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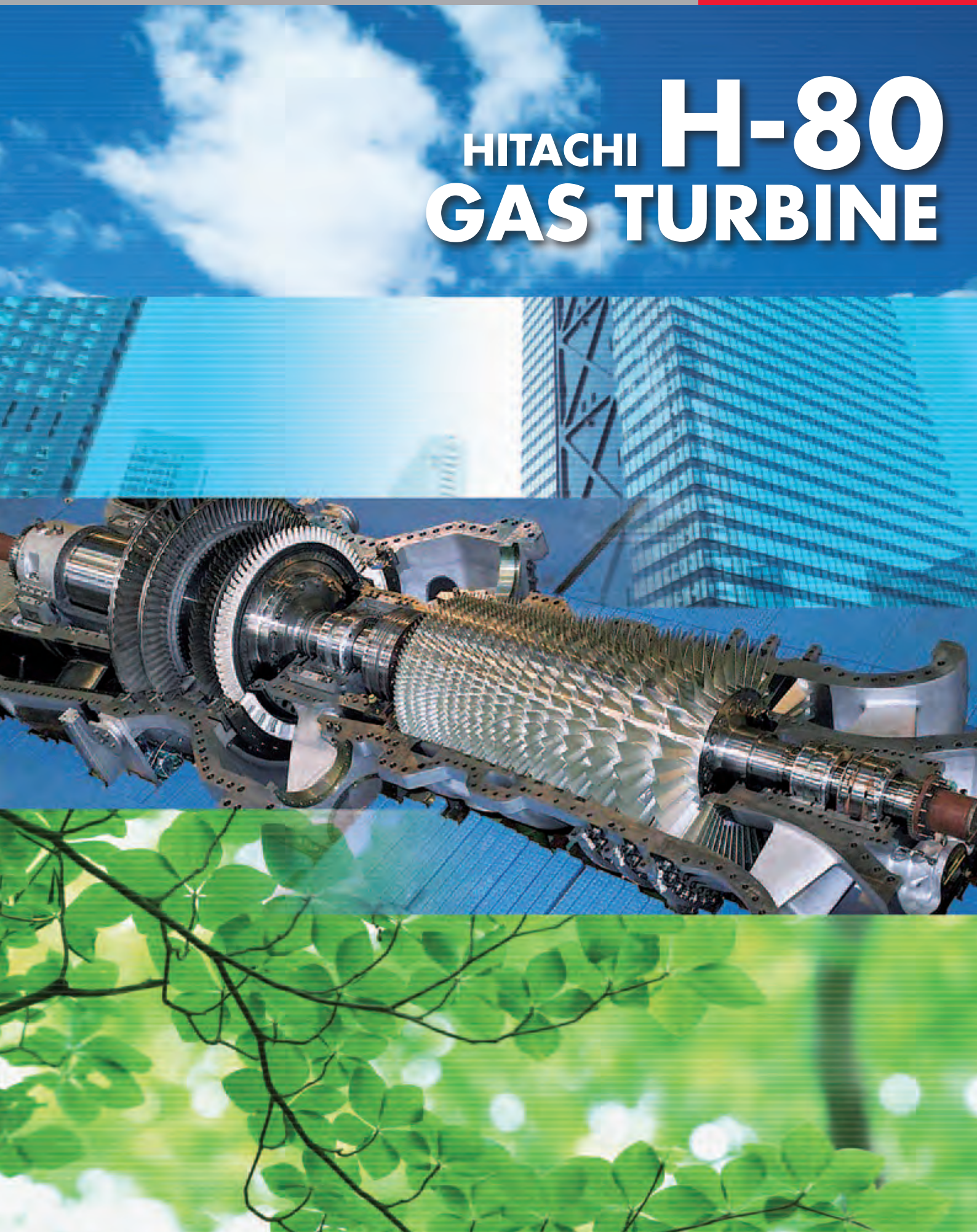
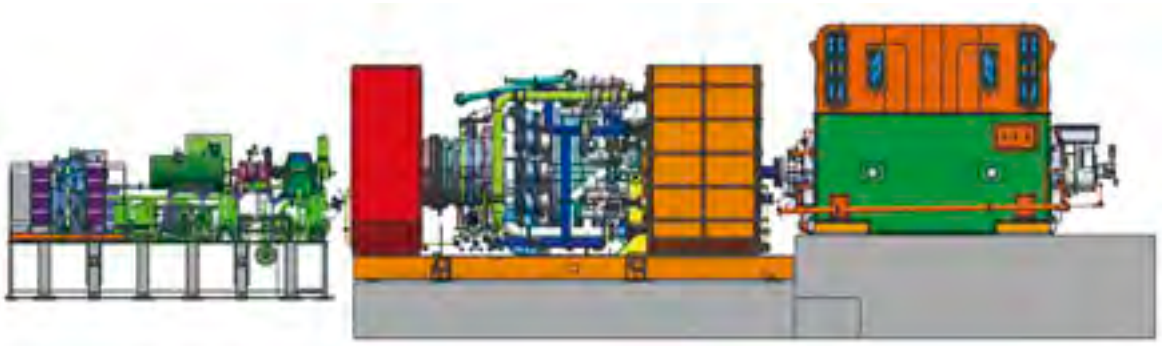
HITACHI H-80 GAS TURBINE



