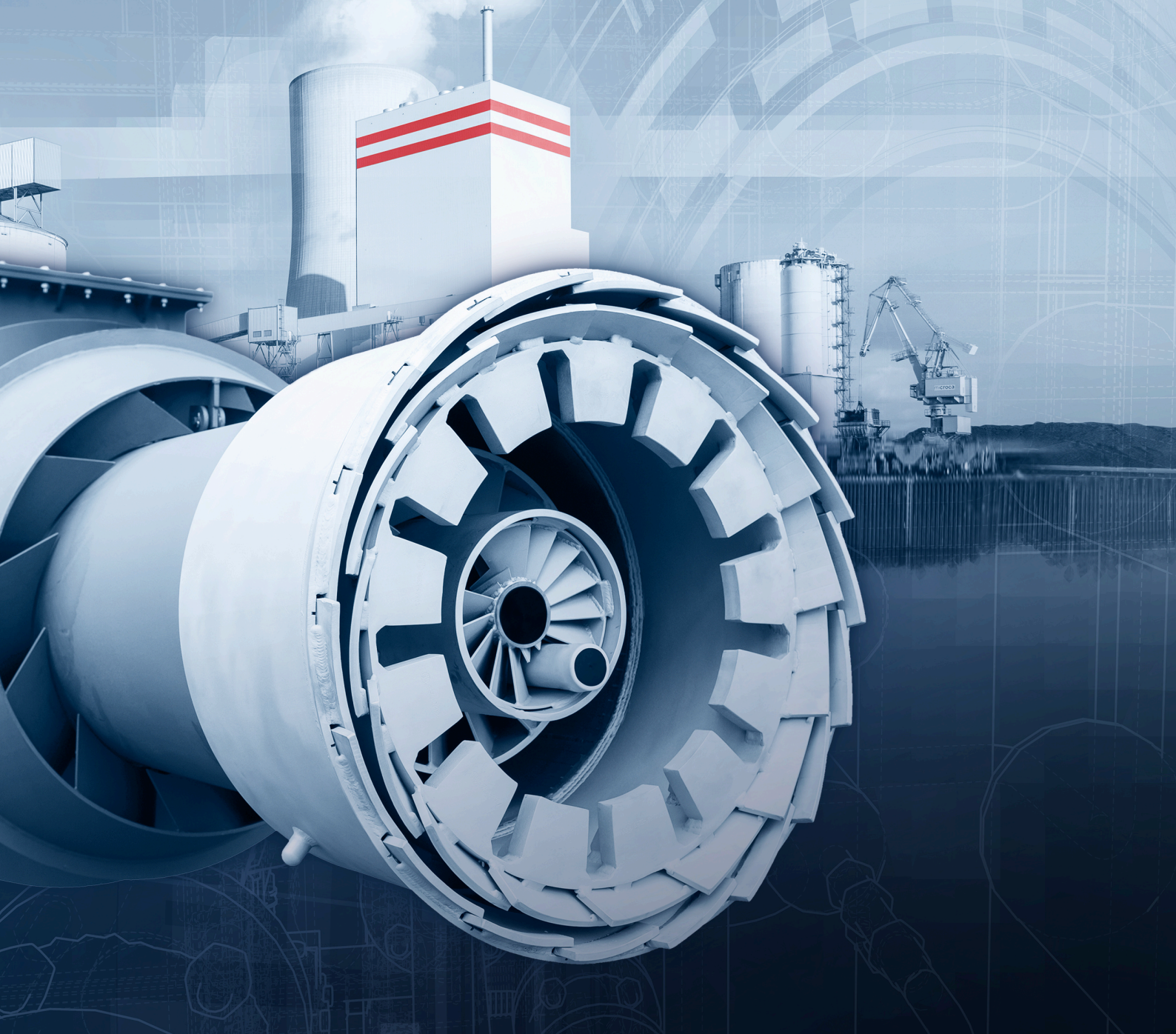


COMBUSTION SYSTEMS





WHEN MAKING A CHANGE, MAKE IT FOR THE BETTER

Operators of industrial power plants are themselves constantly under pressure to improve efficiency, reduce operational costs and meet changing emission requirements. The growing awareness for environmental issues and the need to conserve resources are our incentive for innovation. Upgrades to existing furnaces and combustion systems have become unavoidable as a result of ever more stringent legislation. The real challenge however, is to ensure that the new applications comply to the rules without reducing plant efficiency and increasing operational costs.

