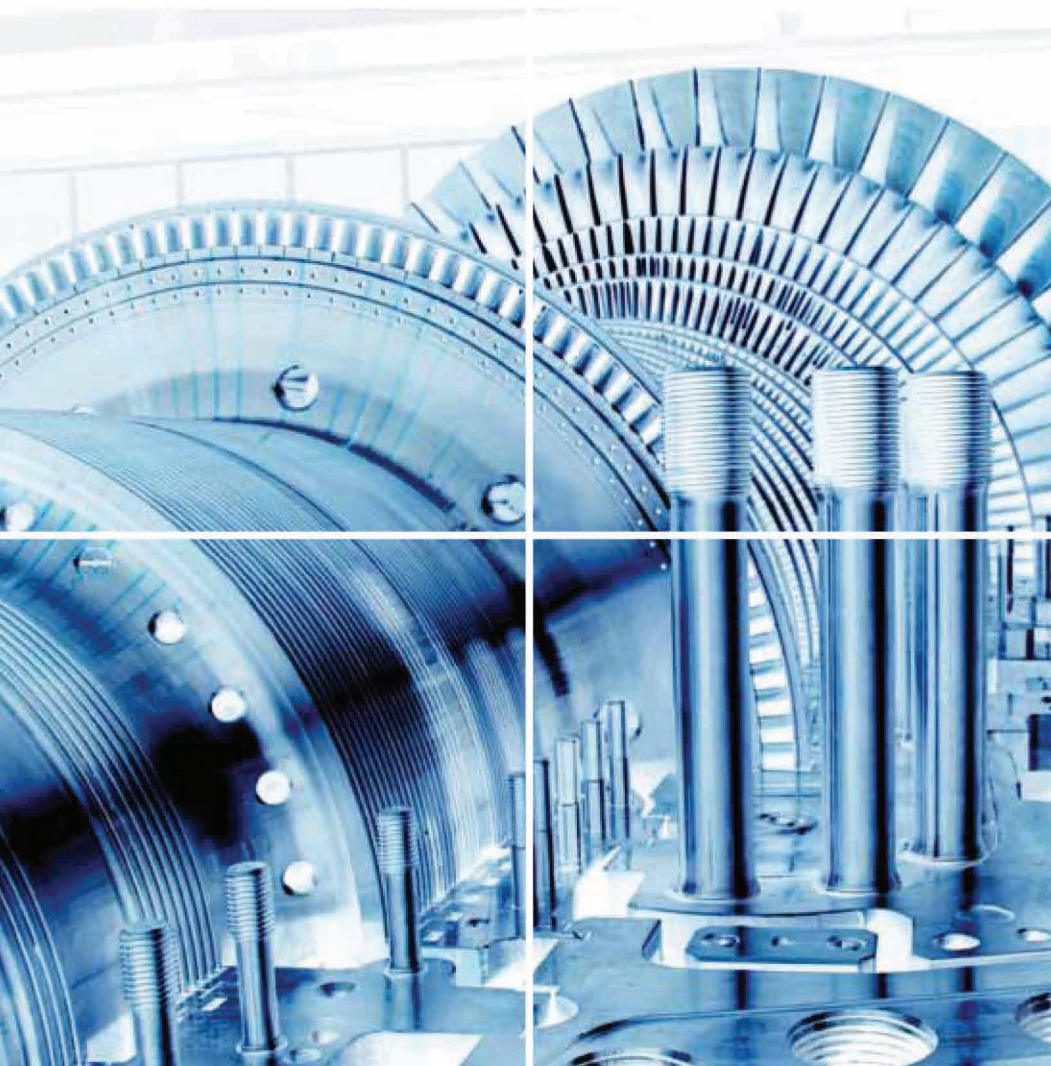


Products and customer service





quality products / our people / smart solutions / advanced technology

Doosan Škoda Power
Part of Doosan Power Systems

Doosan Škoda Power is a leading supplier of modern systems, components and services in the field of design and manufacturing of power generation equipment. Our areas of service expertise include commissioning, retrofit of existing installed equipment and long-term service and maintenance for ŠKODA designed equipment, as well as that of selected producers. We offer our customers a wide spectrum of technically and technologically progressive and economically effective project solutions derived from ŠKODA design components including steam turbines, condensers and heat exchangers. Our company leverages a rich tradition, long experience and professional knowledge, with innovative approaches to project management and quality, harnessed to leading edge technological know-how. Our research and development resources enable us to perfect our products and guarantee further future innovations.

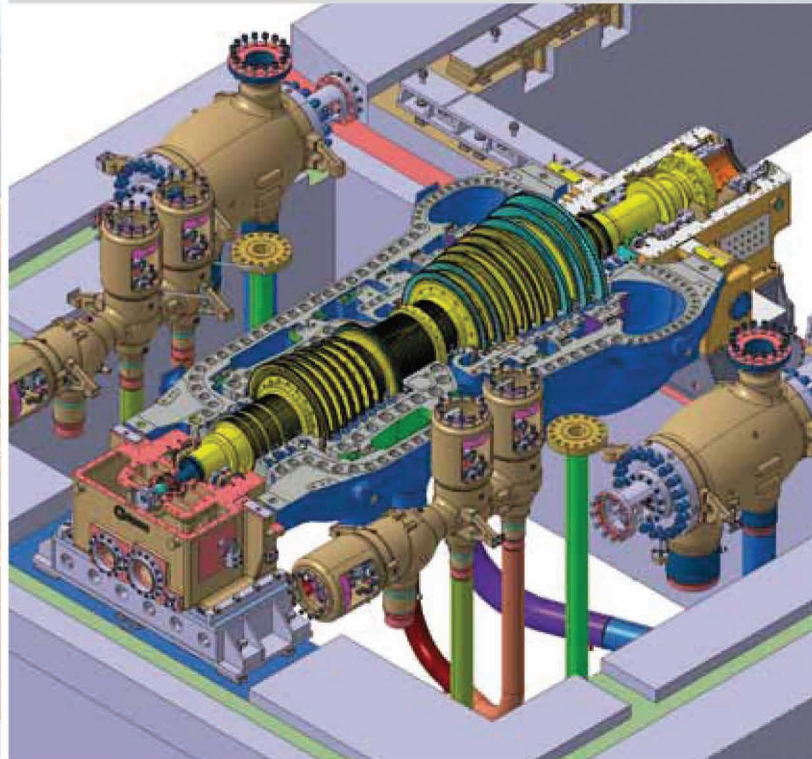
Supplier of Equipment and Services for Power Generation Technology