H-80 Gas Turbine
A Product of Hitachi Technology



Hitachi H-80 is a 100MW class, heavy duty, high efficiency gas turbine. The H-80 utilizes state of the art technology, based on Hitachi's proven track records which show superior quality and reliability.

The H-80 was specifically designed for middle sized power generation and large sized CHP plant. Suitable for numerous applications, including a 138MW class combined cycle power plant (1-1-1 configuration), 284MW class combined cycle power plant (2-2-1 configuration) or a CHP plant of 160 t/h level steam generation (6MPa/300deg.C), the H-80 incorporates efficiency, reliability and flexibility, together with low life cycle costs.

Whatever the application, Hitachi's renowned reputation for superior performance, together with outstanding reliability, and our ability to adapt to our customers needs, means customers are always assured of the optimum solution.

H-80 Gas Turbine

H-80 Package Lifting

H-80 on Trailer

Hitachi Works

Performance— Simple Cycle

H-80 Gas Turbine provides a high efficiency power plant for the middle sized power generation sector.

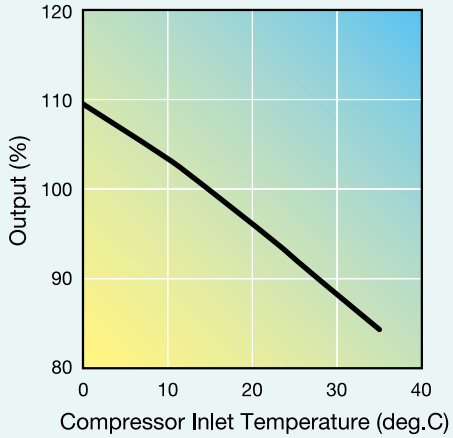
Performance - Simple Cycle

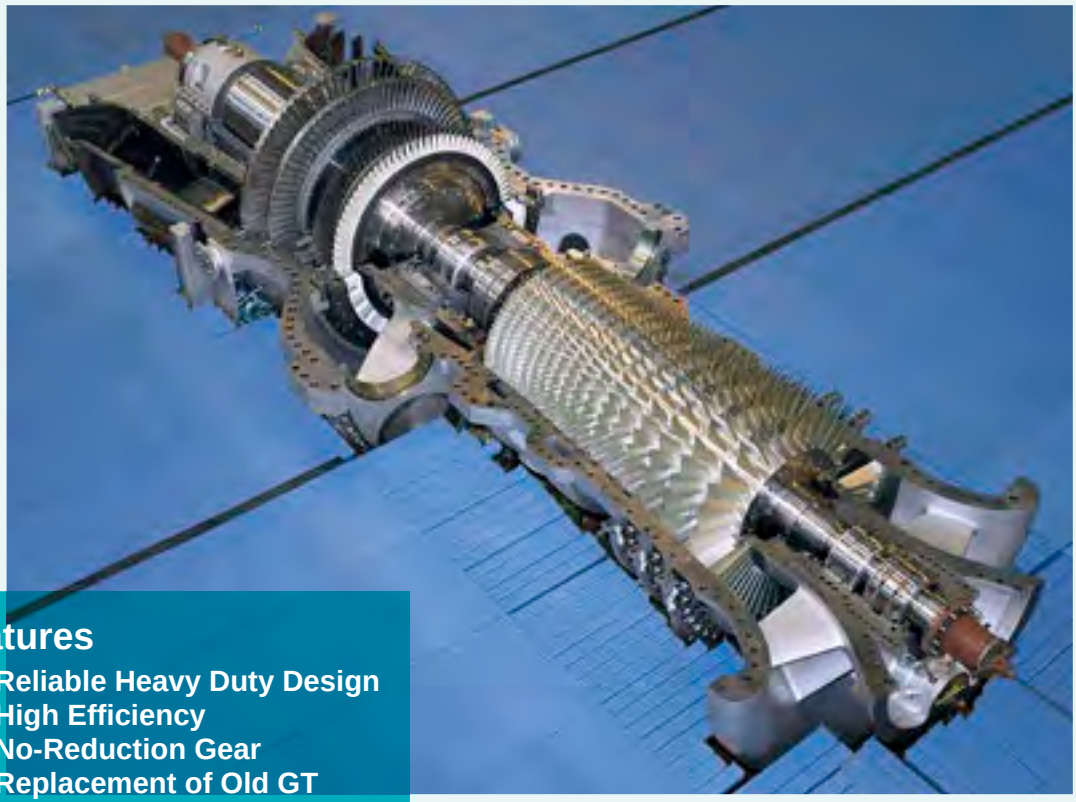
Item	Unit	Natural Gas	
		50Hz	60Hz
Output	MW	97.7	99.3
Efficiency	%(LHV)	**36.5**	**37.5**
Heat Rate	kJ/kWh	9,860	9,602
	Btu/kWh	9,345	9,100
Exhaust Flow	kg/s	289	285
Exhaust Temperature	deg.C	538	530
NOx Emission	ppm@15%O_2	25	25

