SNS COLLEGE OF TECHNOLOGY

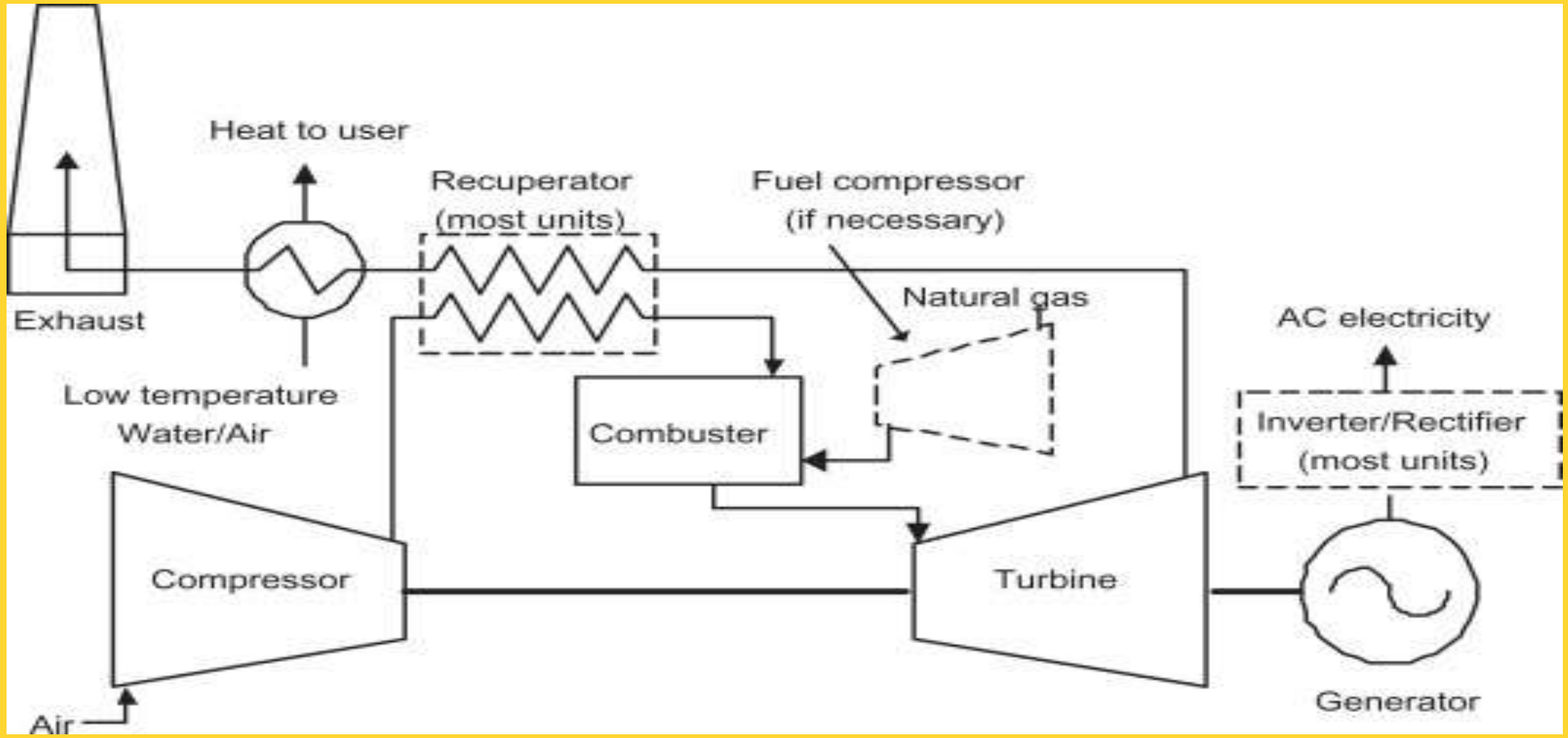
(An Autonomous Institution)

UNIT-III- Micro Turbines

Micro Turbines

An MT is a mechanism that uses the flow of a gas to convert thermal energy into mechanical energy. The technology used in the MT is derived from diesel engine turbochargers, aircraft auxiliary power systems, and automotive designs. MTs consist of a compressor, combustor, turbine, and generator, as shown in Fig. The combustible (usually gas) is mixed in the combustion chamber with air, which is pumped by the compressor. This product makes the turbine rotate, which, at the same time, impulses the generator and the compressor. In the most commonly used design, the compressor and turbine are mounted above the same shaft of the electric generator. The compressors and turbines resemble automotive engine turbochargers, which are typically radial-flow designs. Most of the designs are single-shaft and use a high-speed permanent magnet generator for producing variable frequency and variable voltage AC power.

