UNENE Graduate Course
Reactor Thermal-Hydraulics Design and Analysis
McMaster University
Whitby
March 19-21, April 23-25, May 2, 2004

Thermal Efficiency

Dr Nik Popov

Thermal Efficiency – Inlet Pressure

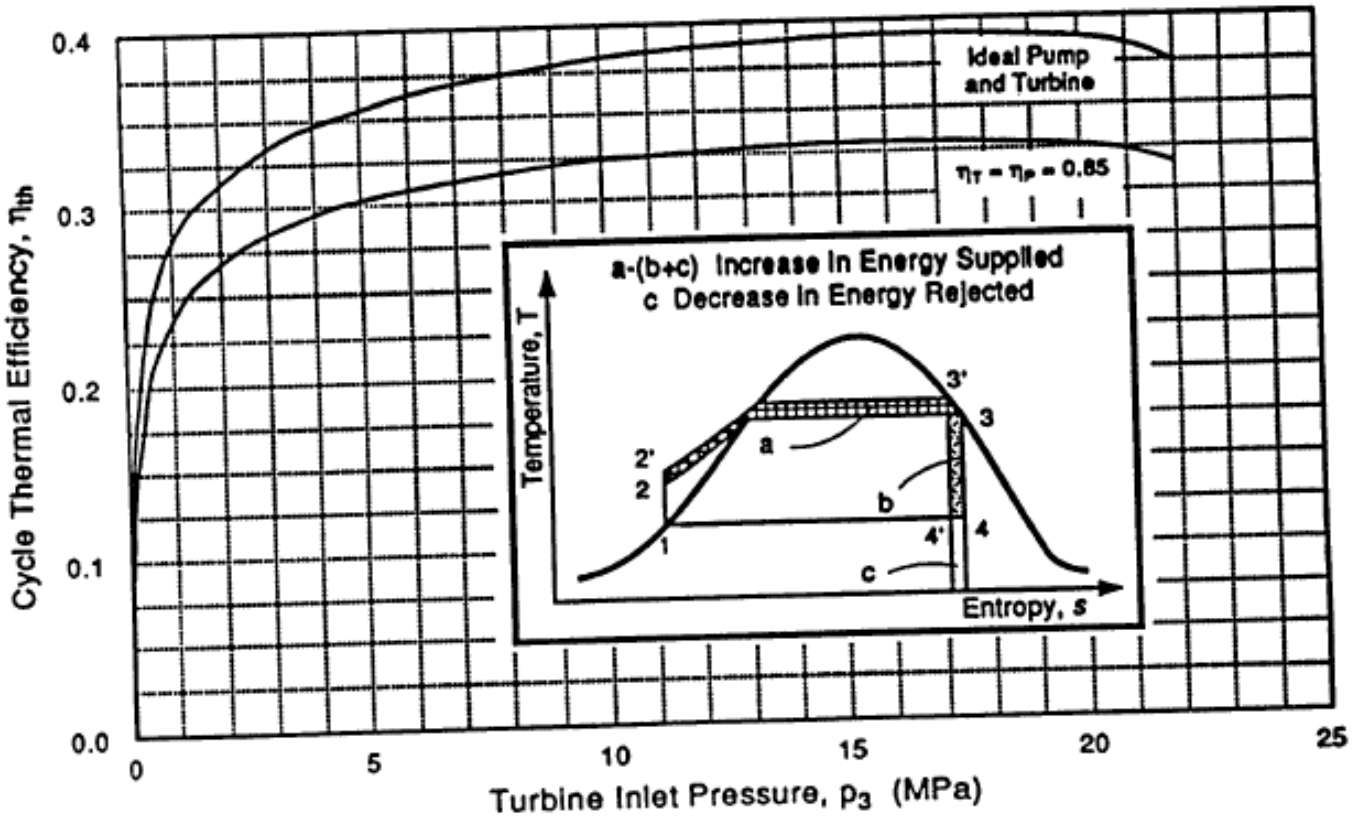


Figure 6-13 Thermal efficiency of Rankine cycle using saturated steam for varying turbine inlet pressure. Turbine inlet: saturated vapor. Exhaust pressure: 7kPa.