ISO Condition (Ambient Temp. 15 deg.C)
Base Load
△Pin = 0 inch H_2O △Pout = 0 inch H_2O

Correction Curve

Effect of compressor inlet temperature on maximum output (Base load)





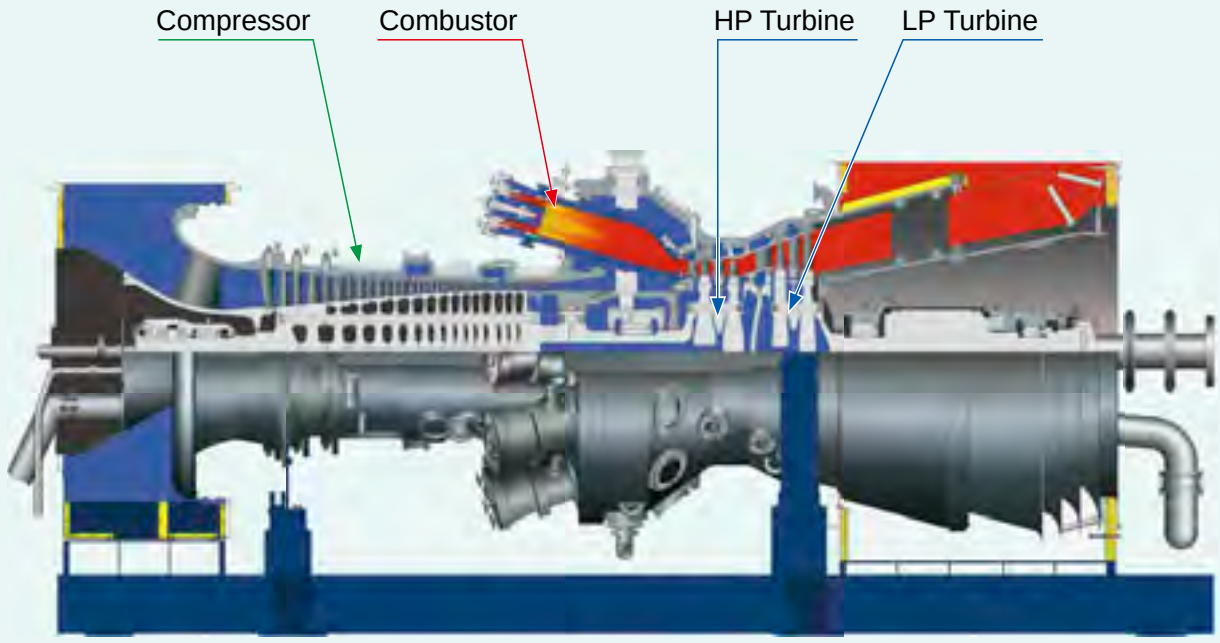
H-80 on Assembling

Features

- Reliable Heavy Duty Design
- High Efficiency
- No-Reduction Gear
- Replacement of Old GT
- On-Site Maintenance
- Package Installation

