prevailing meteorological conditions.

Flue Gas Treatment

Modern flue gas treatment also adheres to the single-train design principle, but will deliver to a standard that is above legal requirements. The annual average is specified relative to the actual oxygen content of approximately 4.27 vol-% for total dust at 10 mg/Nm3, for NOx at 100 mg/Nm3 and for sulphur dioxide (SOx) at 110 mg/Nm3.

This results in a halving of the annual averages required by the Federal Emission Protection Act (13th BlmSchV). This extensive optimization of the flue gas treatment accommodates demands to minimize any additional burden on emissions, in particular in the severely impacted environmental zone in the city of Karlsruhe itself. There is also the option of retrofitting CO_2 capture, since space and a number of construction elements in the area of flue gas ducts and the stack have been provided in the original works.

Alstom's Supercritical Pedigree

Alstom has been a driving force in the supercritical field in Germany for more than 40 years. The company pioneered supercritical steam generation and has supplied more than 80 000 MWe of supercritical boilers worldwide. In addition the company claims to have trained and licensed other companies to install an additional 72 000 MWe of Alstom supercritical boiler technology.

Today, the company's advanced high efficiency pulverized coal supercritical boilers offer many benefits. Higher steam temperature and pressure parameters result in what the company claims is the most economical way to improve plant efficiency and operating flexibility, achieve fuel cost savings and reduce emissions – including CO_2 - for each kWh of electricity generated. An efficiency improvement of just one percentage point equates to 2-3 per cent less CO_2 emitted.

Once-through supercritical technology offers important benefits to plant owners, including increased efficiency, lower emissions levels and operating costs, and greater operating flexibility. Higher steam pressures and temperatures, a hallmark of this technology, make this possible. Water and steam pass through the furnace waterwalls only once in contrast to drum-type boilers, in which water and steam separation occurs, and water is recycled back to the waterwalls.

Supercritical conditions occur when the boiler pressure increases above the critical pressure of 221.2 bar. Above this point, two phase mixtures of water and steam cease to exist and are replaced by a single supercritical fluid. This eliminates the need for water/steam separation in cyclone separators during supercritical operation. Increased efficiency and lower emissions level plants using today's generation of Alstom ultra-supercritical boilers can operate at cycle efficiencies higher than 42-45 per cent HHV (44-47 per cent LHV). As efficiency is increased, less fuel is consumed per kWh, with a corresponding decrease in emissions per kWh. Because these units do not have thick-walled steam drums their start-up times are quicker, further enhancing efficiency and plant economics.

Alstom says the development of increasingly efficient ultra-supercritical cycles for improved efficiency is an ongoing programme. Technology currently under development at Alstom will lead to a prototype 'advanced supercritical' plant, operating at a temperature of 700 °C and pressure of 350 bar.

Higher efficiencies lead to significantly lower fuel consumption, a major consideration in fossil fuelled plants where the fuel itself is its biggest operational cost. And because the capital cost of supercritical plants is close to those of subcritical plants, overall life cycle costs are often reduced.

Greater operational flexibility checks further boxes as today's market realities demand that units are not only designed for baseload operation, but are capable of cycling and/or two-shift operation, where units have to be designed for rapid response times. Alstom once-through ultra-supercritical boilers have the ability to respond and adjust to changes in load demand, while maintaining tight control of steam temperatures.

Alstom's ultra-supercritical boilers also operate in the 'sliding pressure' mode, in which pressure is reduced with falling load. Alstom's Rainer Henning. Project Director for RDK 8 explains: "This allows the maintenance of relatively constant first-stage turbine temperature, reducing the thermal stress on components as the unit is cycled. Less stress translates into less maintenance and higher availability." In addition the steam valves can be operated in a fully open position over a wide range to reduce throttle losses.

These efficient ultra-supercritical boilers boast high availabilities comparable to those of subcritical units, as well as improved plant efficiency at lower loads.

In the quest for maximum efficiency, higher live steam temperatures and pressures are applied that require high temperature materials that have to meet particularly high standards in terms of quality and processing. High temperature materials enable the steam conditions – and corresponding thermal efficiency – of ultra-supercritical steam cycles.

Ideally, materials used in steam generator pressure parts combine high temperature strength with reasonable resistance to oxidation. In addition, the workability of the materials and corrosion behaviour are important attributes.

The increase of steam conditions primarily affects the waterwalls, final super-heater and re-heater tubing, and the thick-walled components, mainly the high-pressure outlet headers and piping to the turbine. Classes of materials include conventional and advanced ferritic steel, austenitic steel, and nickel alloys.

Several boiler materials with improved mechanical properties that have been developed recently and new materials still in the research and development stages will enable more advanced supercritical steam cycles than are today commercially available.

Most materials development is being conducted under national or internationally coordinated programmes. Alstom participates in nearly all these, including the AD 700/COMTES 700 programme funded by the European Commission, and the US Ultra-Supercritical Materials Consortium sponsored by the US Department of Energy. Together, they will ultimately drive the design of supercritical steam cycles to a higher level.

Gigatop two-pole turbogenerator

RDK 8 uses Alstom's hydrogen and water-cooled GIGATOP two-pole turbogenerator with its unique stainless steel hollow conductors, a component that has earned a reputation for reliability. Alstom has the largest experience in hydrogen and water-cooled turbogenerators with more than 270 units in operation since 1970.