Micro Turbines

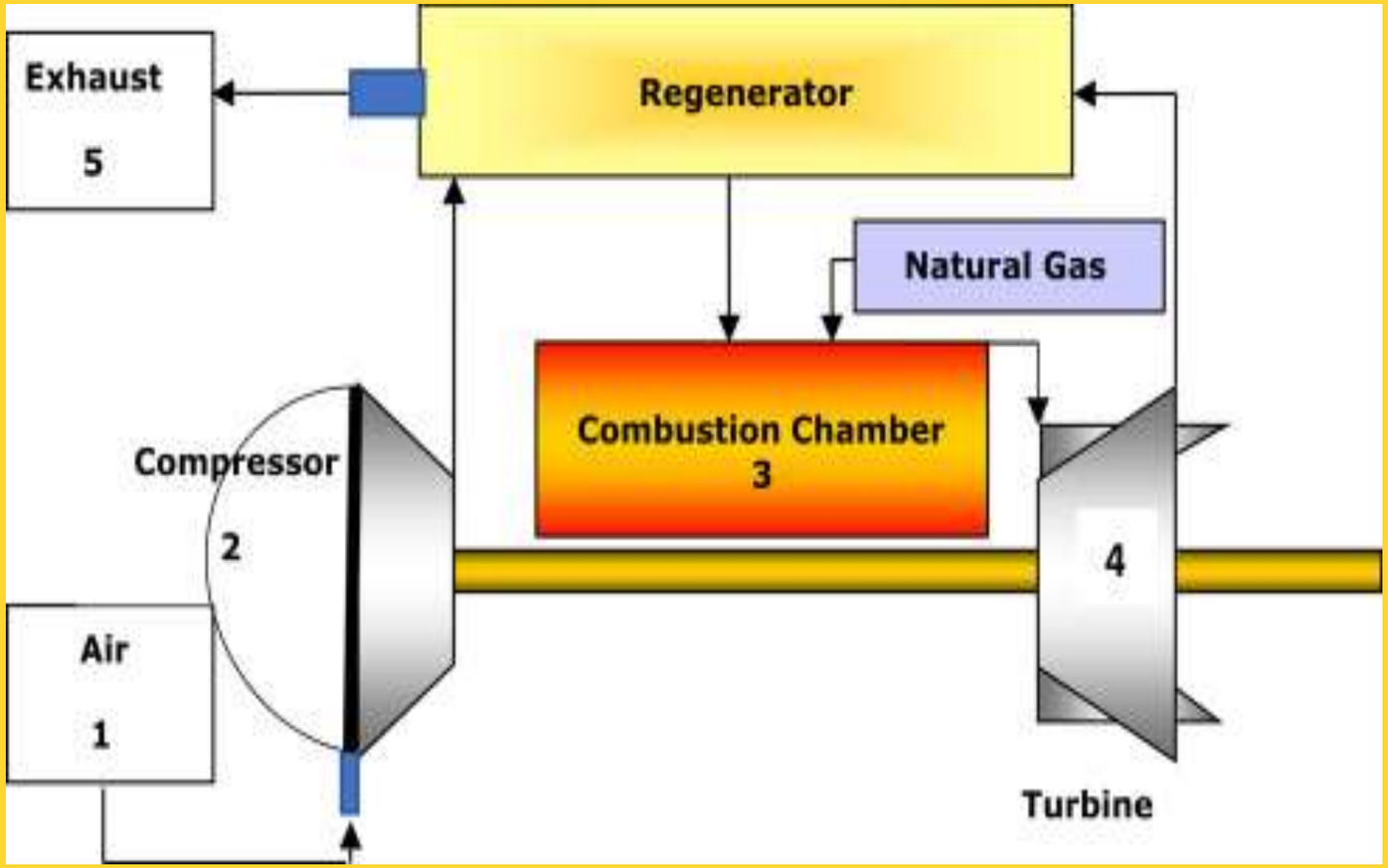


Micro Turbines

A PEI (inverter/rectifier) is employed to produce 50/60 Hz AC or DC power. Most MT units are designed currently for continuous-duty operation and are recuperated to obtain higher electrical efficiencies. Moreover, MTs offer clean operation with low emissions and good efficiency. However, the costs to maintain them are high. MT design is the same as any other type of gas turbine. However, the efficiency of MT is much higher than a gas turbine. In fact, some MTs can reuse the exhaust heat to preheat air used in the combustion chamber. The output power can range from 30 kW to or more than 500 kW. Having said that, in spite of a number of benefits from the usage of MT, the costs are higher than the usage cost of reciprocating engines.

There are different models of MT designed to use different types of fuels. These fuels can range from natural gas to propane. There are also other types of models that can use biofuels, such as gases produced from landfills (e.g., Methane), and fuels produced from animal waste and/or sewage processing plants. In general, microturbine is a turbine engine with an added generator and electric power in a compact scaled-down size is shown in Fig.

Schematic diagram of the Micro-gas turbine using natural gas



Micro Turbines

The microturbine has a number of advantages compared to other types of DG technologies. MT applications: Cogeneration, peak shaving, base-load power, remote power, premium power, and shaft drive.
There are a number of issues which can delay the expansion of MT: Cost of individual generators in relation to average rural cost, i.e., affordability; additional cost such as utility tariff; financing; grid connectivity; market acceptance; future electric utility regulations and policies

Application and Advantages

Applications:

•**Distributed Power Generation:** Micro turbines are often used for distributed power generation in places where a small amount of power is needed, such as remote locations or backup power systems for buildings.

•**Combined Heat and Power (CHP) Systems:** Micro turbines can be part of CHP systems where they generate both electricity and useful heat for heating water or buildings.

•**Transportation:** Micro turbines have been explored for use in hybrid electric vehicles and as range extenders in electric vehicles, though this application is not as common as other uses.

Advantages:

•**Efficiency:** Micro turbines can be highly efficient, especially when used in CHP systems where waste heat is utilized.

•**Low Emissions:** They generally produce lower emissions compared to traditional internal combustion engines.

Reliability: Due to their simple design, micro turbines can be reliable with low maintenance requirements.

Challenges:

•**Cost:** Micro turbines can be expensive to manufacture and install, which can be a barrier to their widespread adoption.

•**Noise and Vibration:** Despite being smaller than traditional turbines, micro turbines can still produce significant noise and vibration.

•**Limited Efficiency at Partial Load:** They might not be as efficient at partial load as larger turbines, which can be a drawback in certain applications.

THANK YOU