EXPERT KNOWLEDGE AND INNOVATIVE THINKING - THE KEY TO EFFECTIVE SOLUTIONS

Steinmüller Engineering has the knowledge and experience to convert a fuel's stored chemical energy into usable energy. We have successfully realized a huge number of projects worldwide, covering various industrial sectors, types and sizes of plant. Special fuels and fuel combinations in particular are our area of expertise, including the development of customized solutions for process residues, biomass, biogas and fossil fuels. Our clients rely on us to find the best strategy for challenging retrofit projects, in accordance with their specific plant designs.

TURN OUR EXPERIENCE INTO YOUR ADVANTAGE!

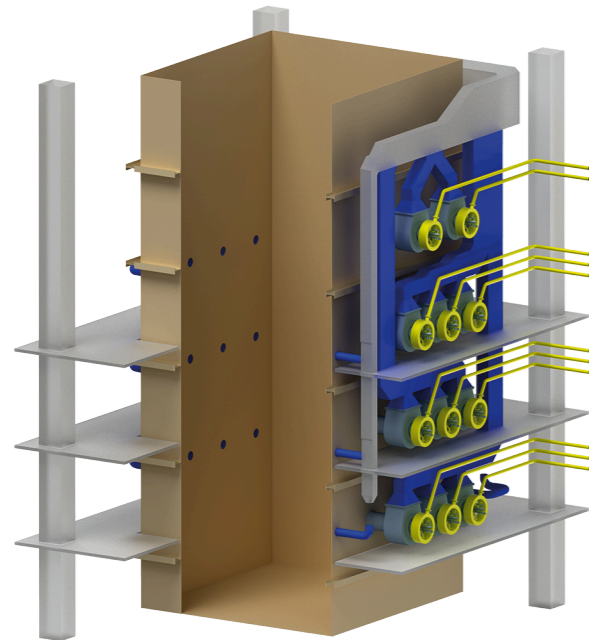
CONTACT

Krzysztof Zajac
Department Manager
Combustion Technologies

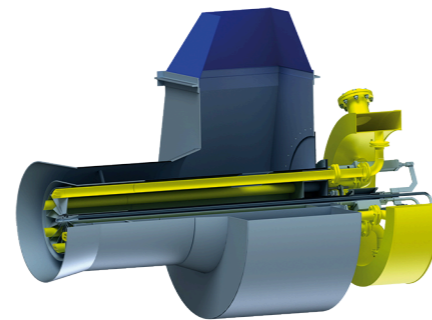
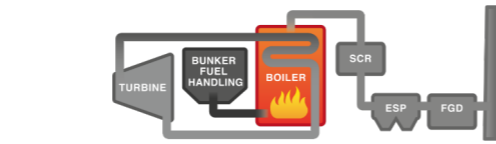


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LIQUIDS AND GAS FIRING SYSTEMS



**OIL AND GAS
VORTEX BURNER**



- **HIGH COMBUSTION EFFICIENCY**
- **LOW EMISSIONS**
- **FLEXIBLE OPERATION**

APPLICATION	TECHNICAL DATA		SCOPE OF SUPPLY
Power Plants and Industrial Boilers NO _x reduction, extension of fuel type, efficiency increase Benefits <ul style="list-style-type: none"> ▪ Minimization of organic residues ▪ High burnout of fuel ▪ Reliable solutions based on decades of experience ▪ Совместное сжигание 	Capacity Gas: 0,6 – 100 MWth	Capacity Oil: 5 – 100 MWth (0,45 – 9 t/h)	<ul style="list-style-type: none"> ▪ Consultancy ▪ Process engineering ▪ CFD-Simulations of boiler furnace and combustion system ▪ Design of furnace ▪ Design of burner ▪ Supply of gas- and oil burners including all related components ▪ Commissioning ▪ Optimization
	FUEL TYPE		
	Refineries: <ul style="list-style-type: none"> ▪ Refinery gas ▪ Visbreaker residues ▪ Vacuum residues ▪ HSC-R ▪ H₂ 	Power plants: <ul style="list-style-type: none"> ▪ Natural gas ▪ Light fuel oil ▪ Heavy fuel oil ▪ Bio fuel 	
	Steel plants: <ul style="list-style-type: none"> ▪ Blast furnace gas ▪ Coke oven gas ▪ Converter gas 		