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Doosan Škoda Power Products and Services for Power Engineering Projects

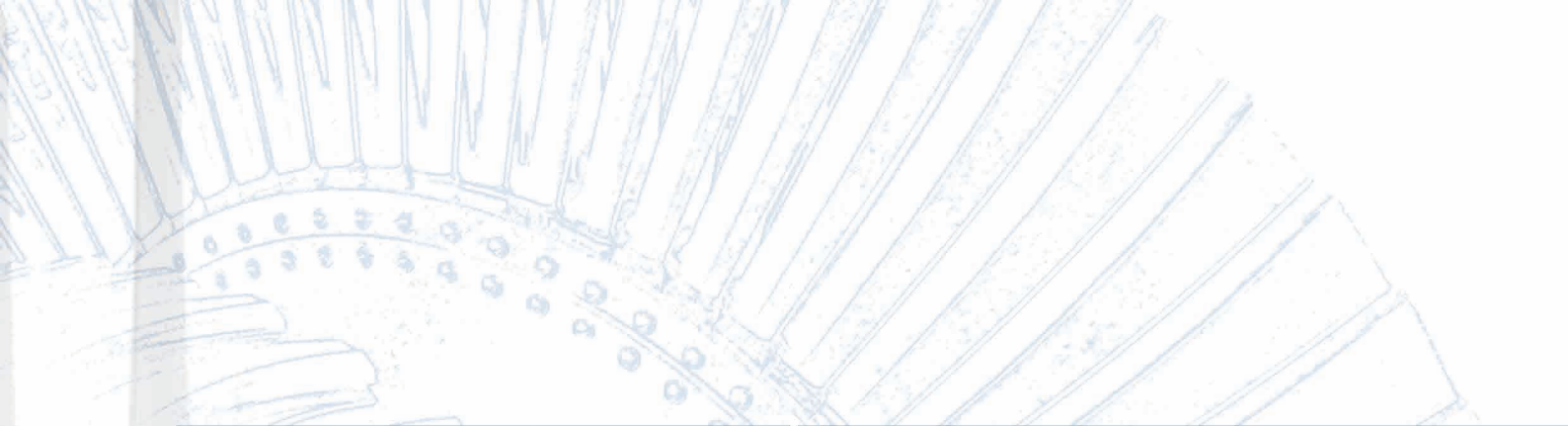
Steam turbines, turbo-generator sets and steam turbine machine halls based on own research & development, design and manufacturing of steam turbines and heat exchangers for:

- Fossil-fuel power plants (e.g. coal)
- Co-generation units using extraction and backpressure steam turbines
- Combined cycle power plants
- Nuclear power plants
- Incineration plants for waste and biomass

Basic Features of Equipment and Services Supplies

- Application of standardised project solutions whenever possible
- Project optimization according to the customer's requirements
- Solutions based on modular designs for steam turbines (ŠKODA MTD10 to ŠKODA MTD80)
- Design and engineering supported by modern SW applications
- High operational reliability and flexibility of the equipment
- Easy maintenance
- After-sale services including long-term service contracts
- Research and development focused on continuous technical improvement
- Own experimental base

- 1 Waste incineration plant – condensing turbine 60 MW with axial exhaust (MTD40CA)
- 2 Nuclear power plant – condensing turbine 1,020 MW (MTD80CR)



