



STEAM TURBINES



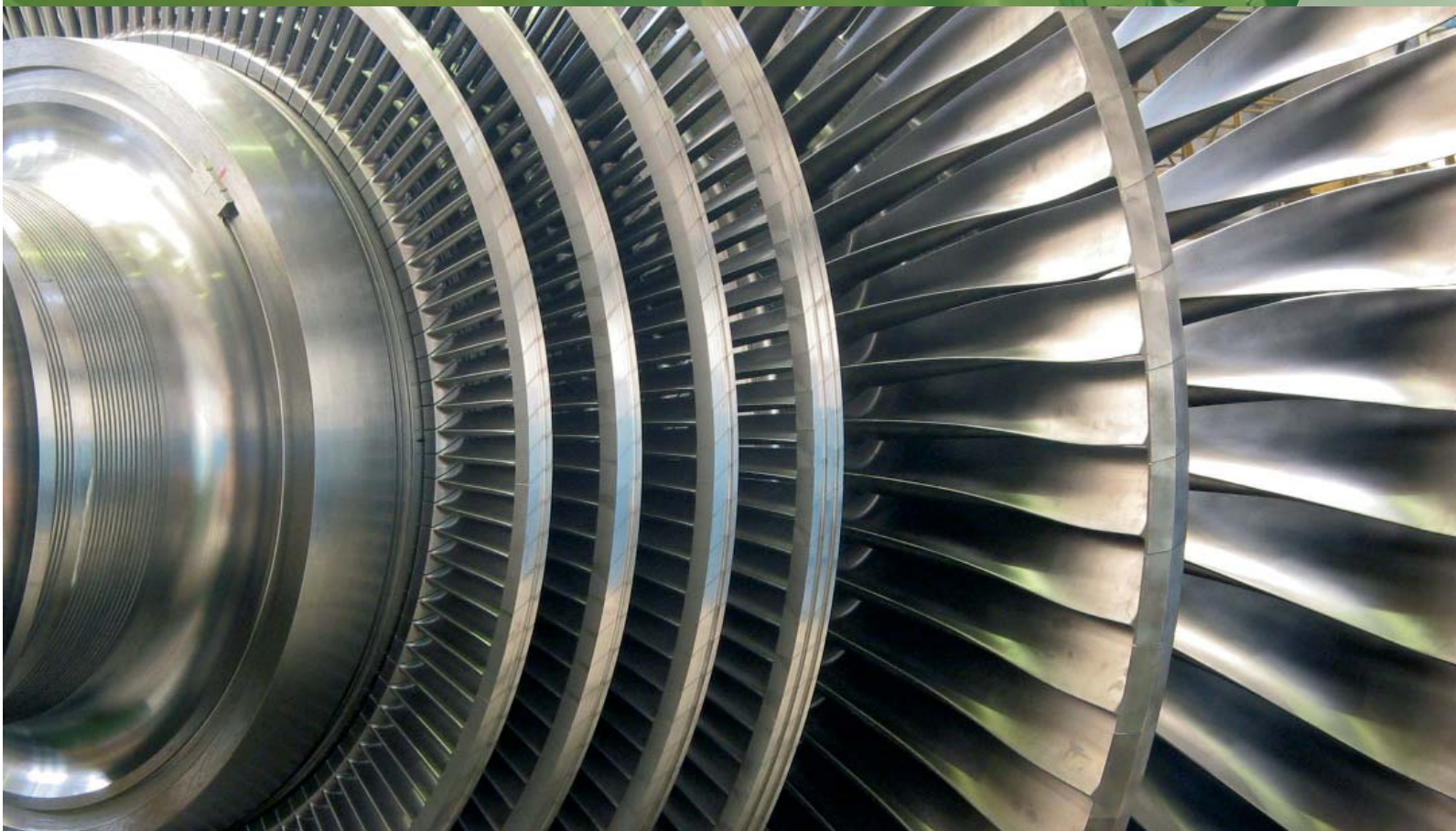
AnsaldoEnergia
A Finmeccanica Company

Steam Turbines

Ansaldo Energia has a comprehensive steam turbine offering covering a wide range of power generation applications:

- Steam turbines for fossil fired cycles
- Steam turbines for combined cycles
- Cogeneration steam turbines for process steam, district heating and desalination plants
- Geothermal steam turbines

Ansaldo Energia has extensive design, manufacturing and installation experience, with more than 300 units rated 100 MW and above, in service or on order for power stations.



