

Energy Saving opportunities and Applications of AARP

1 Utilization of Low Cost steam from Turbine exhaust in Biomass / Solid fuel based Cogeneration Plants.

It is an important waste heat utilization equipment in biomass coal based cogeneration plants (a market that is growing at tremendous pace especially due to Green energy and sustainable development initiatives). In Biomass and solid fuel based cogeneration plants, (working on High Pressure Boiler + Steam turbine based rankine cycle) low pressure steam from steam turbine exhaust is used for running AARP for refrigeration. This way it improves / efficiency of the system. Refrigeration temperature less than -50°C is possible.

2 Use of AARP in Gas / Liquid fuel based Captive Cogeneration Plants.

Waste heat utilization using AARP greatly improves Cogeneration Systems efficiency from typically 30 to 45% to 70 to 90%.

2.1 Utilization of heat rejected (wasteheat) from Reciprocating engine or Gas turbine to produce refrigeration using AARP is done in following ways.

- Exhaust gas of Reciprocating engine genset is typically in the temperature range of
 - HFO Engine Genset - 325°C
 - Gas Engine Genset - 350°C to 600°C .
 - HSD Engine Genset - 350°C to 550°C .

This heat is recovered and used to drive AARP which can give refrigeration down to -55°C .

- Engine Jacket hot water heat is used to drive hot water driven AARP. The typical temperature range of this hot water is 80°C to 121°C (above 100°C , it is called ebullient cooling). The AARP running on this hot water gives $+3^{\circ}\text{C}$ to -10°C temperature.

2.2 The heat from Exhaust of Gas Turbine is recovered to drive the AARP. The typical temperature of Exhaust Gas range from 450°C to 550°C and AARP can give refrigeration upto -55°C .

3 Use of AARP in Independent Power Plants.

In the Power Plants generating power for supply to grid, waste heat generated from exhaust (from engines or gas turbines) which is recovered and used to produce refrigeration which can be used for ice production, or for driving cold storages etc. Therefore AARP opens up opportunities for additional revenue generation and improves returns from power plants.

Over and above power generation it also helps to sell power at more competitive tariff. This improves financial viability of power plants.

4 Applications of AARP - Gas turbine inlet air cooling.

It reduces net CO₂ emissions.

It is well known that output and efficiency of Gas turbines is highly sensitive to inlet combustion air temperature. Following are typical outputs and efficiencies.

Gas Turbine combustion Air Inlet Temperature	Gas Turbine efficiency %	Power output from Gas Turbine
0°C	31	100%
15°C	30	90%
30°C	29	79%
45°C	27	70%

Various methods are therefore used for cooling inlet air temperatures e.g.

- 1) Water fog based evaporative cooling,
- 2) Water cooled LiBr Absorption Chiller based cooling.
- 3) Air cooled AARP based cooling.

In areas where water is not available, air cooled AARP working on exhaust heat of Gas turbine is an automatic choice and an ideal solution for gas turbine inlet air cooling.

5 Biomass / Solid Fuel based / Low cost steam heat driven AARP.

Due increasing cost of petroleum fuels, majority of Indian process industries are rapidly shifting their focus towards steam generation on Agrofuels / coal to bring down cost of steam generation.

Having reduced steam cost steam driven AARP becomes the next logical energy conservation stage which eliminates electricity driven energy consuming Refrigeration Compressors.

6 AARP Saves Water

The unique and most exclusive technical feature of AARP is, it can be on air cooled system. This is great boon for water starved counties. No other absorption technology has this advantage.

Therefore, worldwide and particularly in India AARP has very large potential.