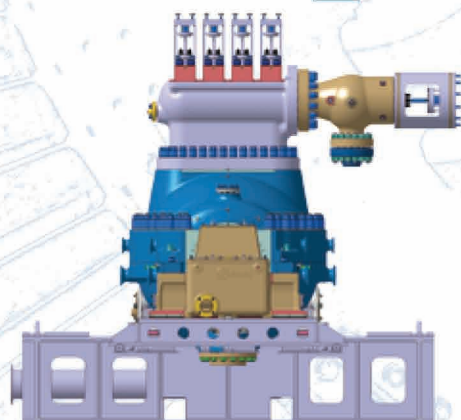
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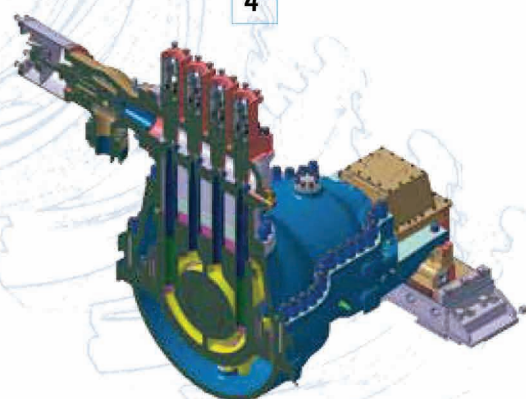
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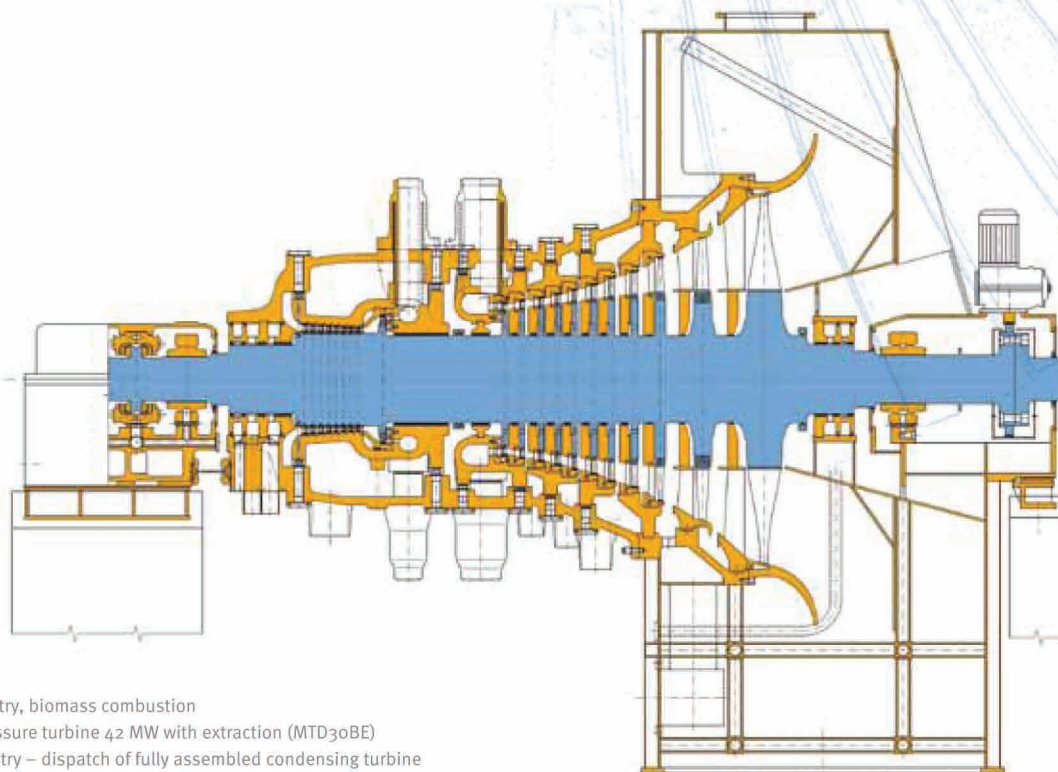
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- 1 Last stage blade – length 1,220 mm (48"), nominal speed 3,000 rpm
- 2 Coal fired power plant 2x500 MW – condensing turbines with reheating (MTD70CR)
- 3 Steel industry – condensing turbine 40 MW (MTD30C)
- 4 Steam turbine – inlet part with control valves



Steam Turbines Characteristics

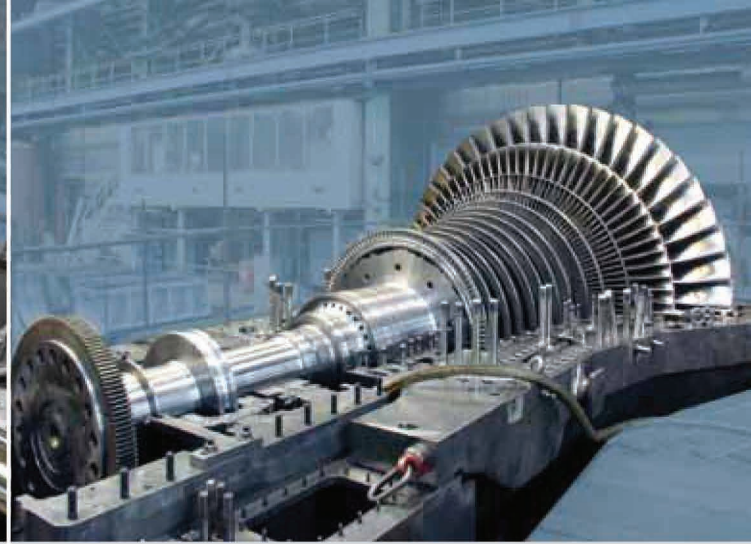
- Applying the modular design approach based on operationally proven elements – the basic module parts generally differ only by flow-part dimensions. Similarity principles are applied to account for such differences
- Modifying the design to meet individual requirements of the customers by suitable combination of standard design elements and tailor-made design
- Solid-forged and welded rotors
- Rugged moving blading, long last stages moving blades both free standing or with snubber connection
- 3D optimised blading
- High performance honeycomb sealing – precise assembled guide wheels
- Moisture extraction from wet steam within the last stages using hollow guide blade
- Free expansion guide wheels and sealing casings
- Applying composite materials for glands with spring backed labyrinth rings
- Horizontally split casings – for high temperatures we use a double-shell design with inner casing
- Tilting pads thrust bearings, tilting pads radial bearing for high speed turbines
- Electronic control system designed from module function units with feedback to high-pressure hydraulic control system, which enables the use of an incombustible regulating liquid
- Turbine reliability coefficient, which is regularly evaluated, exceeds 99 %



- 1 | Steel industry, biomass combustion
– back-pressure turbine 42 MW with extraction (MTD30BE)
- 2 | Steel industry – dispatch of fully assembled condensing turbine
25 MW with extraction (MTD30CE)
- 3 | Cross section of condensing turbine with
reheating (MTD40CR)