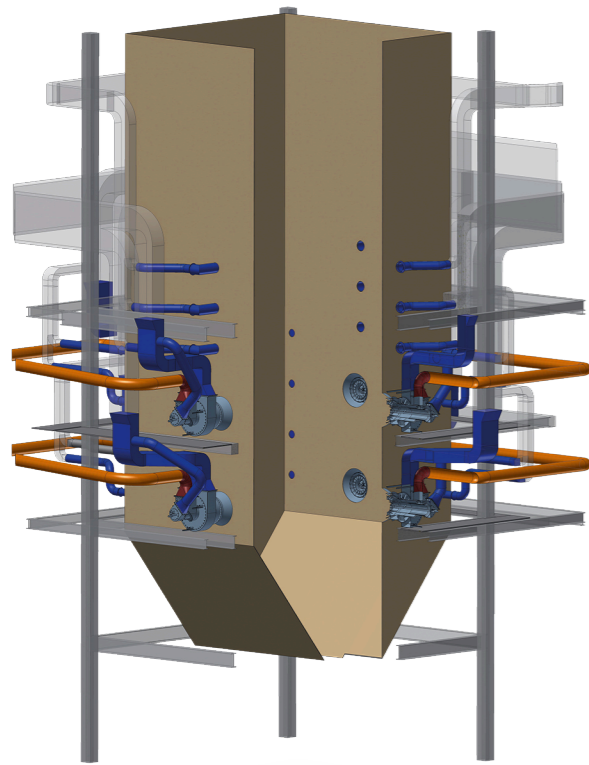
REFERENCE LIST EXCERPT

REFERENCE	CLIENT
Supply and implementation of a new oil and gas firing system at steam generator plus retrofit of a catalytic DeNO _x system, 200 t/h, Heavy Fuel Oil and Low-Pressure-Gas, Shell Wesseling, Germany	Shell Deutschland Oil GmbH, Wesseling, Germany
Study for capacity increase of firing system, Coke-Oven Gas, 240 MWel, CHP Hamborn 5, Germany	RWE Service GmbH, Germany
Basic Engineering and supply for gas connection installation, retrofit for additional natural gas firing system, Tiefstack PS, Germany	Vattenfall Europe Hamburg AG, Germany
Engineering and supply of oil atomiser lances and atomiser sprayer, Mainova, Germany	MAINOVA, Frankfurt, Germany
Engineering and supply for retrofit of burner level oil-to-gasfiring, 2 x 750 t/h, Refinery Residues and Heavy Fuel Oil, PCK Schwedt, Germany	PCK Raffinerie GmbH, Schwedt, Germany
Supply of oil control valve stations, Heavy Fuel Oil and Low-Pressure-Gas, Shell Wesseling, Germany	Shell Deutschland Oil GmbH, Wesseling, Germany
Supply, erection and commissioning of 12 optimised oil burner inserts, CHP West Unit 2, Germany	MAINOVA, Frankfurt, Germany
Feasibility study for gas conversion, 300 MWel, Bituminous Coal, Tiefstack PS, Germany	VPC GmbH, Vetschau, Germany
Oil atomizer lances for an ignition system for the heat power plant 2 x 200 MWel, Bituminous Coal, Tiefstack PS, Germany	Vattenfall Europe Hamburg AG, Germany
Study for capacity increase, coke gas firing system, 2 x 307 MWel, Huckingen PS, Germany	RWE AG, Essen, Germany
Engineering and supply of optimised oil lances, 340 MWel, Knepper PS, Germany	E.ON Engineering GmbH, Gelsenkirchen, Germany
Supervision of revamping at refinery steam generators, life extension and environmental upgrading, Germany	MIRO, Karlsruhe, Germany
Engineering for retrofit of a SCR-DeNO _x plant, 200 t/h, Heavy Fuel Oil and Low-Pressure-Gas, Shell Rheinland Refinery, Germany	Shell Deutschland Oil GmbH, Wesseling, Germany
Review of firing concept for BAO Steel, 1170 t/h, Blast Furnace Gas	Babcock Hitachi Europe GmbH, Oberhausen, Germany

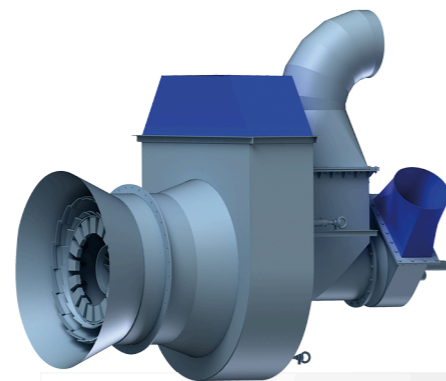
LEGEND

- | | | |
|---------------------------------|---------------------------------------|--------------------------------|
| PS Power Station | SCR Selective Catalytic Reduction | FGD Flue Gas Desulphurization |
| PF Pulverized Fuel | STP Standard Temperature and Pressure | CFB Circulating Fluidized Bed |
| CHP Combined Heat & Power Plant | HRSG Heat Recovery Steam Generator | ESP Electrostatic Precipitator |

