# GENERAL LAYOUT OF FARIDABAD GAS POWER PLANT

# INTRODUCTION

- NTPC Faridabad's combined cycle gas power plant, a significant energy infrastructure project was completed in sept 1999.

- Located near village Mujedi & Neemka in Faridabad district of Haryana state.

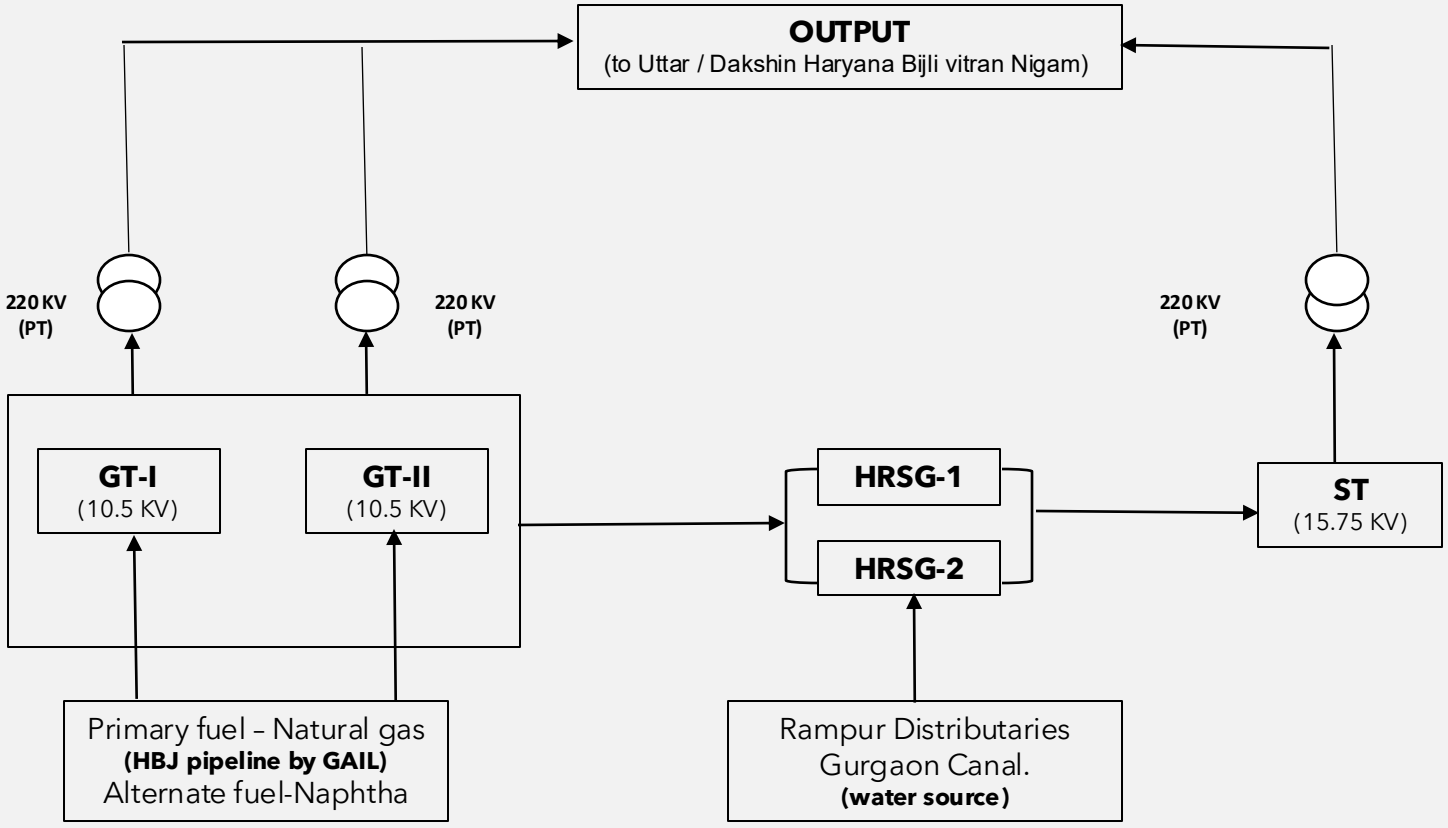
- Total installed capacity: 431.58 MW, with two Siemens V94.2 gas turbines (GT-I & II)-140.8 MW each and one steam turbine (ST-I) -149.9 MW.