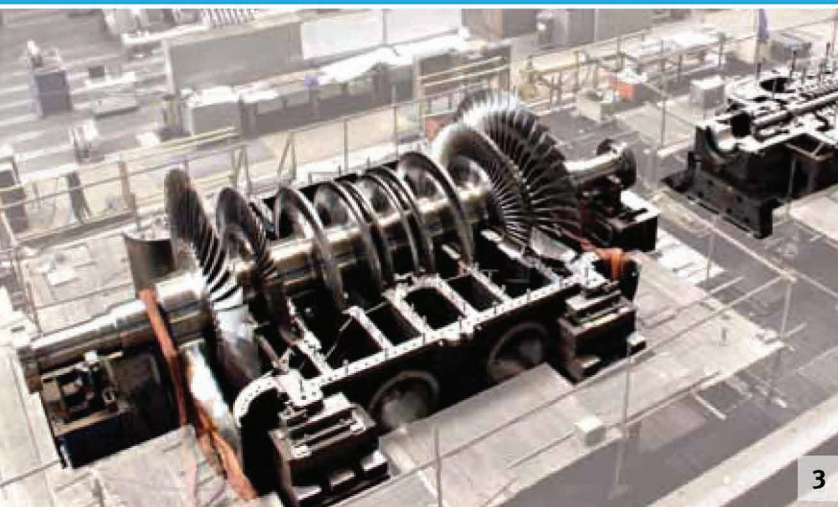


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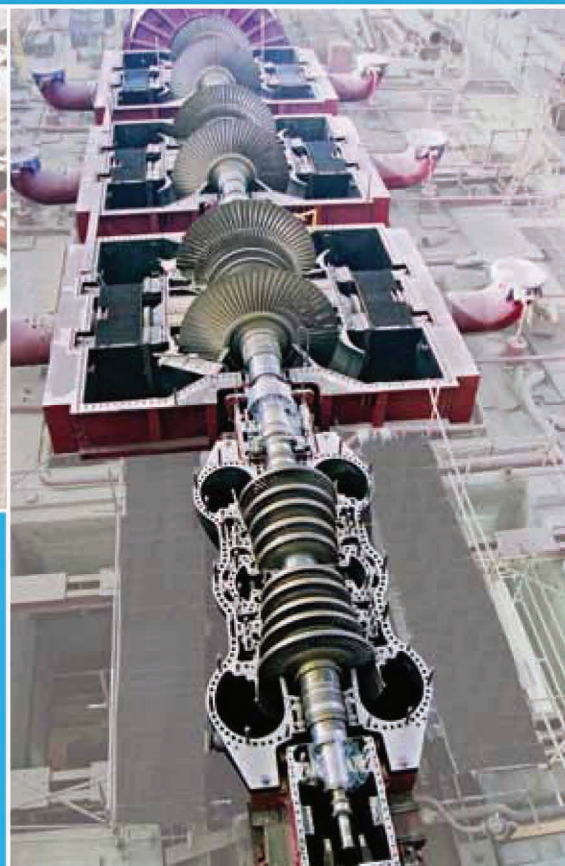
Steam Turbines



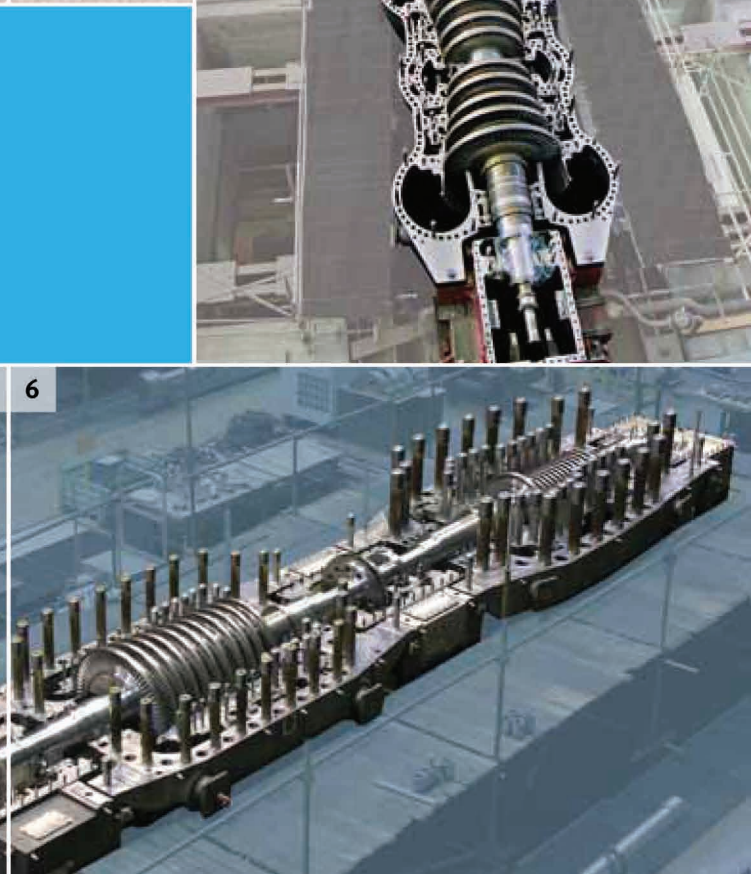
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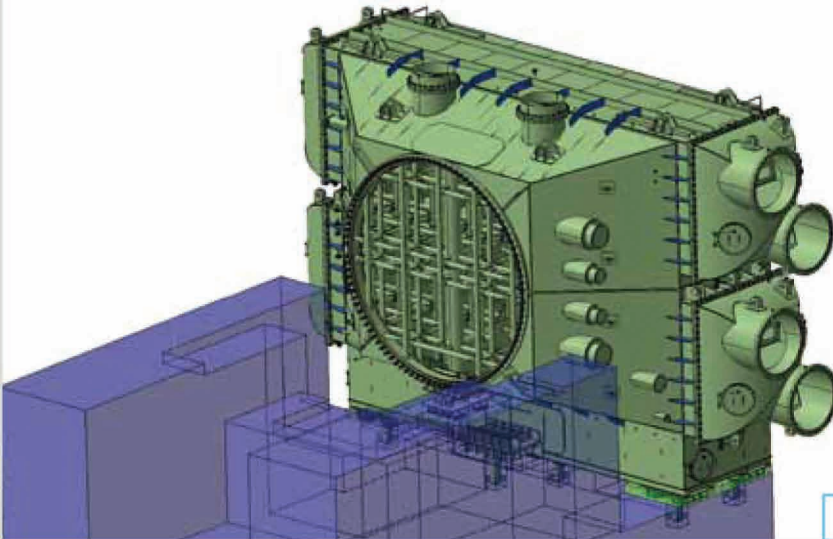
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Heat Exchangers