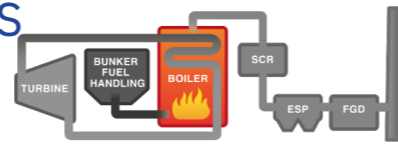
BITUMINOUS COAL AND SUB-BITUMINOUS COAL COMBUSTION SYSTEMS



SM V®*
COAL BURNER



- LOW NO_x EMISSION
- EFFICIENCY INCREASE
- FLEXIBLE OPERATION



APPLICATION	TECHNICAL DATA	SCOPE OF SUPPLY
<p>Power Plants and Industrial Boilers</p> <p>NO_x reduction, extension of fuel range, efficiency increase</p> <p>Benefits</p> <ul style="list-style-type: none"> ▪ Optimized engineering based on CFD-simulation calculations without expensive trials ▪ High availability and efficiency ▪ Increase in operational flexibility ▪ Reliable solution based on decades of experience 	<p>Burner Type: SM V® * Coal Burner</p> <p>Burner Capacity: 15 MWth – 100 MWth</p> <p>Emissions: CO < 100 mg/m³ (STP) NO_x < 280 mg/m³ (STP)</p>	<ul style="list-style-type: none"> ▪ Consultancy ▪ Design of burners ▪ Process engineering ▪ Design of furnace ▪ CFD-Simulations of boiler furnace and combustion system ▪ Supply and installation of firing system components including burners, OFA, etc. ▪ Adaptation of I & C ▪ Commissioning ▪ Optimization
	<p>FUEL TYPE</p> <p>Bituminous Coal</p> <p>Water: 5 – 38 % ar</p> <p>Ash: 10 – 40 % ar</p> <p>VM daf: 15 – 45 %</p> <p>LCV: 12 – 32 MJ/kg</p>	