Experience

Applications	Units	Power (MW)
Fossil fueled power plants	344	65,800
Combined Cycles power plants	97	7,460
Cogeneration power plants	607	5,825
Geothermal power plants	130	2,118
Nuclear power plants	12	6,180
Total	1,190	87,383

Geothermal steam turbines

Ansaldo Energia has designed, built and commissioned more than one hundred geothermal units since 1912 throughout the world, in sizes ranging from 250 kW to 60 MW and for all types of steam or water dominated geothermal sources.

This extensive experience (more than 2000 MW installed) has enabled the company to achieve a high level of reliability and efficiency as well as remarkable flexibility in terms of adapting to different steam conditions and plant arrangements.

State-of-the art technology, modular design and cutting edge construction methods are used to pre-engineer different turbine models for different geothermal steam conditions, and power output levels.

Geothermal steam turbine design features

Feature	Benefits
impulse/reaction construction	better protection against solid particles entering the steam path
new generation airfoil and steam seal	high efficiency
top or lateral exhaust fully integrated with condenser	simple layout
patented design solutions to prevent problems arising from dissolved solids or steam impurities	simplified maintenance



GT 60 Geothermal Steam Turbine (60 MW)

Cogeneration steam turbines

These turbines up to 250 MW are employed in industrial, desalination, district heating plants.

As it is basically the process which dictates steam parameters and therefore turbine design, each cogeneration steam turbine is a unique product tailored to the client's specific needs.

Cogeneration steam turbines have a modular construction, enabling the production of back pressure and condensing turbines with or without controlled extraction.

Cogeneration steam turbine main design features

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|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none">• modular design• with or without control stage• single and two cylinder design | <ul style="list-style-type: none">• one or two internally controlled process steam extractions• axial or vertical exhaust• package unit design |
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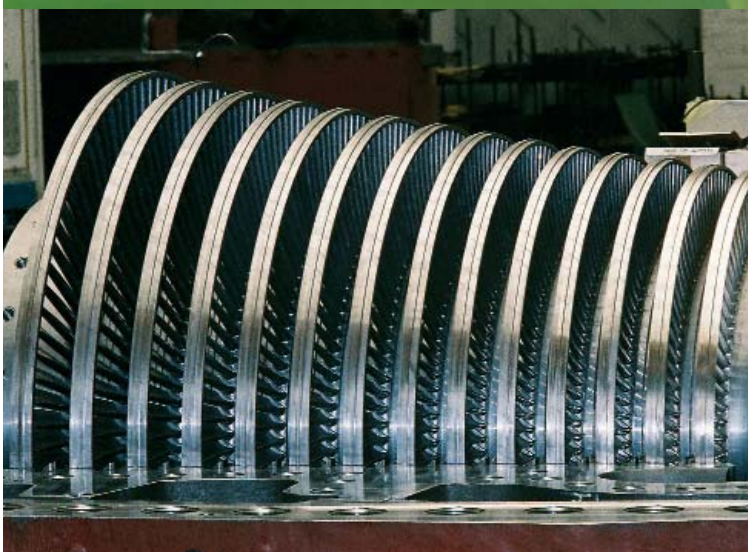


80 MW cogeneration steam turbine

Steam turbines for fossil fired cycles

Today's big power generation turbines are reheat type with regenerative feedwater cycle and possible district heating plant applications.

Ansaldo Energia is now offering an updated reheat turbine product line, specifically designed to satisfy all possible customer requirements in terms of operating conditions, performance and reliability, including turbines for supercritical and ultrasupercritical applications.



STEAM TURBINE CONFIGURATION						
Applications	Speed (hz)	Basic Configuration	Output Range (MW)	Max. Main Steam Data		
				Pressure (bar)	Temperature (C°)	
<div><div></div> RH Fossil - Power Plants</div>	50 60	TC - DF <div></div>	200-1200	300	600/610	
<div><div></div> RH Fossil - Power Plants</div>	50 60	TC - DF <div></div>	150-350	170	540/565	
<div><div></div> RH Fossil - Power Plants</div>	50 60	TC - SF <div></div>	100-250	170	565/565	

The main technical features are based on successful operating experience throughout the world in the full range of applications combined with modular design to improve reliability and performance.

Their advanced design concept and special construction features make Ansaldo Energia steam turbines particularly appropriate for operation in advanced steam conditions ($>565^{\circ}\text{C}$).

The extensively referenced modular design can be applied without modification.

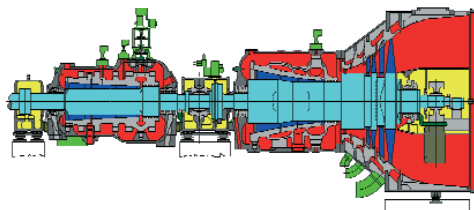
The only adaptation required for operation in advanced steam conditions is the 10% chromium steel which must be used for HP, IP inner casings, valve bodies and middle rotor sections.