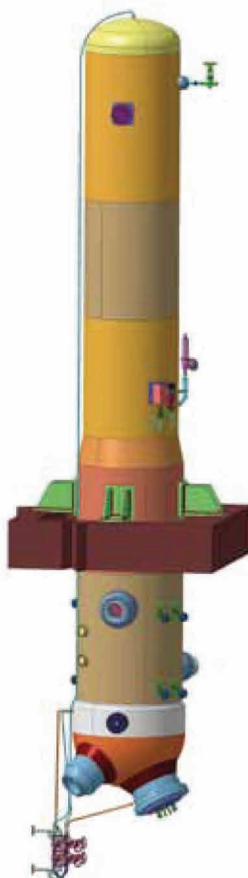
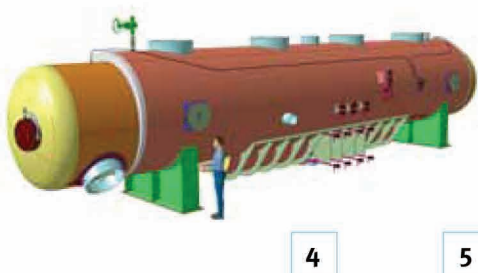
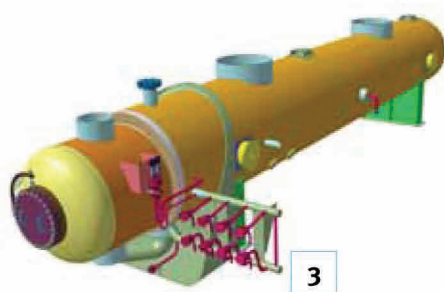
For the whole portfolio of ŠKODA steam turbines.

Characteristics

- Design of the most recent heat exchangers are based on thermodynamic computations according to our own SW, as well as worldwide accepted standards in the heat exchanging field – e.g. HEI Standard and standards for pressure equipment – e.g. ASME Code, AD Merkblatt
- The most sophisticated heat exchanger components are manufactured from alloys and titanium materials
- High operational reliability

Products

- Surface condensers with auxiliaries
 - With radial or axial turbine steam outlet
- Feeding water heating systems
 - High-pressure heaters
 - Low-pressure heaters
- Heat exchangers for district water heaters
- Retrofit and upgrade of ŠKODA design heat exchangers.



- 1 Biomass plant – back-pressure turbine 38 MW (MTD3oB)
- 2 Waste incineration plant – condensing turbine 60 MW (MTD4oCA)
- 3 Combined cycle cogeneration plant – condensing extraction turbine 150 MW with reheating (MTD6oCER)


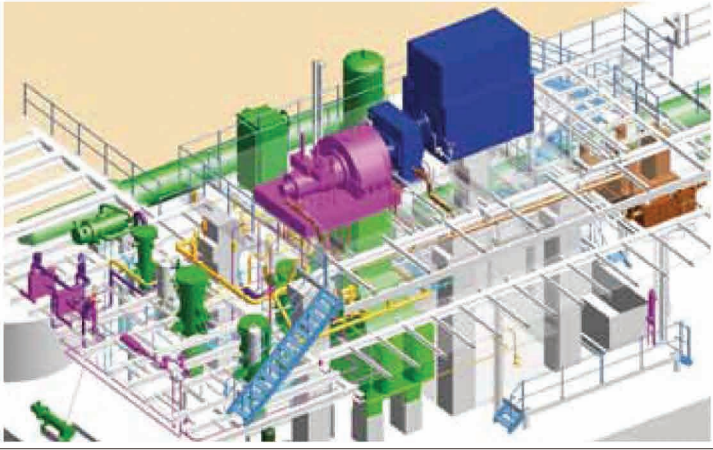
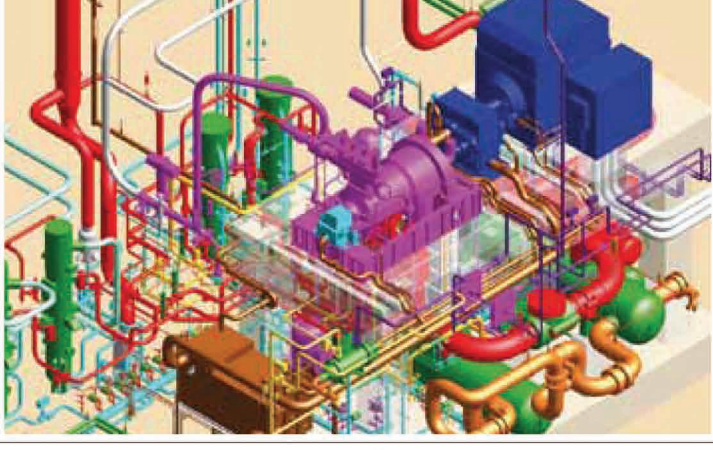
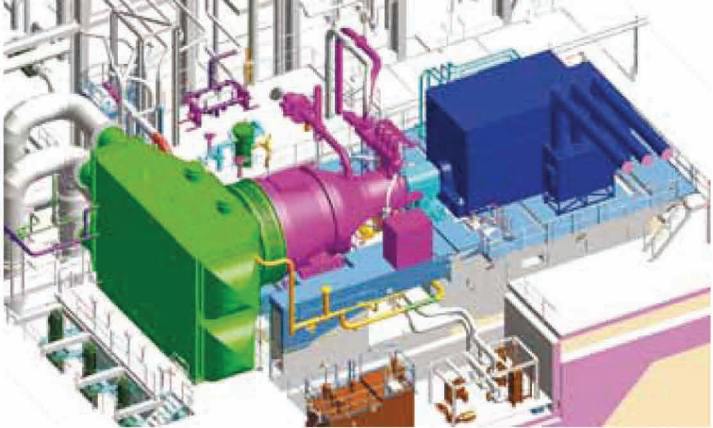
- 4 Nuclear power plant – condensing turbine 1020 MW (MTD8oCR)
- 5 Coal fired power plant – HP and IP part of condensing turbine 200 MW with reheating (MTD7oCR)
- 6 Coal fired cogeneration plant – back-pressure turbine 80 MW with reheating (MTD5oBR)

