Microturbines

Small and high – speed power plants

Experimental microturbines go back to the 1940s. But it is only in recent years that there has been sustained interest in power applications. Several microturbine generator (MTG) manufactures are now announcing commercial availability of their products, targeting end-users, utilities, and energy service providers.

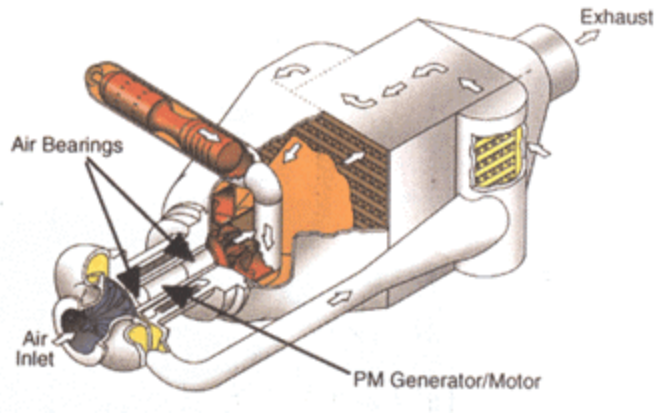
MTGs are small, high-speed power plants that usually include the turbine, compressor, generator, and power electronics to deliver power to the gird. They typically operate on natural gas. Future units may have the potential to use diesel and lower energy fuels such as gas produced from landfill or digester gas.

Most MTG designs have a high-speed gas turbine engine driving an integral electrical generator that produces 20-100 kWe power while operating at high speed, generally in the range 50,000-120,000 rpm.

Most MTG engine designs typically have one or several power-producing sections, which include the turbine, compressor and generator on a single shaft. Other designs offer two shafts. During operation, engine air is drawn into the unit and passes through the recuperator where the temperature is increased by hot exhaust gas. The air flows into the combustor where it is mixed with fuel, ignited and burned. The ignitor is used only during start-up, and then the flame is self-sustaining.

The combusted gas passes through the turbine nozzle and turbine wheel, converting the thermal energy of the hot expanding gases to rotating mechanical energy. The turbine drives the compressor and generator. The gas exhausting from the turbine is directed back through the recuperator, and then out the stack.

To be competitive with existing technology, most MTG manufacturers rely on enhanced reliability and lower maintenance costs. MTG manufacturers expect to achieve greater reliability and lower costs by using fewer moving parts and lower manufacturing costs. Manufacturers thus expect economy of manufacturing of microturbines to replace the economies of scale of central plants.



Using the turbo-charger technology, the cost of producing an MTG can be progressively lowered – depending on the manufactures expertise in achieving economies of manufacturing and particularly if casting can be used instead of machining.

Manufacturers realise that with an adequate volume of sales, relying on low cost economics of manufacturing, MTGs have a stronger potential to compete at the meter with large central power plants. Additionally, on-site power may be able to pick off other markets within niches to provide for future product development.

MTGs are intended to provide the energy industry with dispersed power generation assets that may be located close to the loads they serve. For utilities, interest in MTGs is based on deferred central power plant construction, deferred distribution line upgrades, and improved reliability. End-use customers may view MTGs as an alternative to other small generators, an environmentally acceptable power generation device, and a reliability improvement mechanism.

There is speculation that MTGs may be an integral part of the future utility infrastructure. This envisages numerous small generators scattered throughout a utility's traditional distribution network working parallel to central power plants. Some believe this will emulate what personal computers and local area networks did by working parallel to mainframes.

If current technology proves itself, the next hurdles relate to applications such as power quality, stand-by power, and peak shaving. In the longer term, there is the possibility, of a hybrid combination of MTGs with other technologies such as fuel cells. The fuel cell supplants the combustor on the MTG, while the MTG can be used to pressurise the fuel cell. In such a combination, efficiency is expected to be as much as 60 per cent and emissions less than 1.0 ppm No_x with less-then-detectable So_x and other target pollutants (sulphur compounds are removed from the fuel prior to use).

Reference book:
Power Line Volume 4 No. 4
January 2000