* ® Registered Trademark Staged Mixing Burner

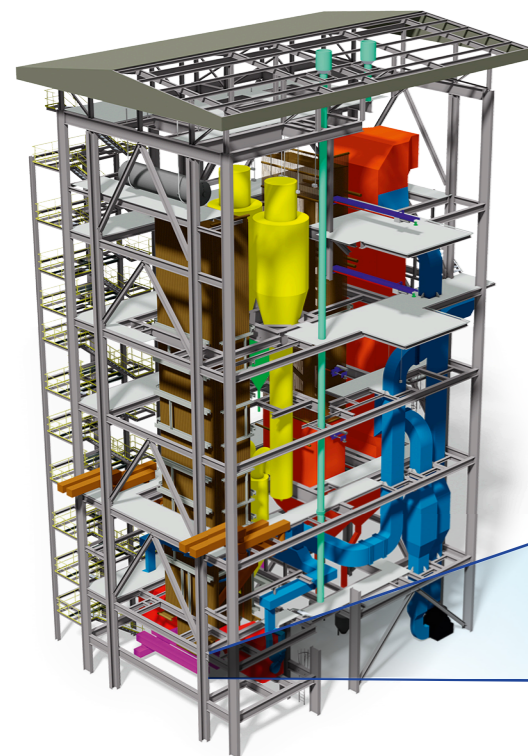
REFERENCE LIST EXCERPT

REFERENCE	CLIENT
Modification and capacity increase of LowNO _x firing system, Bituminous Coal, Altbach PS, Germany	EnBW Kraftwerke AG, Karlsruhe, Germany
Modernization of firing system and extension of coal range, installation of LowNO _x burners, 500 MWel, Bituminous Coal, Herne PS Unit 4, Germany	STEAG GmbH, Essen, Germany
Investigation and recovery scope development support after boiler damage, 600 MWel, Bituminous Coal, Duvha PS, South Africa	Eskom Enterprises, Johannesburg, South Africa
Modification of the firing system and installation of LowNO _x burner, 550 MWel, Bituminous Coal, Rheinhafen-Dampfkraftwerk (RDK) PS Unit 7, Germany	EnBW Kraftwerke AG, Karlsruhe, Germany
Concept design study for LowNO _x burner technology, 200 – 730 MWel, Bituminous Coal, ESKOM'S fleet, South Africa	Eskom Enterprises, Johannesburg, South Africa
Engineering support for manufacturing, installation and commissioning of PF burners, 200 MWel, Bituminous Coal, Camden PS, South Africa	Eskom Enterprises, Johannesburg, South Africa
Modification of the firing system and installation of LowNO _x burner, 700 MWel, Bituminous Coal, Mehrum PS, Germany	Balcke-Dürr GmbH, Ratingen, Germany, for E.ON Power
Boiler design review and study for future change in coal quality, 6 x 600 MWel, Bituminous Coal, Tutuka PS, South Africa	Eskom Enterprises, Johannesburg, South Africa
Design study on coal range extension in supercritical utility boilers, 5 x 830 MWel, Bituminous Coal, Mundra PS, India	Coastal Gujarat Power Generation, Mumbai, India
Boiler concept study for coal range extension, 465 MWel, Bituminous Coal, CHP Altbach I, Germany	EnBW Kraftwerke AG, Karlsruhe, Germany
Concept study for coal range extension at 6 x 600 MWel, Bituminous Coal, Duvha PS, South Africa	Eskom Enterprises, Johannesburg, South Africa
Boiler concept study for capacity increase and coal range extension, 330 MWel, Bituminous Coal, CHP II Altbach PS, Germany	EnBW Kraftwerke AG, Karlsruhe, Germany
Conceptual design for adaptation of firing equipment to an extension of acceptable coal specification, 2 x 100 MWel, Bituminous Coal, Tiefstack PS, Germany	Vattenfall Europe Hamburg AG, Germany

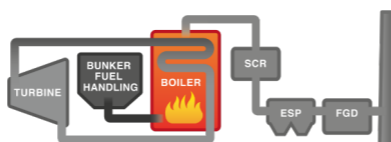
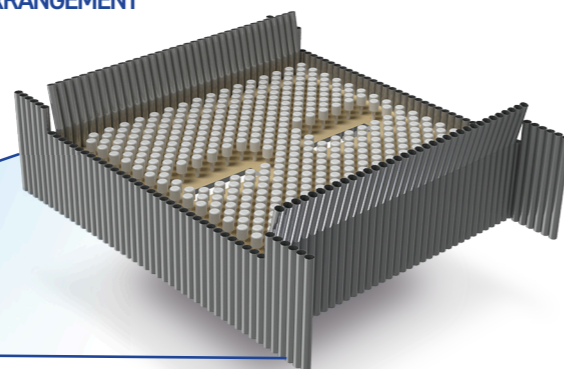
LEGEND

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| PS Power Station | SCR Selective Catalytic Reduction | FGD Flue Gas Desulphurization |
| PF Pulverized Fuel | STP Standard Temperature and Pressure | CFB Circulating Fluidized Bed |
| CHP Combined Heat & Power Plant | HRSG Heat Recovery Steam Generator | ESP Electrostatic Precipitator |

CIRCULATING FLUIDIZED BED BOILER



AIR DISTRIBUTION
NOZZLE PLATE
ARRANGEMENT



- TAILOR MADE DESIGN
- HIGH EFFICIENCY
- WIDE FUEL RANGE

APPLICATION	BOILER TYPE	SCOPE OF SUPPLY
Power Plants and Industrial Boilers Circulating fluidized bed boiler with direct desulfurization Benefits <ul style="list-style-type: none"> ▪ Tailor made design to meet customer specific requests and space limitations ▪ Sub- and super-critical boiler design with and without reheater ▪ Advanced nozzle cap design for optimized fluidization ▪ Refractory protection for critical zones in furnace ▪ Cyclone configuration for optimal arrangement of plant components ▪ Convective pass with low erosion design 	<ul style="list-style-type: none"> ▪ Natural circulation ▪ Once through 	<ul style="list-style-type: none"> ▪ Consultancy ▪ Sophisticated calculation tools for flow and heat transfer ▪ Engineering from concept to detail ▪ Supply of core components ▪ Site supervision, commissioning ▪ Optimization
	FUEL TYPE	