- 1 Axial condenser
- 2 Retrofit of condensers for 220 MW turbines
 - Titanium type
 - Increase of turbine output by 2.6 MW
- 3 Low-pressure heater
- 4 High-pressure heater
- 5 District water heater

Modular Design of ŠKODA Steam Turbines

Type	Turbine characteristics	Layout				
		Condensing – lower outlet Type xxC	Condensing – axial outlet Type xxCA	Backpressure Type xxB	Extraction Type xxC(B)E	With steam reheating Type xxC(B)R
ŠKODA MTD10	<ul style="list-style-type: none">• Condensing and backpressure• Axial outlet to condenser• Layout alternatives:<ul style="list-style-type: none">– Common foundation frame for complete turboset including lubrication oil system– Separate foundation frame					
ŠKODA MTD20	<ul style="list-style-type: none">• Condensing and backpressure alternatives with the possibility to apply one controlled extraction• Possibility of axial or radial outlet to the condenser• Layout alternatives<ul style="list-style-type: none">– Common foundation frame for complete turboset including lubrication oil system– Separate foundation frame					
ŠKODA MTD30	<ul style="list-style-type: none">• Condensing or backpressure with the possibility to apply controlled steam extractions• Without steam reheating• Possibility of axial or radial outlet to the condenser					
ŠKODA MTD40	<ul style="list-style-type: none">• Single casing condensing or backpressure turbines directly connected with the generator• With or without steam reheating• Possibility to apply controlled steam extractions• Possibility of axial or radial outlet to the condenser					

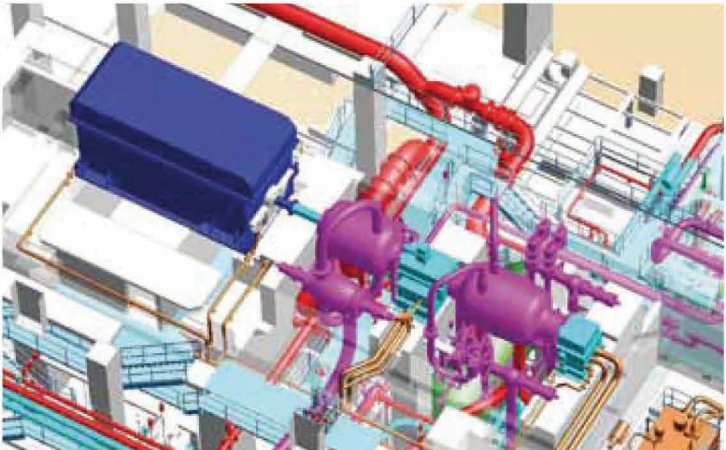
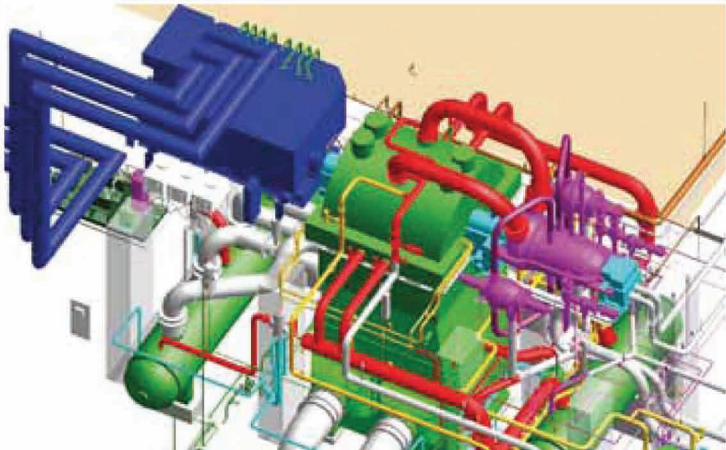
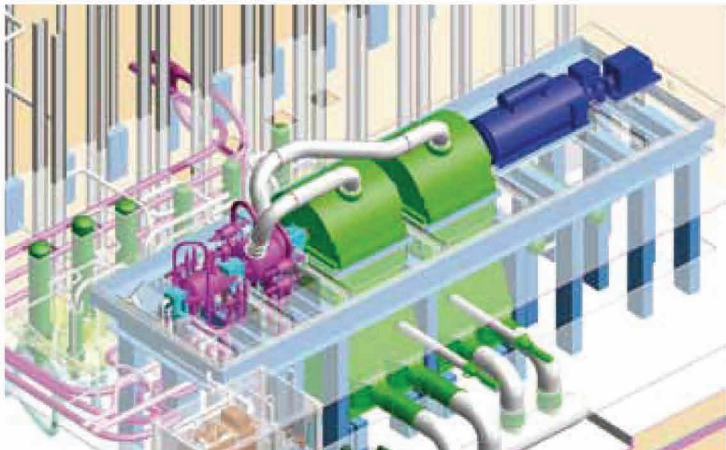
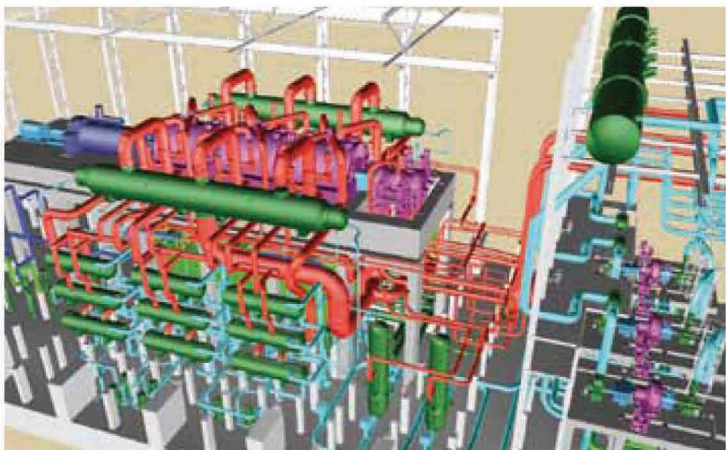
C – condensing turbine; B – backpressure turbine; A – turbine with axial outlet to the condenser;
E – extraction turbine; R – turbine type with steam reheating