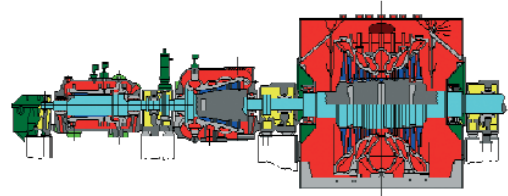
Features	Benefits
Full 3-D design reaction blading	High efficiency
Integral shrouded blading in HP, IP and LP front stages	
Advanced steel blading for LP last stages up to 48" size	Reduced exhaust losses
Single bearing concept	High operating flexibility
Double shell design	
Shrink rings for HP inner casing	
LP casing independent from bearing housing	Low thermal stress Material optimised for operating temperature
Welded rotor design	

REHEAT TURBINES CONFIGURATIONS - Models and Configurations

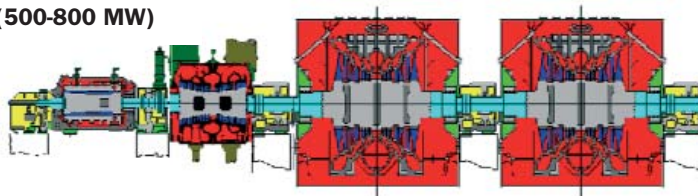
MT 15 (100-250 MW)



RT 30 (200-500 MW)



RT 70 (500-800 MW)



Steam turbines for combined cycles

Steam turbines for reheat, non reheat combined cycles must be easy to adapt to different gas turbine configurations (number and models) and the steam conditions delivered by various heat recovery steam generators.

Ansaldo Energia steam turbines are optimised to meet the full range of customer requirements and all specific site conditions. The combined cycle steam turbines product line incorporates all the main features currently being implemented on conventional medium and large units plus additional features required by specific application.



Features

Full arc admission

Axial or side exhaust arrangement




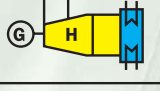
Benefits

Improved efficiency and operation

Low profile plant layout

Steam turbines for single shaft arrangements (gas turbine, generator, steam turbine on a single shaft line) are also available to optimize installation compactness and therefore reducing associated costs.

STEAM TURBINE CONFIGURATION

Applications	Speed (hz)	Basic Configuration	Output Range (MW)	Max. Main Steam Data	
				Pressure (bar)	Temperature (C°)
■ RH Combined Cycle Power Plants	50 60	TC - DF 	150-300	170	565/565
■ RH Combined Cycle Power Plants	50 60	TC - SF 	100-200	170	565/565
■ SH Combined Cycle Power Plants	50 60	TC - DF 	100-250	125	540
■ SH Combined Cycle Power Plants	50 60	SC - SF 	40-150	125	540

Fossil Fired Steam Applications

Ansaldo supplies EPC turnkey and turbine island steam power plants covering all fossil fuel types such as: oil, natural gas, coal, with subcritical and supercritical steam parameters.

Neyveli Lignite Corporation power plant extension (India)

The Neyveli 4 and 5 are lignite fired subcritical units rated 210 MW.

Ansaldo Energia as EPC contract supplied, on turnkey basis, the plant power island including: steam turbine generator sets, condensers, thermal cycles with associated equipments, boilers, ESP, and DCS.

The steam turbines are: single reheat, tandem compound single flow LP, 150 bar/535°C/535°C steam parameters.

Avedoere 2 - one of the world's most advanced combined heat and power plant (Denmark)

Avedoere 2 is a supercritical plant fed by natural gas, biomass and oil, commissioned in 2001.

Ansaldo supplied the complete turbine island.

The Ansaldo steam turbine, reheat, extraction condensing is one of the most advanced of this type.

Steam turbine Power output is 534 MW in the full condensing mode, steam parameters are:

300 bar/580°C/600°C.

Plant efficiency levels stand at about 48%.



Special Applications

Ansaldo Energia supplies also:

- Repowering (conversion of steam plants into combined cycle)
- Add-on (conversion from open cycle into combined cycle)
- Cogeneration plant power island (district heating,

Ansaldo Energia has over 150 years experience in the electrical and mechanical engineering business. It is a global player in the power generation sector with an installed capacity of over 170,000 MW. Ansaldo Energia offers the full range of manufacturing, engineering, contracting and service activities, as well as a flexible approach to power projects.

Steam fossil fired, gas turbine and combined cycle, hydroelectric, geothermal and nuclear power plants, supplied turnkey, in separate lots or by components. The Quality Systems, certified as complying with ISO 9001 by a recognised certification society, cover all aspects including, design, planning, manufacture, testing, inspection, installation and servicing.



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