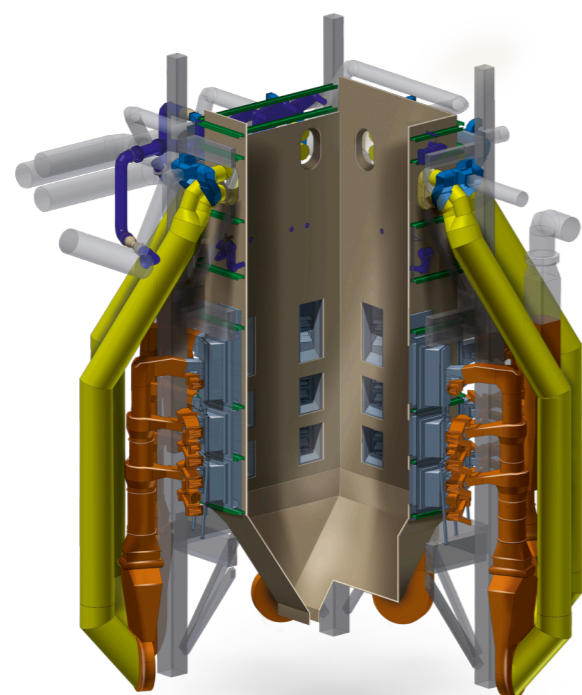
REFERENCE LIST EXCERPT

REFERENCE	CLIENT
Layout and basic engineering for heat and power CFB steam generator, 90 t/h, Lignite, Tabor PS, Czech Republic	CKD Praha DIZ a.s., Praha, Czech Republic
Basic design review CFB boiler, 330 MWel, Lignite, Stanari PS, Bosnia & Herzegovina	EFT Group, Belgrade, Serbia
Basic design engineering for a process steam CFBC boiler, 35 t/h, Bituminous Coal, new-built plant, Vietnam	Martech Boiler Company, Ho Chi Minh City, Vietnam
Basic and partial detail design for 2 x 270 MWel CFBC boilers, Becl PS, India	AE&E Lentjes GmbH, Ratingen, Germany
Engineering for CFB Boiler, Low Rank Coal, 2 x 80 t/h, Indonesia	PT. ZUG Industrie Indonesia, Jakarta, Indonesia
Study for CFB operation boiler 6, comparison of operation values with initial design parameters, Pre-Dried Lignite, 248 MWth, Merkenich PS, Germany	RheinEnergie AG, Cologne, Germany
Know-how transfer and training in the design of CFBC boilers, Eskom Enterprises, South Africa	Eskom Enterprises, Johannesburg, South Africa
Consultancy and supervision services – Owner's engineer for the construction of the 330 MWel lignite-fired thermal power plant Stanari, Bosnia & Herzegovina	EFT – Rudnik i Thermoelektrana Stanari d.o.o., Belgrade, Serbia
Know-how transfer and technical training for circulating fluidized bed boilers (CFB), Indonesia	PT. ZUG Industrie Indonesia, Jakarta, Indonesia
Know-how transfer – Engineering for circulating fluidized bed (CFB) boiler technology	PJSC EMAlliance, Taganrog, Russian Federation
Pressure part layout and design for CFB steam generators, 2 x 250 MWel, Lignite, Neyveli PS, India	AE&E Lentjes GmbH, Ratingen, Germany
CFBC Market study	Babcock-Hitachi Europe, Oberhausen, Germany
Engineering for standardisation of CFB design, Biomass, IHI, Tokyo, Japan	IHI Corporation, Tokyo, Japan

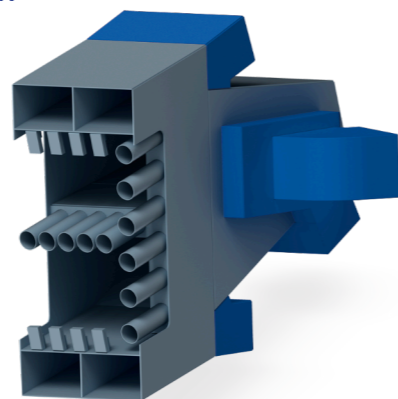
LEGEND

PS Power Station	SCR Selective Catalytic Reduction	FGD Flue Gas Desulphurization
PF Pulverized Fuel	STP Standard Temperature and Pressure	CFB Circulating Fluidized Bed
CHP Combined Heat & Power Plant	HRSG Heat Recovery Steam Generator	ESP Electrostatic Precipitator