Capacity output [MW]	Nominal turning speed [rpm]	Steam parameters: pressure temperature	Layout example
Up to 7	12,000	3-5 MPa 350-450 °C	<p>Turbine 3 MW type ŠKODA MTD10CA</p> 
From 15 to 30	8,000	3-14 MPa 300-540 °C	<p>Turbine 11.5 MW type ŠKODA MTD20CE</p> 
From 20 to 55	5,500 / 6,000	3-14 MPa 300-540 °C	<p>Turbine 38 MW type ŠKODA MTD30B</p> 
From 30 to 200	3,000 / 3,600	3-14 MPa 300-570 °C	<p>Turbine 79 MW type ŠKODA MTD40CA</p> 

Doosan Škoda Power also produces high speed steam turbines with variable turning speed and with gearbox, which are applied e. g. as driving units for sugar cane mills, drives for feeding pumps and compressors.

Modular Design of ŠKODA Steam Turbines

Type	Turbine characteristics	Layout				
		Condensing – lower outlet Type xxC	Condensing – axial outlet Type xxCA	Backpressure Type xxB	Extraction Type xxC(B)E	With steam reheating Type xxC(B)R
ŠKODA MTD5o	<ul style="list-style-type: none">• Double-casing turbines with single-flow HP and LP part• With or without steam reheating• Possibility to apply controlled steam extractions• Possibility of axial or radial outlet to the condenser• Possibility to apply high-speed HP part with a gear to synchronous turning speed of the LP part					
ŠKODA MTD6o	<ul style="list-style-type: none">• Double-casing turbines with combined HP-IP part and double-flow LP part with steam reheating• Lower steam outlet to the condenser• Possibility to apply controlled steam extractions					
ŠKODA MTD7o	<ul style="list-style-type: none">• Multi-casing turbines with steam reheating• Lower steam outlet to the condenser• Possibility to apply controlled steam extractions					
ŠKODA MTD8o	<ul style="list-style-type: none">• Multi-casing turbines for nuclear power plants• Inlet steam parameters on the saturation limit• Turbines with steam reheating and moisture separation• Lower steam outlet to the condenser• Possibility to apply controlled steam extractions i.e. for heating					

Capacity output [MW]	Nominal turning speed [rpm]	Steam parameters: pressure temperature	Layout example
From 80 to 210	3,000 / 3,600	6-18 MPa 450-580 °C	<p>Turbine 80 MW type ŠKODA MTD50BR</p> 
From 80 to 400	3,000 / 3,600	8-18 MPa 450-600 °C	<p>Turbine 140 MW type ŠKODA MTD60CER</p> 
From 200 to 900 (1,000)	3,000 / 3,600	12-18 MPa 500-580 °C USC: 30 MPa 600/620 °C	<p>USC turbine 660 MW type ŠKODA MTD70CR</p> 
From 200 to 1,200	3,000	4-7 MPa saturated steam	<p>Turbine 1,020 MW type ŠKODA MTD80CR</p> 

Service



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Basic Services

- Spare parts supply and management
- Expert services applying advanced diagnostic tools
- Turbine overhauling and repairing
- Service „HOTLINE“ in case of emergencies
- Residual lifetime assesment
- Measuring of performance degradation

Long-Term Maintenance Agreements

- Partnership with OEM
- Predictable long-term maintenance costs
- Optimized maintenance program and costs
- Guarranteed availability or reliability
- Overhauling in shortest possible time
- Spare parts management

Retrofits

- Retrofit of ŠKODA equipment improves performance and extends lifetime
- Return on investment 3-5 years
- Use of original foundation with minor modifications
- Replacement of old steam path with 3D blading
- Keeping the original turbine design and dimensions (bearing span etc.)
- Keeping the original generator
- Using the original condenser and heaters
- Control system upgrade

- 1 | Rotor repair technology of Doosan Škoda Power – repairs are carried out by submerged arc welding and subsequent localized head treatment
- 2 | Retrofit of low-pressure components of 8x220 MW ŠKODA turbines. Results of the retrofit:
 - Decrease of specific heat consumption of the turbine set by 3,5%
 - Increase of power output by 9 MW for each unit
 - The safe and reliable operation extended by 30 years

