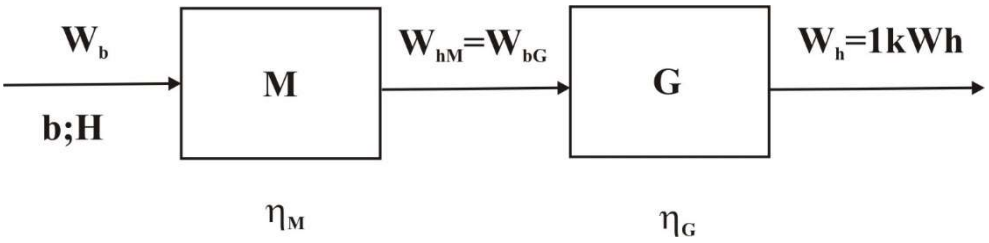
<u>Problem 1</u>: Efficiency of an aggregate

A gas engine drives a generator, that has an efficiency of 96%. The fuel consumption of the engine is 0.4 m^3 gas with heating value 31MJ/m^3 for 1 kWh electricity production.

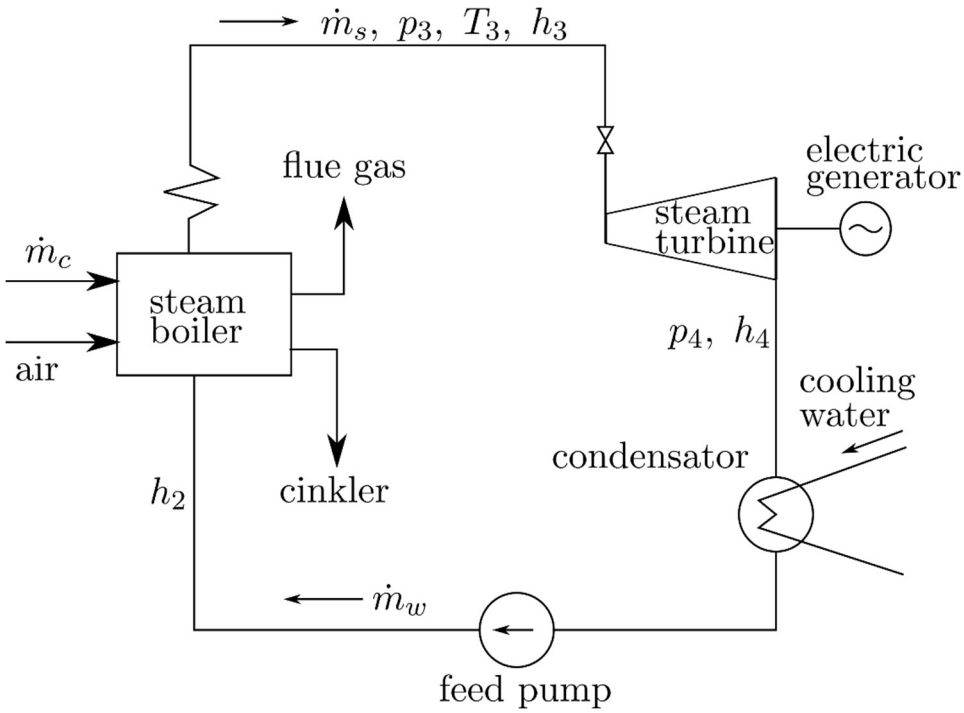
a) **Find the specific heat consumption of the <u>aggregate</u>!**
b) **Find the specific heat consumption of the <u>gas engine</u>!**
c) **Find the efficiency of the <u>gas engine</u>!**
d) **Find the efficiency of the <u>aggregate</u>!**



<u>Problem 2</u>: Thermal power plant

The figure shows a simplified circuit diagram of a thermal power plant. The useful power and the efficiency of the generator are 50 MW and 97%, respectively. The efficiency of the steam turbine driving the generator is 87%. The pressure, temperature and enthalpy of the fresh steam are p_2=110 bar, t_2= 500°C, and i_2=3370 kJ/kg. The pressure in the condenser is p_3=0.04 bar, and the enthalpy of the steam is i_3=2180 kJ/kg.

a) **Find the steam needed to achieve the given generator power!**
b) **Find the coal consumption per hour, if the efficiency of the boiler is 80%, the enthalpy of the feed water is i_1=125 kJ/kg, and the heating value of the coal is 20 MJ/kg.**
c) **Depict the power Sankey diagram of the circuit!**
d) **Find the overall efficiency of the power plant!**



<u>Problem 4:</u> Through-flow-type boiler

Find the power loss (P'=?) of an electric through-flow-type boiler, if the temperature of the inlet water is T_1=14.2 °C, the constant temperature of the outlet water is T_{const}=30.1°C, and the electric heating power is P_{el}=1811 W. The volume flow rate was measured by a volume metering tank: the measured volume was V_{MT}= 940 ml and the measuring time was t_{MT}= 35.9 s. Assume the density ρ_W=1000 kg/m^3 and the specific heat c_W=4187 J/kg°C of the water constant and independent of temperature. How much would be the temperature increase of the water, if the boiler operated without power loss?