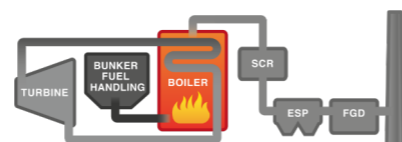
LIGNITE COMBUSTION SYSTEMS



RSM® *-LIGNITE BURNER



- LOW NO_x EMISSION
- EFFICIENCY INCREASE



APPLICATION	TECHNICAL DATA	SCOPE OF SUPPLY
Power Plants and Industrial Boilers NO _x reduction, extension of fuel range, efficiency increase Benefits <ul style="list-style-type: none"> ▪ Optimized engineering based on CFD-simulation calculations without expensive trials ▪ High availability and efficiency ▪ Increase in operational flexibility ▪ Reliable solution based on decades of experience 	Plant in Service Phase: <ul style="list-style-type: none"> ▪ Maintenance and repairs ▪ Upgrades ▪ Management support ▪ Appropriate supply of spare parts ▪ Sustainable planning and control of outage phases 	<ul style="list-style-type: none"> ▪ Consultancy ▪ Design of burners ▪ Process engineering ▪ Design of furnace ▪ CFD-Simulations of boiler furnace and combustion system ▪ Supply and installation of firing system components including burners, OFA, etc. ▪ Adaptation of I & C ▪ Commissioning ▪ Optimization
	FUEL TYPE Lignite Water: 25 – 70 % ar Ash: 0 – 50 % ar VM daf: 30 – 70 % LCV: 3,5 – 22 MJ/kg	

* ® Registered Trademark Staged Mixing Burner

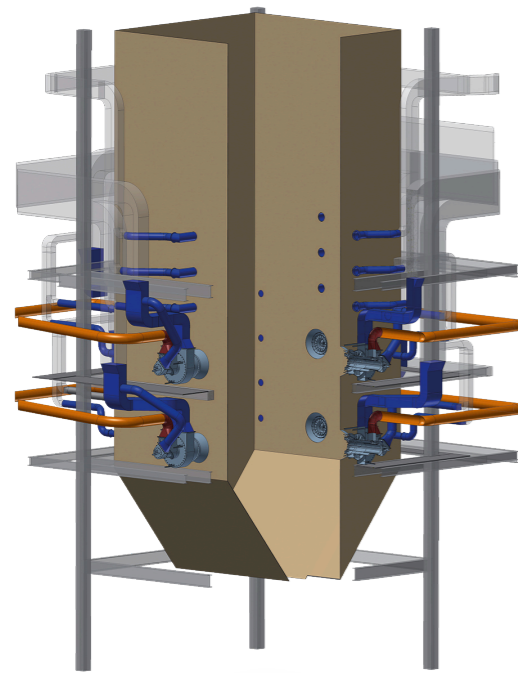
REFERENCE LIST EXCERPT

REFERENCE	CLIENT
Engineering and supply of a LowNO _x firing system, 350 MWel, Lignite, Kostolac PS B1, PE Industry, Serbia	PE Electric Power Industry, Belgrade, Serbia
Lignite firing system modification, 4 x 227 MWel, Lignite, Maritza East 3 PS Unit 1 – 4, Maritza, Bulgaria	ContourGlobal, Sofia, Bulgaria
Engineering for firing system retrofit, 2 x 600 MWel, Lignite, Niederaussem PS Unit G and H, Germany	RWE AG, Essen, Germany
Basic engineering for LowNO _x firing system modification, 11 x 250 MWel, Lignite, Jänschwalde PS, Germany	Vattenfall Europe Generation AG & Co. KG, Cottbus, Germany
Wall-air system detail design, 11 x 250 MWel, Lignite, Jänschwalde PS, Germany	Vattenfall Europe Generation AG & Co. KG, Cottbus, Germany
Process and basic design for proposal of 500 MWel power plant, Lignite, Turow PS, Poland	Doosan Babcock Energy Ltd., West Sussex, UK
Concept study and engineering for LowNO _x burner modifications, 2 x 640 MWel, Lignite, Neurath PS Unit D and E, Germany	RWE Power AG, Essen, Germany
Feasibility study of potential modifications for NO _x reduction by primary measures, 345 MWel, Lignite, Sostanj PS Unit 5, Slovenia	Siemens d.o.o., Ljubljana, Slovenia
Basic & detail engineering including commissioning for NO _x reduction, 2 x 600 MWel, Lignite, Weisweiler PS, Germany	RWE Power AG, Grevenbroich, Germany
Engineering for modification PF-ducts, 2 x 640 MWel, Lignite, Neurath PS unit F+G, Germany	RWE Power AG, Grevenbroich, Germany
Study for NO _x reduction, 2 x 500 MWel, Lignite, Boxberg III PS, Germany	Lausitz Energie Kraftwerk AG, Cottbus, Germany
Engineering support for boiler protection concept, 2 x 450 MWel, Lignite, Schkopau PS, Germany	Uniper SE, Düsseldorf, Germany
Engineering for optimization combustion system, 625 MWel, Lignite, new built power plant, Laos	Hongsa Power Company Limited, Vientiane, Laos
Basic design study for a super critical one through PC boiler, 600 MWel, Raw Lignite, Power Plant in Indonesia	IHI Corporation, Tokyo, Japan