- The water source for the Faridabad Power Plant is the Rampur Distributaries of the Gurgaon Canal.

- The main fuel is natural gas, which will be piped from the HBJ (Hajira–Bijaipur-Jagdishpur) pipeline by GAIL. Naphtha will be used as an alternate fuel.

- Quantity consumption rates in the plant.
  i. Natural gas: 6.79 kg/s
  ii. Naphtha: 6.58 kg/s
  iii. Water: 700 tonnes/hour/unit

# FGPP General layout



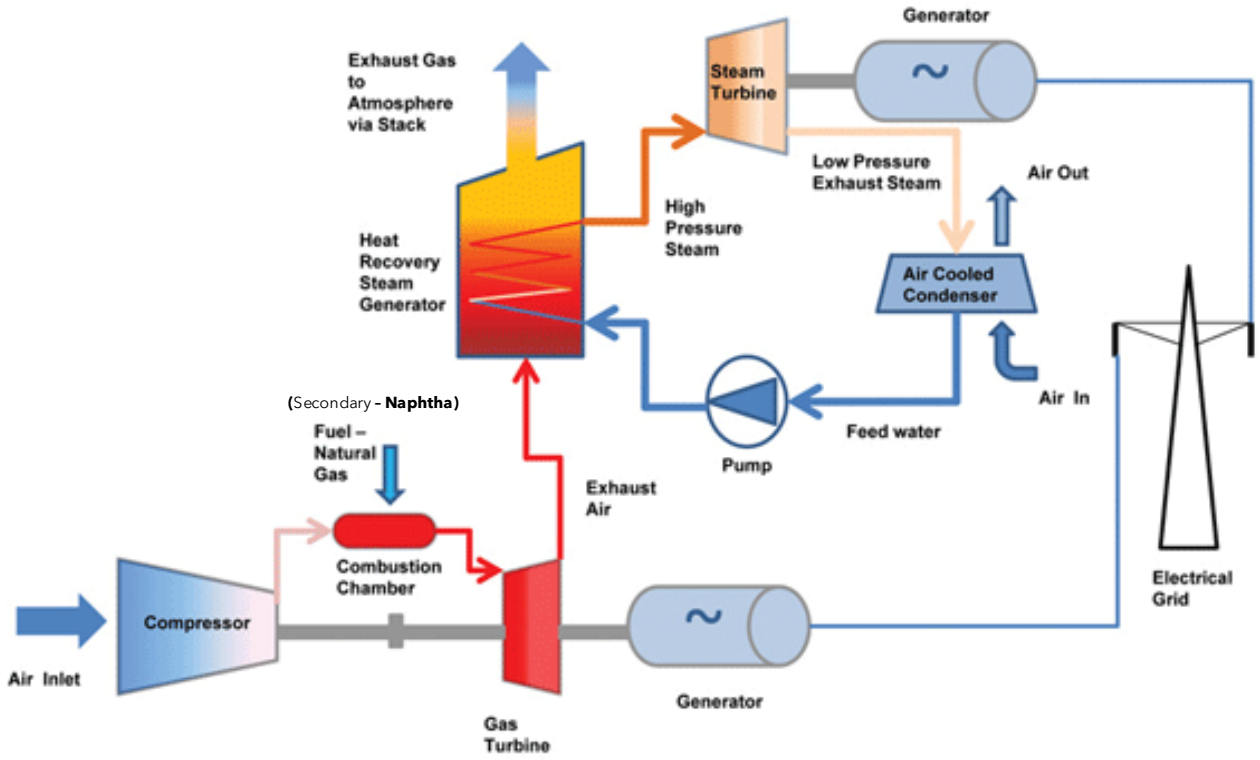

GT-I : Gas turbine –1
GT-II : Gas turbine –2
ST : Steam turbine
HRSG : Heat recovery steam generator.
PT : Power transformer