Specification— Features

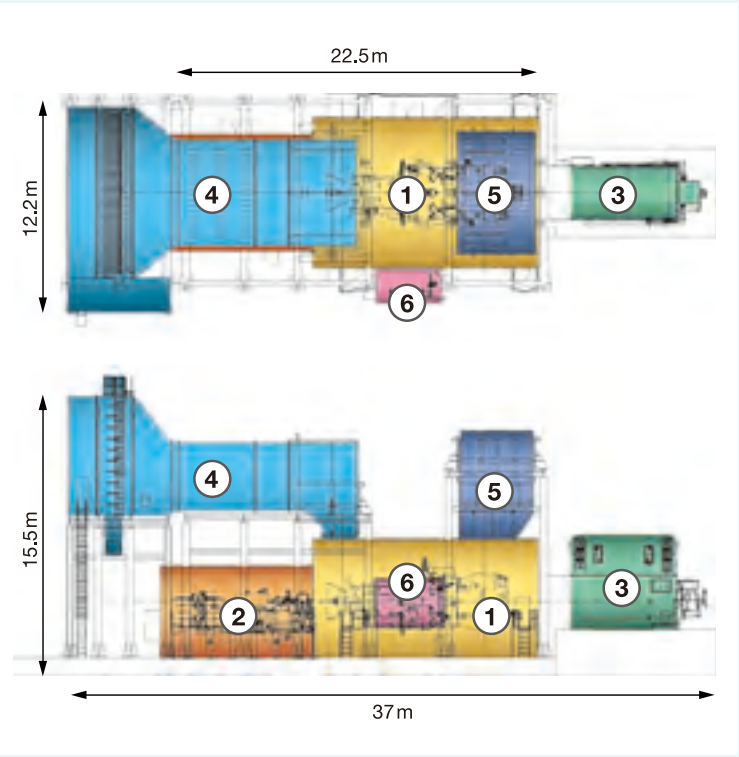
H-80 features a heavy duty gas turbine with two shaft configuration providing flexible power both for 50 and 60 Hz applications.



Item		Specification
Gas Turbine	Type	Heavy Duty, 2 Shafts
		Horizontal Split Casing
	Rotating Speed	HP Turbine & Compressor: 4,580 min^{-1} LP Turbine: 3,600 min^{-1} / 3,000 min^{-1}
Compressor	Type	17 Stages, Axial Type Pressure Ratio: 17
Turbine	Type	HP Turbine: 2 Stages LP Turbine: 2 Stages
	Cooling	Air Cooled 1st, 2nd & 3rd Stage Nozzle Air Cooled 1st & 2nd Stage Bucket
Combustor	Type	Reverse Flow Type
		Low NOx Type
		10 Cans

Package Design

Package design offers the following benefits ;
- Minimizes Site Installation Work and Period
- Easier Handling and Transportation
- Easier Assembly
- Economical and Delivery-time benefit to Customer

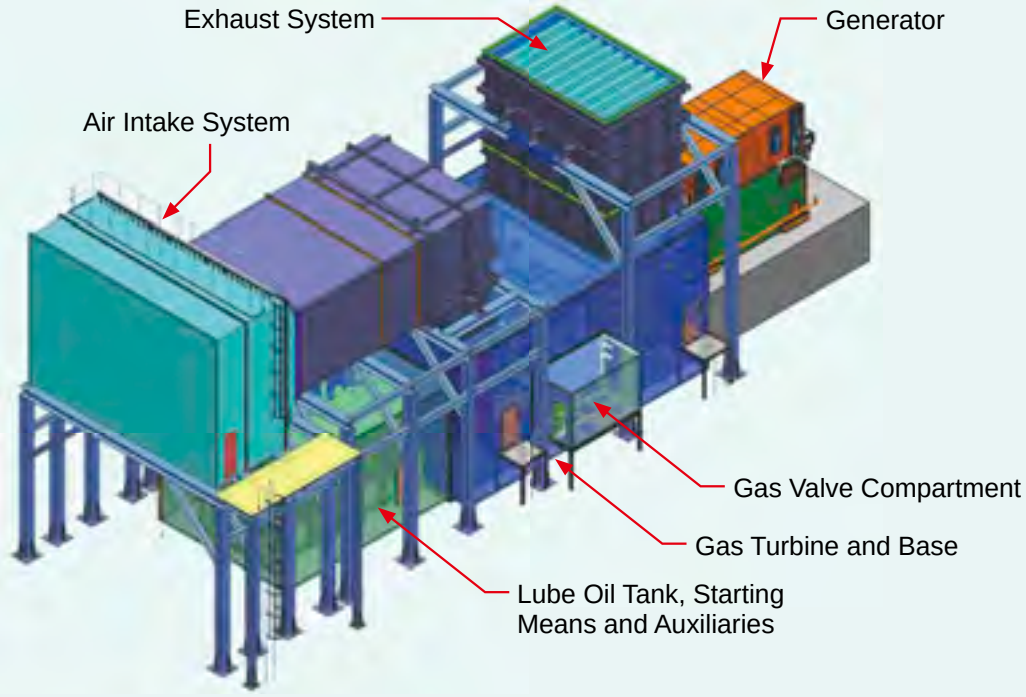


No.	Package	Weight
1	Gas Turbine and Base	165 t
2	Lube Oil Tank, Starting Means and Auxiliaries	40 t
3	Generator	195 t
4	Air Intake System	125 t
5	Exhaust System	33 t
6	Gas Valve Compartment	5 t