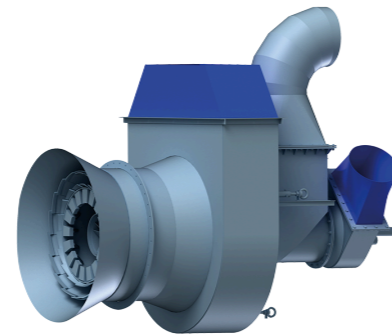
LEGEND

PS Power Station	SCR Selective Catalytic Reduction	FGD Flue Gas Desulphurization
PF Pulverized Fuel	STP Standard Temperature and Pressure	CFB Circulating Fluidized Bed
CHP Combined Heat & Power Plant	HRSG Heat Recovery Steam Generator	ESP Electrostatic Precipitator

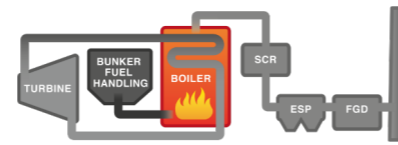
DRY LIGNITE COMBUSTION SYSTEMS



DRY LIGNITE
VORTEX BURNER



- HIGH FLEXIBILITY, AVAILABILITY & EFFICIENCY
- RELIABLE USE IN CO-FIRING



APPLICATION	TECHNICAL DATA	SCOPE OF SUPPLY
<p>Coal Fired Power Plants and Industrial Boilers</p> <p>Pollution reduction, extension of fuel range, efficiency increase</p> <p>Ignition burner and auxiliary burner for medium and peak loads</p> <p>Benefits</p> <ul style="list-style-type: none"> ▪ High flexibility, availability and efficiency ▪ Reliable use in co-firing ▪ Reliable solution based on decades of experience ▪ Savings on expensive start up fuel 	<p>Burner Type:</p> <ul style="list-style-type: none"> ▪ Integrated Vortex Burner <p>Burner Capacity:</p> <p>10 - 100 MW</p> <p>Emissions:</p> <p>CO < 100 mg/m³ (STP)</p> <p>NO_x < 190 mg/m³ (STP)</p>	<ul style="list-style-type: none"> ▪ Consultancy ▪ Design of burners ▪ Process engineering ▪ Design of furnace ▪ CFD-Simulations of boiler furnace and combustion system ▪ Supply and installation of firing system components including burners, OFA, etc. ▪ Adaptation of I & C ▪ Commissioning ▪ Optimization
	<p>FUEL TYPE</p> <p>Pulverized Dried Lignite</p> <p>Water: 10 - 20 % ar</p> <p>Ash: 4 - 16 % ar</p> <p>VM daf: 30 - 70 %</p> <p>LCV: 18 - 22 MJ/kg</p>	

REFERENCE LIST EXCERPT

REFERENCE	CLIENT
Engineering for C&I implementation for dry lignite test burner, 20 MWth, Lignite, RWE Ibbenbüren PS, Germany	RWE, Essen, Germany
Study for integration of TBK (pre-dried Lignite) burner in anthracite slag-tap firing system, 848 MWel, Bituminous Coal, Ibbenbüren PS, Germany	RWE Service GmbH, Nordhorn, Germany
Engineering service for support during bidding phase for design of boilers including a co-firing concept, 2 x 550 MWel, Pre-Dried Lignite, Niederaussem PS Unit K, Germany	Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan
Concept design study for optimization of firing system considering dry lignite burners, 2 x 550 MWel, Lignite, Niederaussem PS Unit K, Germany	RWE Power AG, Essen, Germany
Concept study for a 1100 MWel dry lignite-fired steam generator, Japan	Ishikawajima-Harima Heavy Industries Co., Ltd., Tokyo, Japan
Design study for a super critical steam generator fired with Pre-Dried Lignite without flue gas circulation, Germany	RWE Power AG, Essen, Germany
Feasibility study for the implementation of dry lignite burners including test phase, Germany	RWE Power AG, Essen, Germany

LEGEND

- | | | |
|---------------------------------|---------------------------------------|--------------------------------|
| PS Power Station | SCR Selective Catalytic Reduction | FGD Flue Gas Desulphurization |
| PF Pulverized Fuel | STP Standard Temperature and Pressure | CFB Circulating Fluidized Bed |
| CHP Combined Heat & Power Plant | HRSG Heat Recovery Steam Generator | ESP Electrostatic Precipitator |

**RELY ON GOOD
EXPERIENCES**

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RELY ON GOOD EXPERIENCES

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PHOTOS

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