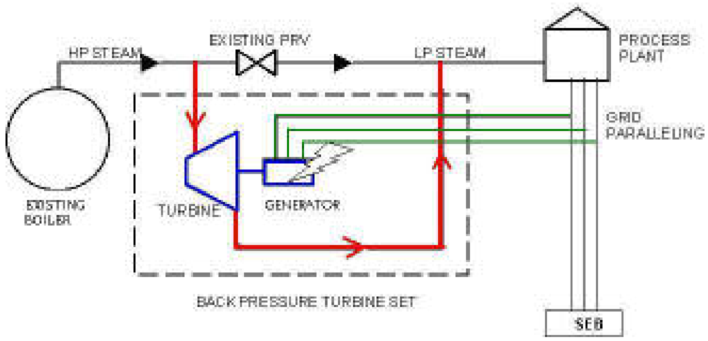
Concept of Incidental Power Generation using Steam Turbine

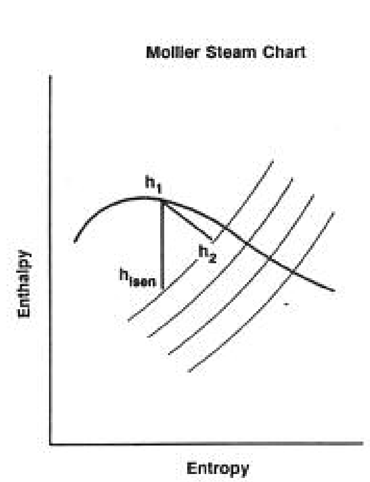


Simple Description

Back pressure steam turbines are used for incidental energy generation or cogeneration – simultaneous generation of thermal energy and electrical energy from a single primary energy source. Industries using steam for heating applications generally require steam at moderate to low pressures. In most of the industries the boiler pressure is higher than the process pressure and Pressure Reducing Valves (PRVs) are used to reduce the steam pressure from the boiler pressure to the process pressure. Back Pressure Steam Turbines are used in parallel with the PRVs to generate electrical power using the steam pressure difference across the PRV. The amount of power that can be generated depends on the inlet pressure, outlet pressure and the quantity of steam flowing through the Turbine. If the difference between the existing boiler pressure and the process pressure is not sufficient to generate power with economic feasibility, the existing boiler can be replaced with a higher pressure boiler. With rising power costs, the investment gets paid back in a very short period of time, in most cases less than a year.

Detailed Technical Description

Back Pressure Steam Turbine utilizes the pressure difference between the boiler pressure and the process pressure, more specifically enthalpy difference, to generate electrical power.



Ideal back pressure steam turbine process is an isentropic process. That is, the steam pressure is reduced without changing the entropy. This pressure drop is called isentropic drop. This is an Ideal Process and cannot be achieved in practice owing to the thermodynamic process limitations. Thus the actual process in a back pressure steam turbine follows the path h_1 to h_2, instead of ideal isentropic path h_1 to h_{iso}. The point h_2 on the Mollier Chart depends on the adiabatic efficiency of the steam turbine. The power generated from a back pressure steam turbine can be calculated in simple terms as below

Shaft Power = Isentropic Enthalpy Drop (h_1 - h_{iso}) X Turbine Efficiency
(…converted to power units)

Net Electrical Power Generated**
= Shaft Power X Gearbox Efficiency X Generator Efficiency

**Above calculations are for reference only. Actual power generation possible from a set of steam conditions is calculated considering various other losses and factors.

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