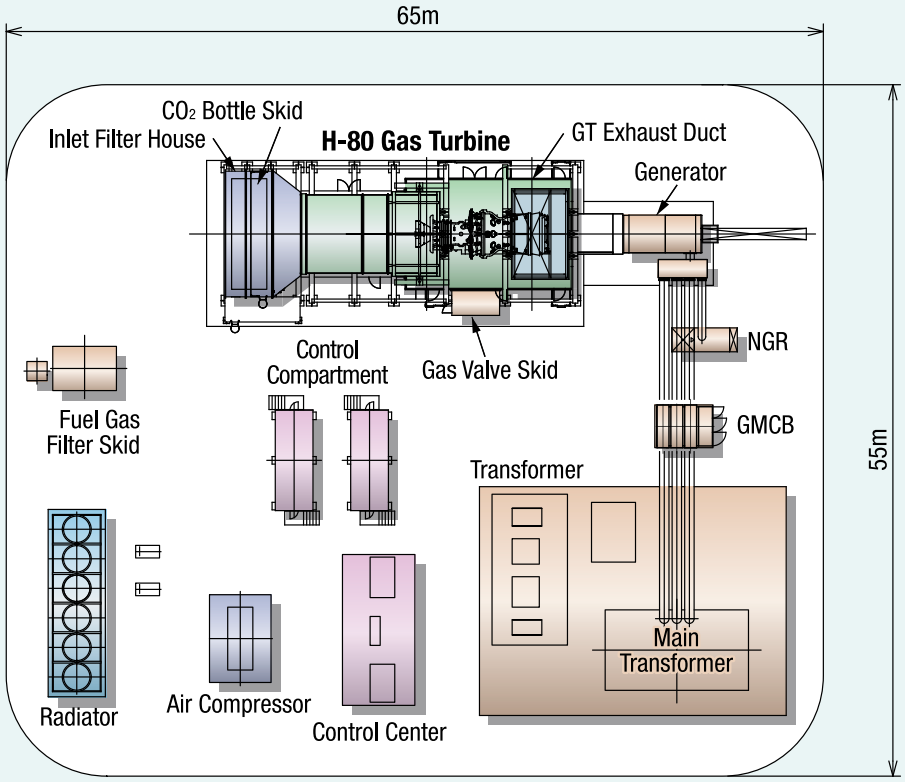
H-80 on Trailer

Application— Simple Cycle Power Plant

Simple Cycle Power Plant provides for larger power output under limited site premises conditions. Hitachi offers optimized site layout to meet customer's project requirement.



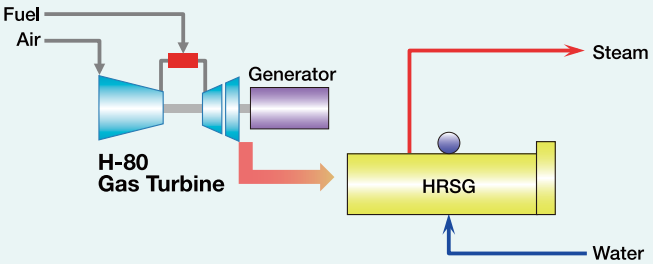
Typical Arrangement (Simple Cycle Power Plant)



Application— Cogeneration Power Plant

Cogeneration plant with H-80 gas turbine provides large capacity of steam production as well as high thermal efficiency of the heat and power generation.