Service



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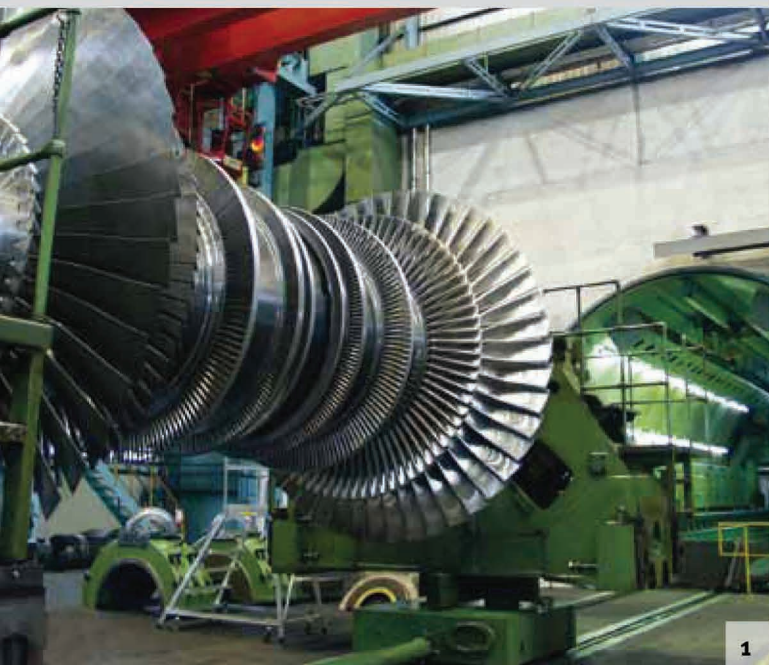
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- 1 Special services – rotor alignment applying middle-frequency heating methods
 - 2 Retrofit of ŠKODA 114 MW backpressure turbine, heating plant
 - 3 Retrofit of high-pressure parts of 2 x 1,000 MW ŠKODA turbines, nuclear power plant.
- Result of the retrofit:
- Increase of power output by 20 MW for each unit
 - The safe and reliable operation extended by 30 years

Service



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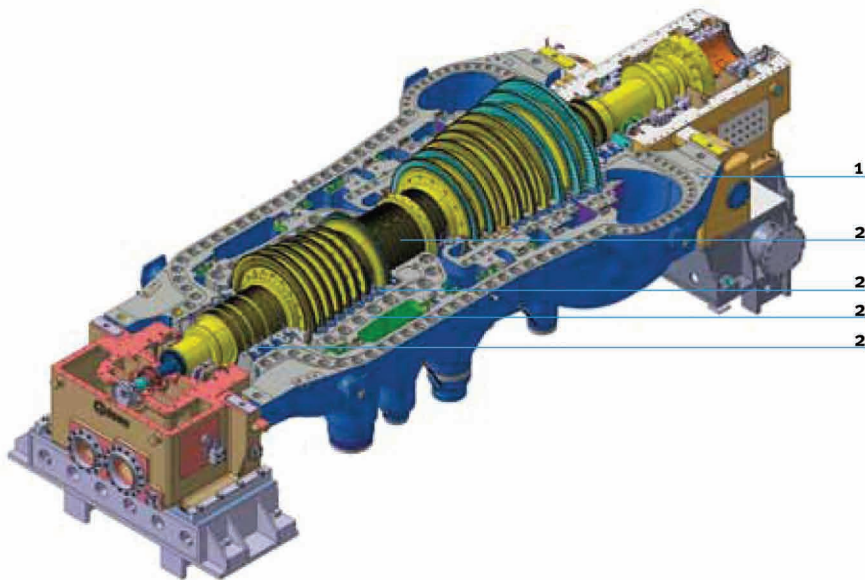
Repair Facilities

- 1 Special services – rotor balancing in high-speed balancing tunnel
- 2 Turbine casing machining – CNC machining center

Selected Retrofit Projects

- Steam path retrofit
- 3 – modernization of diaphragms
 - 3 – EH system upgrading

Turbine Retrofit / Re-engineering

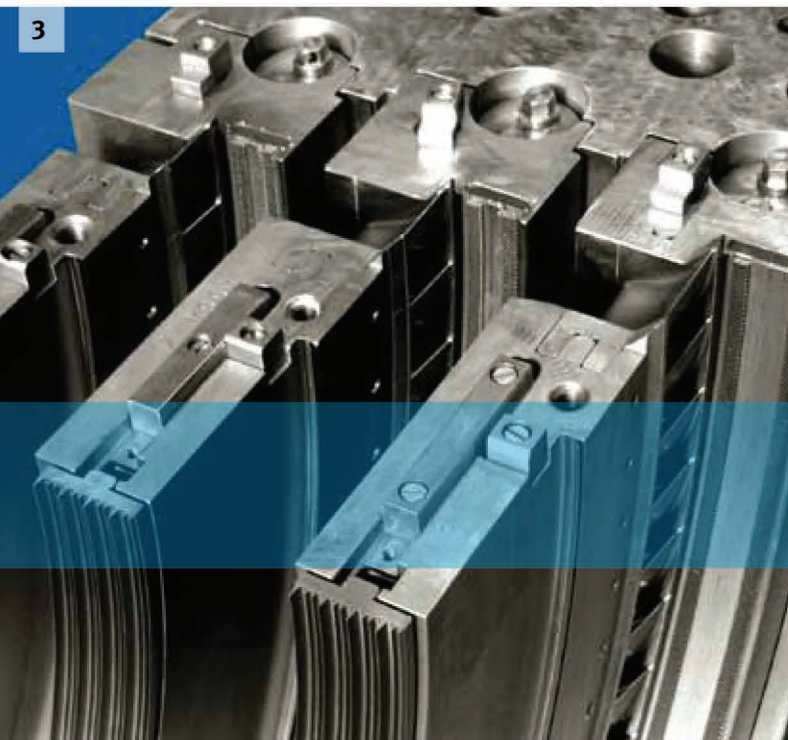


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1 Turbine internal component replacement

- 1) Original casing
- 2) New flow part – rotor + internal casing + guide wheels + glands (+carriers)

3



3

