

GAS TURBINES



AnsaldoEnergia
A Finmeccanica Company

Gas Turbines

Ansaldo Energia brings to the market gas turbines of different sizes based on advanced consolidated technology, combining the robustness of its standard design with its well known ability in fulfilling customer needs with tailored solutions.

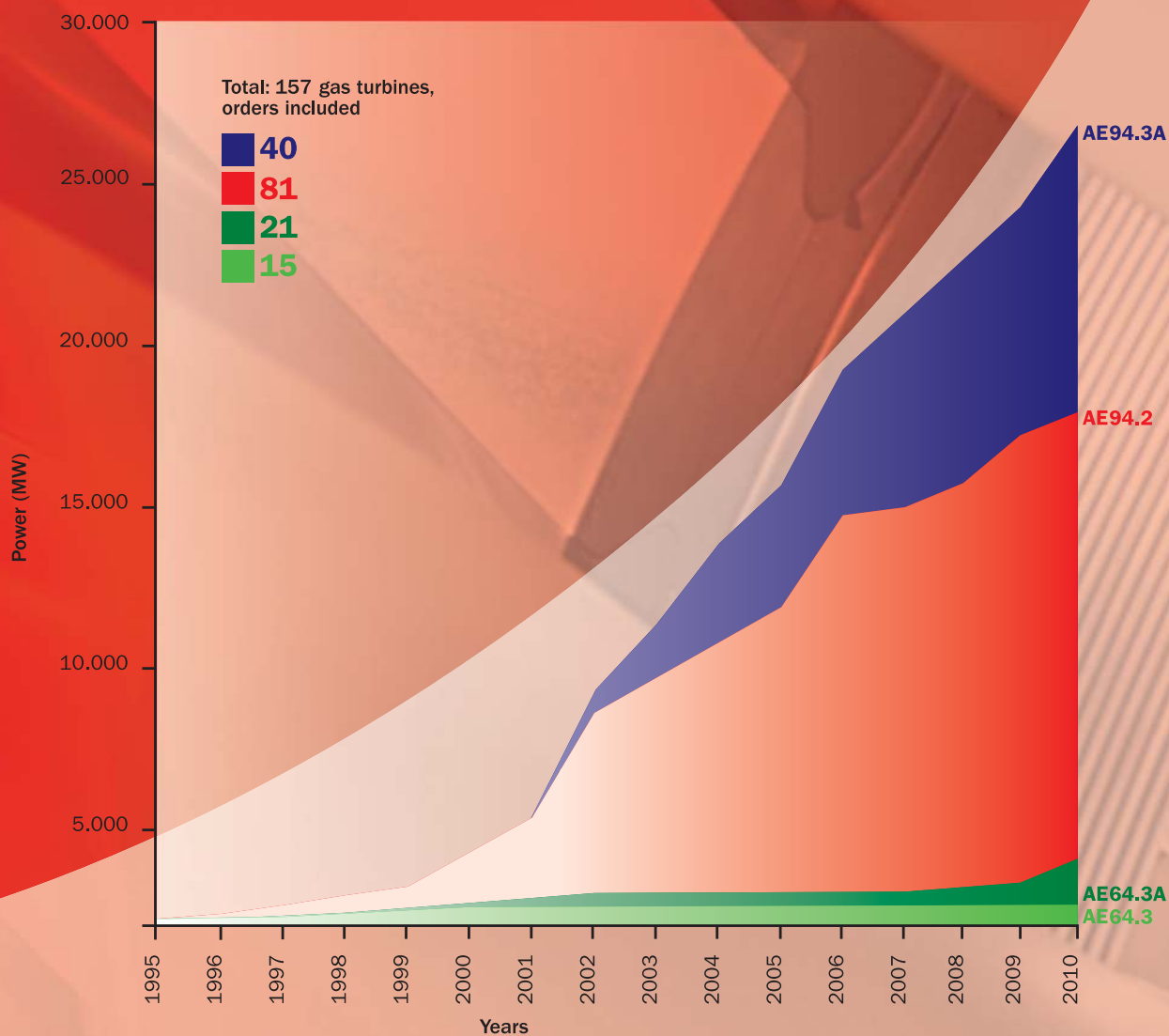
The comprehensive offering covers a wide range of power generation applications:

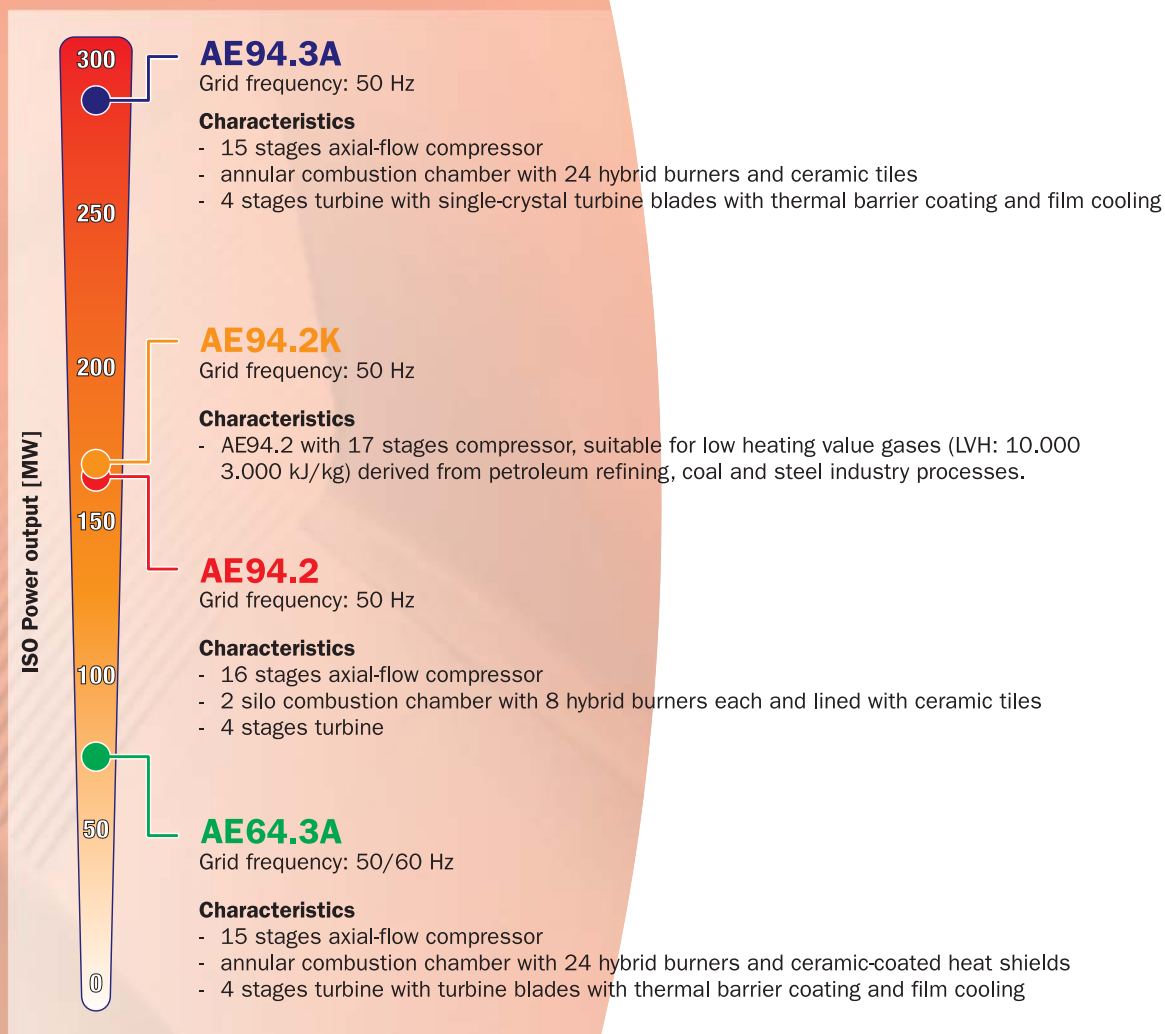
- gas turbines packages
- gas turbines for power islands and grid support
- gas turbines in turnkey simple cycle plants
- gas turbines in turnkey combined cycle plants

Ansaldo Energia has installed more than 100 gas turbines for several applications and this extensive experience has enabled the Company to achieve a high level of reliability and efficiency as well as remarkable flexibility of the gas turbine fleets.