System Configuration

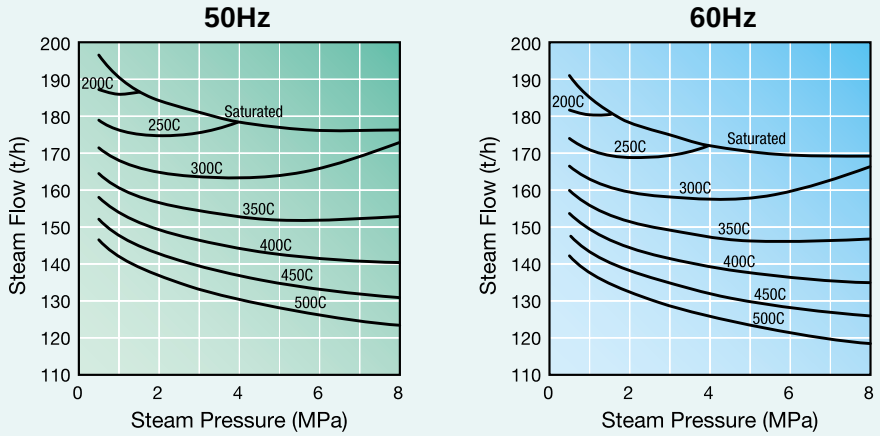


Typical Performance

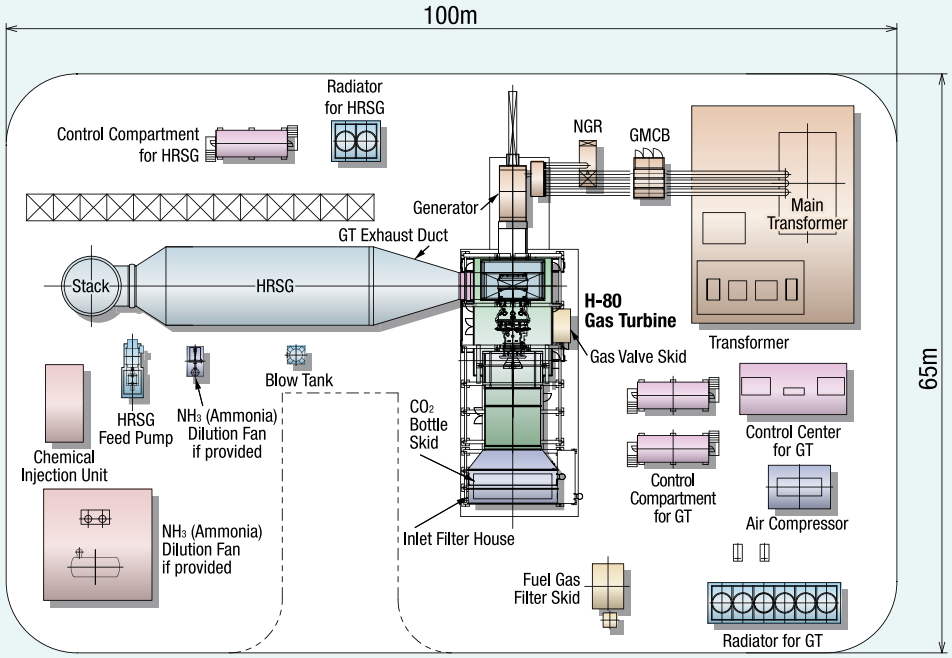
	50Hz	60Hz
Power Output	95.2 MW	96.5 MW
Heat Output (6 MPa/300 deg.C)	165 t/h	160 t/h
Overall Efficiency	More than 80% (LHV)	

ISO Condition (Ambient 15 deg.C)

Unfired Steam Production



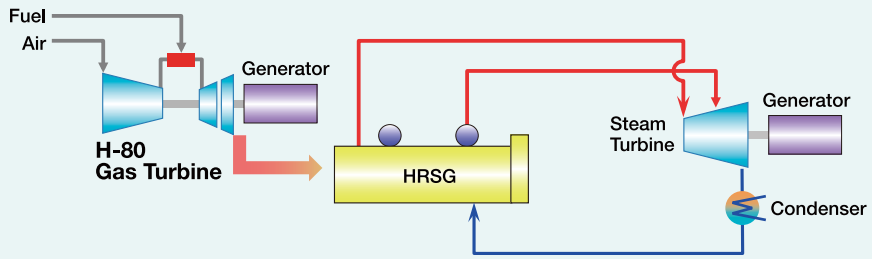
Typical Arrangement (Cogeneration Power Plant)



Application— Combined Cycle Power Plant (1-1-1)

The power plant of 1-1-1 configuration (one H-80 Gas Turbine, one Heat Recovery Steam Generator and one Steam Turbine) provides approximately 138 MW power output.