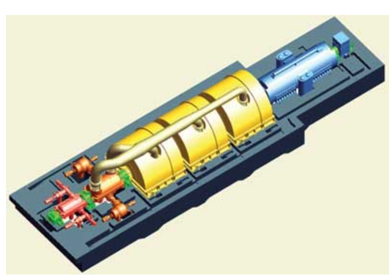
Indeed, the company reports that one unit in the US boasted 607 days uninterrupted operation before a scheduled shutdown. With output ranges of 400 MW to 1400 MW at 50 Hz and 340 MW to 1100 MW at 60 Hz, the GIGATOP is designed to support the largest steam turbine power plants.

Both powerful and modular, its flexible configuration is designed to fit the needs of a range of individual applications while delivering optimum efficiency. The GIGATOP two-pole is based on technology pioneered by Alstom more than 30 years ago, and is undergoing constant improvement taking account of continuous feedback from operational experience worldwide and using the latest computing tools and modern manufacturing techniques. The result is a reliable, technology-rich turbogenerator with a proven track record.

Another result, Alstom says, is a judicious marriage of mature and advanced technology. The company cites an example: since the invention of the Roebel bar in 1912, the Roebel transposition technology has been constantly fine-tuned and perfected to yield greater efficiency and increased utilization. Used also in the transport sector for road and rail applications, the unit is shipped in only a very small number of individual parts, leading to shorter delivery and faster erection times; it means, in the case of power plants such as RDK 8, that units can come on-stream faster and generate revenue earlier.

Although Alstom claims the GIGATOP is the world's most powerful turbogenerator running at full speed, delivering up to 1400 MW, its compact design nonetheless results in a short overall shaft length, occupying less space than conventional designs.

The stator winding is water cooled, while the rotor and stator core are directly cooled by hydrogen, resulting in a high level of efficiency from full load to part load. The unique design of the GIGATOP's press plates allows it to deliver high reactive power, which contributes to stabilising the grid voltage quickly in case of disturbances.



The STF100 steam turbine at RDK 8 will be the largest in operation at any fossil power plant

Alstom says much emphasis has been placed on arriving at a robust, reliable design, enabling the unit to withstand all the forces it could be subjected to under a range of extreme operating conditions. Mechanical integrity is ensured through extensive testing. The casing, for example, is subjected to an over-pressure test that is well above the normal operating pressure.

The stator core is designed for zero maintenance. Axially flexible to allow thermal expansion, it is rigid in the radial and tangential directions to withstand high electromagnetic forces. To facilitate maintenance, the end-winding has been designed so that it can be easily re-tightened during regular maintenance, which accelerates maintenance operations.

It is held under constant axial pressure by press segments, press plates and fully insulated through bolts. As a result, there is no expected loosening of the laminations over the lifetime of the machine. The stator core is made of low-loss insulated steel sheet. The patented design of the laminated press-plates leads to low losses, low temperature and better efficiency.

The water-cooling system in the stator winding is designed to provide optimum reliability. De-ionized water flows through the stainless steel cooling tubes to remove the heat dissipated by the stator winding. The corrosion resistance of stainless steel ensures that the cooling tubes do not clog, the losses are minimized and efficiency enhanced. The tubes themselves are welded to water clips located at both ends of each bar, next to the brazed lugs. The electrical and cooling circuits are therefore kept separate, further improving reliability. Over the past 30 years, Alstom's stainless-steel tube technology has demonstrated excellent reliability in operation.

The GIGATOP two-pole uses a triple-circuit hydrogen sealing system instead of a single-circuit system, bringing significant benefits in safety. The resulting very low hydrogen consumption also helps to reduce operational costs and keeps the hydrogen at very high purity levels, so that the unit's efficiency is sustained at a high level over the long-term.

The unit also features Alstom's 'Micadur' insulation system, which consists of a glass-fibre tape incorporating mica flakes. The taped bars are vacuum-impregnated with a solvent-free epoxy resin and thermally cured. Finally, the surface is coated with a corona-protection varnish. The system has been developed over 50 years.

Micadur meets all the requirements of thermal class F (155 °C) specification, while the GIGATOP two-pole itself operates in thermal class B (130 °C); this means, says Alstom, that it has a large built-in safety margin.

RDK 8 Project Timeline

EnBW began the concept planning and project development in May 2005, followed by the quotation process between April 2006 and the end of 2006. Based on the tenders submitted for the main works of the plant, comprising the boiler and turbine system, the flue gas treatment and the general planning, a fundamental investment decision was taken to proceed with the project in December 2006. On this basis, an order for the creation of the approval documents was awarded to Alstom for the power block, while Austria Energy & Environment was awarded the flue gas treatment and Fichtner the general plan.

The approval procedure in accordance with the federal emission protection laws was carried out in the period between May 2007 and the first quarter of 2008. Later, on 1 March 2008, a permit for an earlier start to construction was awarded by the regional authority in Karlsruhe. Construction work commenced immediately afterwards. The awarding of the permit in accordance with the federal emission laws was made on 8 May 2008, while boiler assembly work began in April 2009. Completion of commissioning is scheduled for 2012.

RDK 8, like Neurath, is proof that fossil fuels can play an essential role in securing power supplies well into the 21st century while minimizing CO_2 emissions using the best available technology.

New standards are being set in boosting efficiency further by utilizing cogeneration for district heating networks. And flue gas cleaning systems have been designed to comply with standards above and beyond statutory requirements, which will additionally halve RDK 8's mid-year readings for emission-critical factors such as particulates and NOx.

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