Cumulated Equivalent Operating Hours 5.000.000





Thermodynamic data ISO base load

	AE64.3A	AE94.2	AE94.2K	AE94.3A
Turbine inlet temp. acc. to ISO 2314 [°C]	1190	1075	1060	1250
Pressure ratio [-]	16,7	11,9	12,0	18,2
Power output at gen. term. [MW]	75	170	170	294
Efficiency at gen term. [%]	35,9	34,9	36,5	39,7
Exhaust gas mass flow [kg/s]	213	537	540	702
Exhaust gas temperature [°C]	574	541	545	580

Ansaldo Energia Gas Turbine Main Features

- Compressor cold end drive
- Disk type rotor with two bearings
- Axial exhaust
- Manhole for hot gas path inspection (no need to open the turbine)
- Compressor with variable inlet guide vanes
- All blades and vanes replaceable with rotor in place

Operational flexibility

On the basis of its operating experiences Ansaldo Energia has installed world wide gas turbines well responding to the Customer needs in terms of fuel diversification, grid stabilization, performance optimization, environmental impact reduction, and operational flexibility.

In particular, besides the conventional fuels such as:

- natural gas
- light distillate

also special applications for burning

- syngas, refinery gases, blast furnace gases
- hydrogen enriched fuels
(in connection with CO₂ sequestration projects)
- naphtha
- heavy oil

are fully available for our gas turbines.

In addition, the possibility to perform frequent and fast start up/shut down and the capability to sustain grid frequency variation and high transient modes, such us load rejection and island mode, make the gas turbines fundamental helpers of the electrical grid.

Environmental constraints

Over the past 15 years, more and more stringent environmental constraints set by international and local regulators have induced gas turbine manufacturers to develop innovative solutions.

As reference, Ansaldo Energia gas turbines models fuelled by **fuel gas** and equipped with Hybrid Burner combustion system achieve less than 50 mg/Nm³ NOx emissions and less than 30 mg/Nm³ CO emissions.

Moreover Ansaldo Energia has successfully designed upgrades that reduce emissions significantly and guarantee the same reliability and availability.

The released upgrade is:

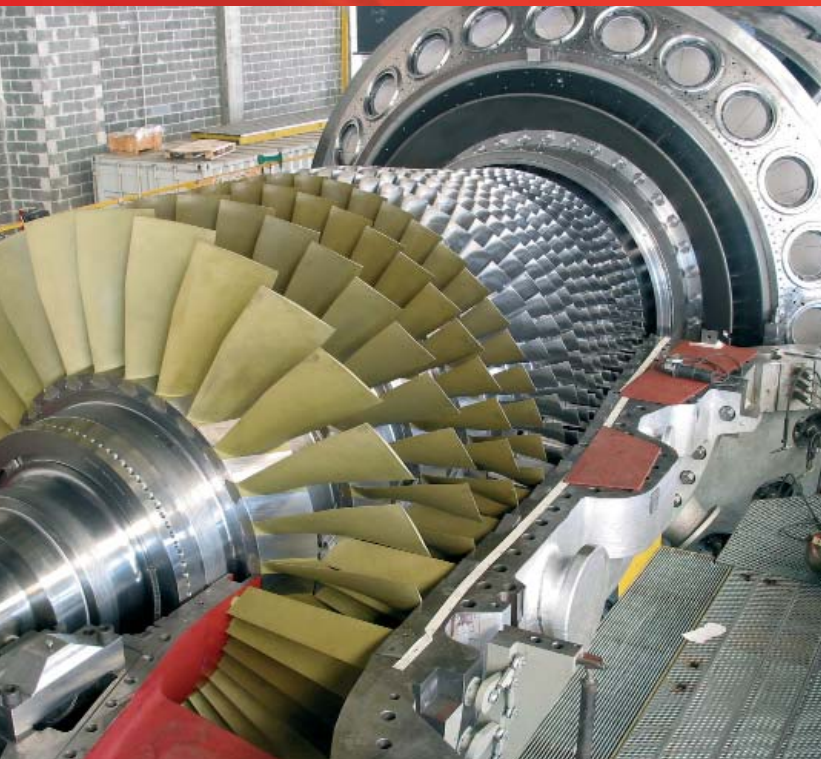
- **VeLoNOx™** combustion system for AE94.2 and AE94.3A

The new VeLoNOx™ Solution brings gas turbine owners to enhanced Emission Reduction, achieving guaranteed NOx emissions lower than **30 mg/Nm³**.

The above solution is fully available also as retrofit application.

In case of **fuel oil** supply, all Ansaldo Energia gas turbines models are equipped with combustion system featuring LPP (Lean Pre-evaporised Premix) technology.

The system is very flexible and can be operated in dry operation and/or with water injection or water emulsion in order to fulfil the most stringent emission requirements.