System Configuration

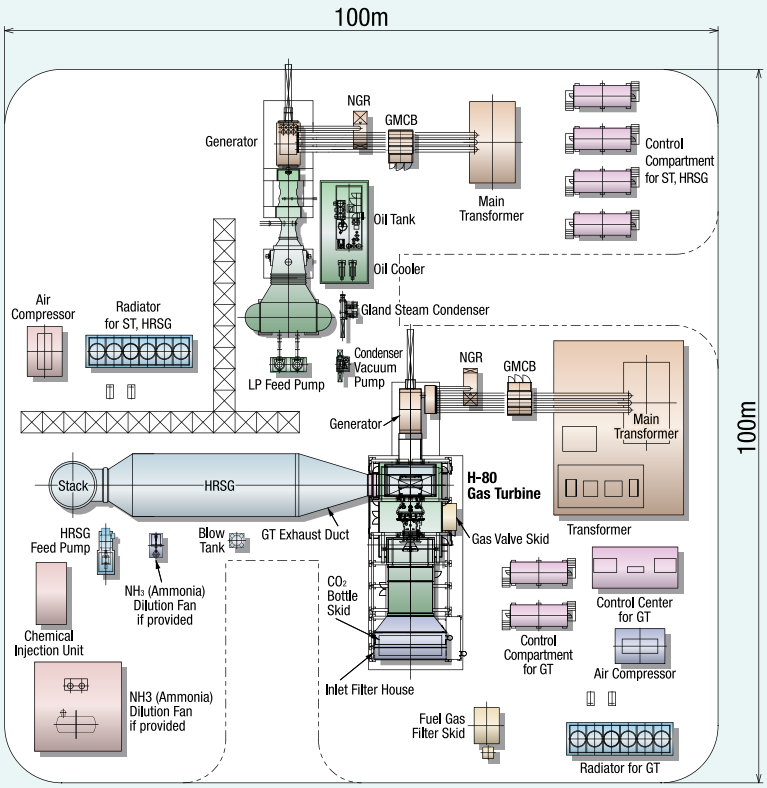


Typical Performance

	50Hz	60Hz
Total Plant Output	138.0 MW	137.9 MW
Gas Turbine Output	95.2 MW	96.5 MW
Steam Turbine Output	42.8 MW	41.4 MW
Gross Efficiency	**52.0 % (LHV)**	**52.5 % (LHV)**

ISO Condition (Ambient 15 deg.C)
Non-Reheat, Dual Pressure

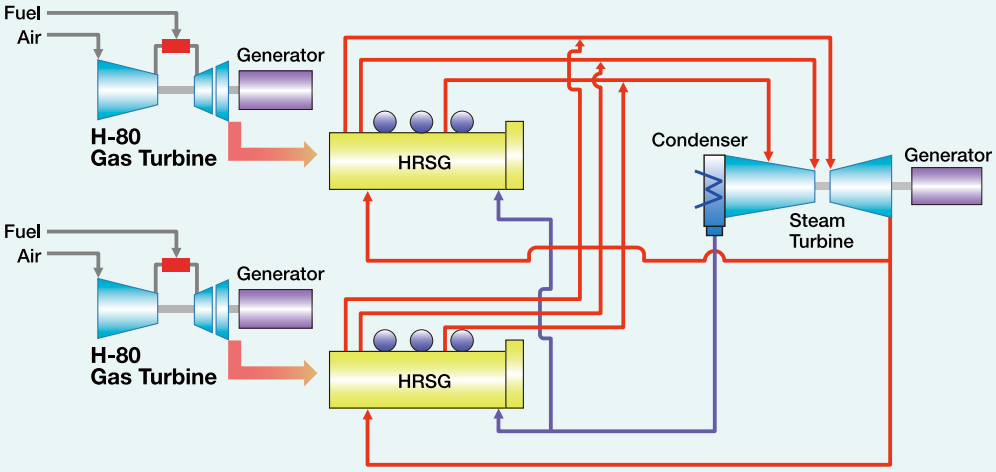
Typical Arrangement (Combined Cycle Power Plant)



Application— Combined Cycle Power Plant (2-2-1)

The power plant of 2-2-1 configuration (two H-80 Gas Turbines, two Heat Recovery Steam Generators and one Steam Turbine) provides approximately 284 MW power output.
This configuration gives operational flexibility to meet various power demands.