# OPERATIONAL DETAILS OF THE PLANT.

- The rated output is 135 MVA for the gas turbine (GT) and 191.6 MVA for the steam turbine (ST).
- The rated terminal voltage is 10.5 kV for the GT and 15.75 kV for the ST.
- The rated speed is 3000 rpm.
- The plant uses a closed-cycle water system for cooling.
- It features a black start facility with a 3.3 MW diesel generator operating at 2000 rpm.
- The mode of operation is peak load.
- The startup time for gas turbine take 15 to 20 min and for steam turbine 5 to 10 hrs to reach its rated power.

# COMBINED CYCLE GAS POWER PLANT

operates on both the Brayton cycle (gas turbine cycle) and the Rankine cycle (steam turbine cycle) to improve overall efficiency.



# WORKING OF COMBINED CYCLE GAS POWER GENERATION SYSTEM .

- Fuel is supplied to both turbines.
- Fuel is burned in the gas turbines, producing flue gases at high pressure and temperature that rotate the turbine shaft.
- This turbine shaft is directly connected to the shaft of the gas turbine generator, leading to power generation in two generators.
- The flue gases then flow through waste heat recovery steam generator (WHRSG), moving through super-heaters, evaporators, economizers, and condensate preheaters.
- Water circulating in these components absorbs heat from the flue gases and converts into high-pressure and low-pressure steam.
- The high-pressure steam generated in the WHRSG is sent to the steam turbine, while the low-pressure steam is directed to the LP turbine.
- The steam exiting the high-pressure turbine, along with the additional low-pressure steam from the WHRSG, is also supplied to the LP turbine.
- In these steps, the high-pressure and low-pressure turbines rotate as the steam flows through them.
- These rotors are connected to the rotors of the steam turbine generators by a rigid coupling. Therefore, as the turbine rotor rotates, the generator rotor also rotates, producing electricity at the generator.

# MECHANICAL CORE
## OF THE POWER PLANT.

The main generating unit comprises three primary components.

1. Gas Turbine
2. Heat Recovery Steam Generator
3. Steam Turbine

# GAS TURBINE

A gas turbine is a type of continuous flow internal combustion engine that converts the energy from a fuel into mechanical work through a process called the **Brayton cycle.** Atmospheric air flows through a compressor, increasing its pressure, then fuel is sprayed into the air and ignited, generating a high- temperature flow. This hot, pressurized gas then enters a turbine, producing shaft work output that drives the compressor and can be used to power various applications such as aircraft propulsion, electricity generation, or mechanical systems.

# HEAT RECOVERY STEAM GENERATOR

A heat recovery steam generator (HRSG) is a heat exchanger that recovers heat from a hot gas stream, such as a combustion turbine or other waste gas stream. It produces steam that can be used in a process (cogeneration) or used to drive a steam turbine (combined cycle).

## IT CONSIST OF FOUR MAJOR COMPONENTS :

1. Superheater
2. Evaporator
3. Economizer
4. Water Preheater

- **Superheater** dries the saturated vapor and may superheat it to a significant temperature for additional energy storage. It is typically placed in the path of the hottest gas and upstream of the evaporator.
- **Evaporator** converts water into steam. It heats water that falls from the steam drum and converts it into saturated steam, which is then forwarded to the superheater.
- **Economizer** preheats the feedwater before it enters Evaporator, increasing the efficiency of the HRSG by reducing heat loss.
- **Water Preheater** serves as an initial heater for water that is pumped from the condenser before entering the feedwater tanks

# STEAM TURBINE

A steam turbine is an external combustion engine that uses high-pressure steam from a boiler to spin turbine blades, converting thermal energy into mechanical work. The steam expands in the turbine, generating shaft work for electricity generation, mechanical drives, or propulsion. After expansion, steam is condensed and recycled in the Rankine cycle.

# Thank you.

Sincere thanks to -

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