Start up and after sales services

Ansaldo Energia offers a full range of services and qualified personnel for erection and/or supervision, startup and testing. The availability of standard arrangements and in some cases package solutions ensure rapid, problem-free erection, startup and commissioning.

The Ansaldo Service Organisation provides technical assistance services worldwide in the fields of maintenance, spare parts supply and preventive maintenance programs, so ensuring that Customers are in the best position to achieve optimum operation.

The Ansaldo Service Organisation also provides Customers with personnel training courses organised in house using specially prepared didactic materials.

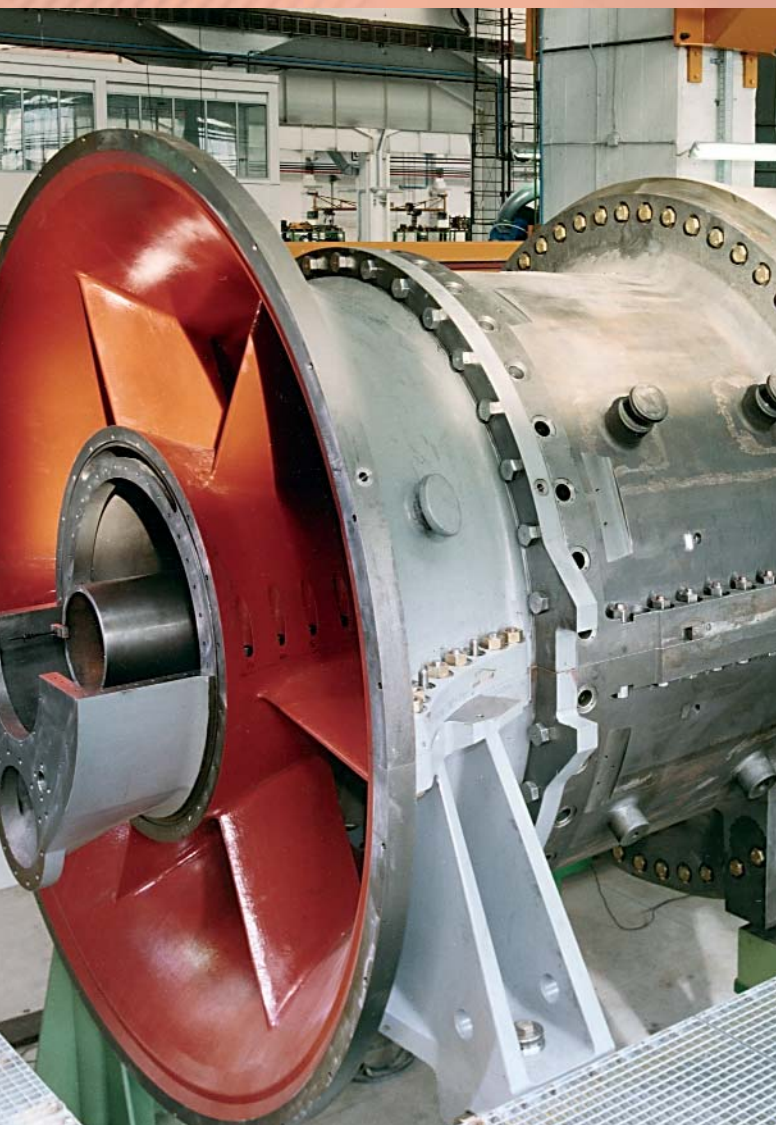
Manufacturing

In order to meet the challenge of increasing market competitiveness, in recent years the Company has heavily invested in human resources, advanced technology and new products.

A significant portion of the investment was spent on consolidating and upgrading manufacturing facilities, to optimize the production of complete flange to flange gas turbines, including hot gas path components.

Full supply chains have been developed for all the components including the ones featured by the highest technological levels in order to dominate the full manufacturing process.

The manufacturing capacity of the workshop is being increased from the present 18 gas turbines per year to the value of 28 gas turbines per year in the near future.



Gas turbine control system

The control system has been designed specifically by Ansaldo Energia to meet the stringent requirements of new generation advanced performance gas turbines, while at the same time offering customers familiarity and ease of maintenance.

System development has drawn on know-how gathered during the implementation of hundreds of gas and industrial steam turbine applications. Before release, the system was tested extensively at Ansaldo Energia production facilities with the support of dynamic real time simulators, for fuel controller, sequence controller and protection system.