System Configuration

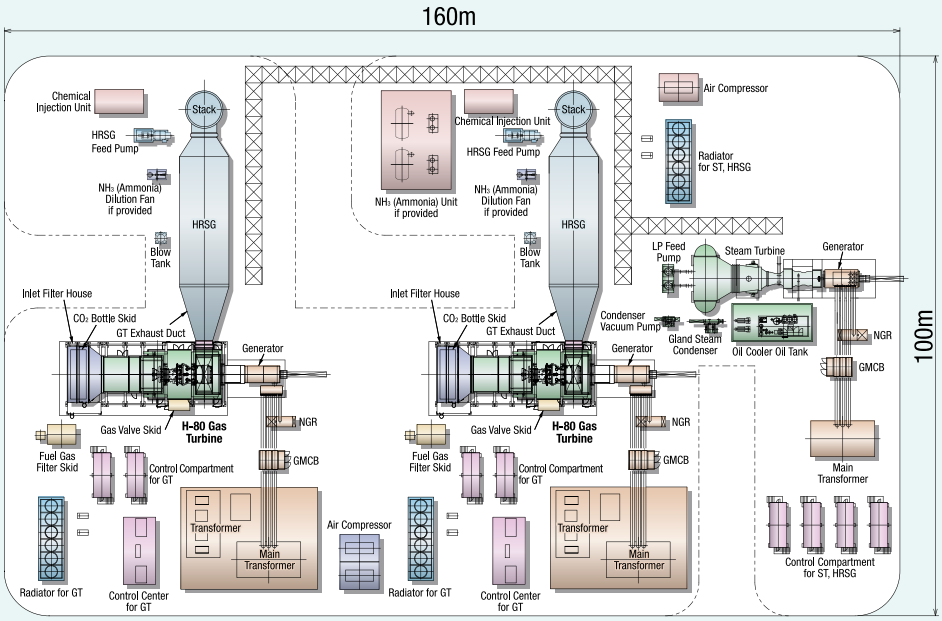


Typical Performance

	50Hz	60Hz
Total Plant Output	284.5 MW	284.1 MW
Gas Turbine Output	95.2 MW x 2 Units	96.5 MW x 2 Units
Steam Turbine Output	94.1 MW	91.1 MW
Gross Efficiency	**53.6 % (LHV)**	**54.1 % (LHV)**

ISO Condition (Ambient 15 deg.C)
Reheat, Triple Pressure

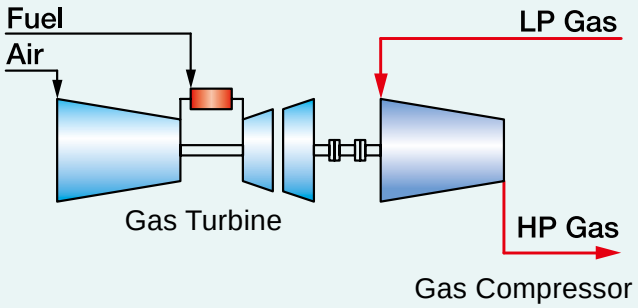
Typical Arrangement (Combined Cycle Power Plant)

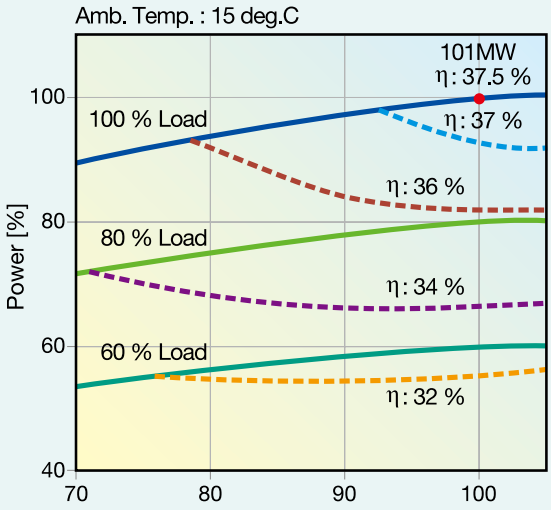


Application— Mechanical Drive

H-80 is also applicable for Mechanical Drive applications, especially compressor drive for large size of LNG Plant.

System Configuration

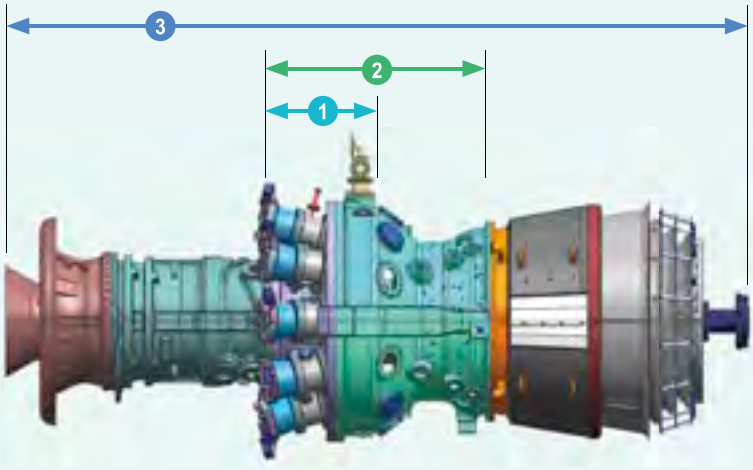




LP Turbine Speed [%] 100%=3,600 mm^{-1}

Periodical Shutdown Inspection

Heavy Duty Design as well as Horizontal split casing configuration enables on site maintenance.



Inspection Type	Typical Interval (h)*
1 **Combustion Inspection**	12,000 (Natural Gas fuel)
2 **Hot Gas Path Inspection**	24,000 (Natural Gas fuel)
3 **Major Inspection**	48,000 (Natural Gas fuel)

Note: 8000 hours/year continuous operation case

* Interval shall be subject to operating cycle and conditions, etc.

Hitachi Turbine Global Service

Hitachi H-Series Gas Turbines have been supplied to the middle size power generation sector throughout the world.

H-Series Gas Turbines

H-15		16.9 MW 34.3%
H-25		32.0 MW 34.8%
H-80		50Hz/60Hz 97.7/99.3 MW 36.5/37.5%

No. GKKP-12-120