Gas turbine control system features are the following:

- Double redundancy in hot backup for all system processors.
- Functionally distributed redundant architecture to allow fully automatically safe unit operation (golden push button i.e. completely automatic startup, shut down and operation).
- Modular architecture to accommodate the full range of client requirements by adding pre-assembled HW and SW modules.
- System designed for complete simple cycle applications with a standard interface for combined cycle operation.
- Extensive use of displays, graphics and mimic diagrams allows all plant diagnostic and supervision functions to be centralised on the operator's desk.
- Product specifications comply with the most widely used industrial standards.
- Integrated system for single shaft application (gas and steam turbines with a common generator).

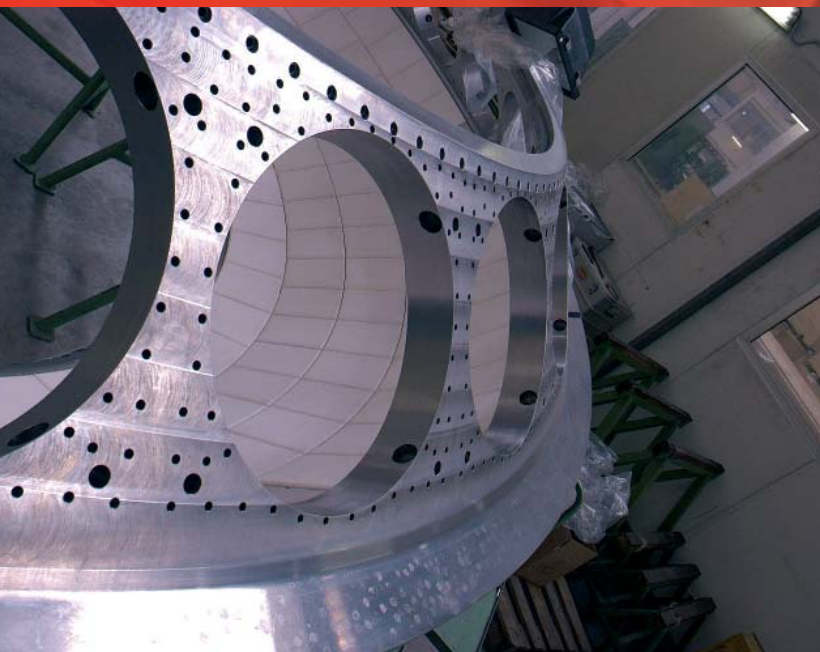
Gas turbine control system specifications are described as follows.

Control, protection and sequence functions are handled separately, but created using the same functional blocks and uniform technology.

High performance processors for critical controls (TG speed fuel control, electrical transients, etc. – max cycle time: 8 msec).

Dedicated special boards for:

- automatic synchronization with the electric grid
- hydraulic servo valve actuation
- sequence event recorder (if required)
- VDU based operator interface (conventional tile panel optional)
- 1,200 I/O for fully automatic operation and supervision
- 2v3 and 1v2 field mounted instrument redundancy.



Ansaldo Energia combined cycle power plants

Ansaldo Energia supplies combined cycles incorporating AE64.3A, AE94.2, AE94.3A gas turbines. The full range of plant configurations covers all possible customer arrangement, flexibility, reliability and availability requirements.

Plant Performance

Combined Cycle	Plant Configuration	No. & Type of GT	Net Plant Power Output [MW]	Net Plant Efficiency [%]	Net Plant Heat Rate [kJ/kWh]	Grid Frequency [Hz]
1AE643-CC1M	1 + 1	1 x AE64.3A	112	53,8	6698	50/60
2AE643-CC1M	2 + 1	2 x AE64.3A	224	53,8	6689	50/60
1AE643-CC1S	Single Shaft	1 x AE64.3A	112	53,8	6698	50/60
1AE942-CC1M	1 + 1	1 x AE94.2	251	52,1	6904	50
2AE942-CC1M	2 + 1	2 x AE94.2	507	52,6	6843	50
1AE943-CC1M	1 + 1	1 x AE94.3A	427	58,2	6190	50
2AE943-CC1M	2 + 1	2 x AE94.3A	855	58,2	6188	50
1AE943-CC1S	Single Shaft	1 x AE94.3A	427	58,2	6190	50

Note:

ISO conditions with:

- condenser vacuum = 0.035 bar;
 - GT inlet pressure loss = 10 mbar ISO;
 - GT exhaust pressure loss = 30/30/35 mbar
- ISO resp. for AE64.3A/AE94.2/AE94.3A gas turbines.



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 176,000 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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