Thermal Efficiency – Outlet Pressure

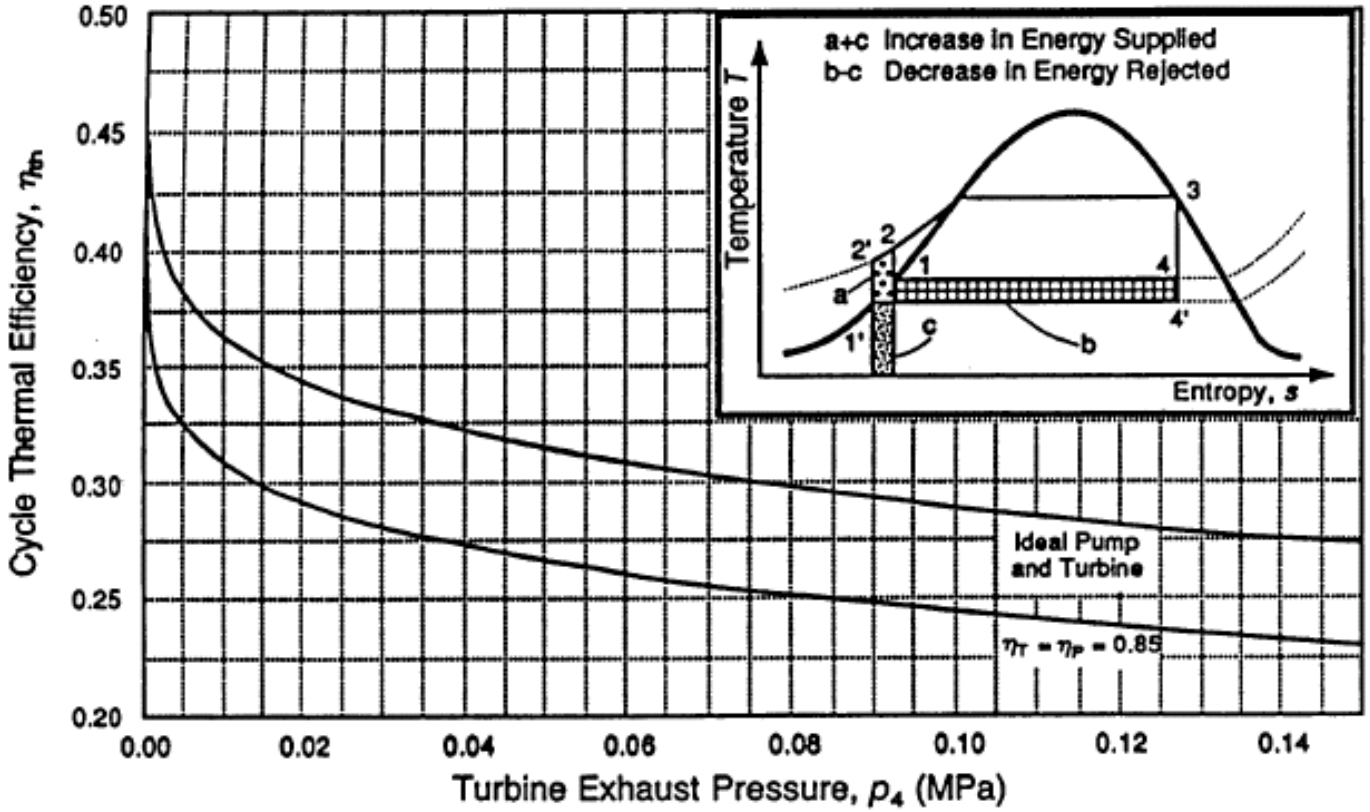
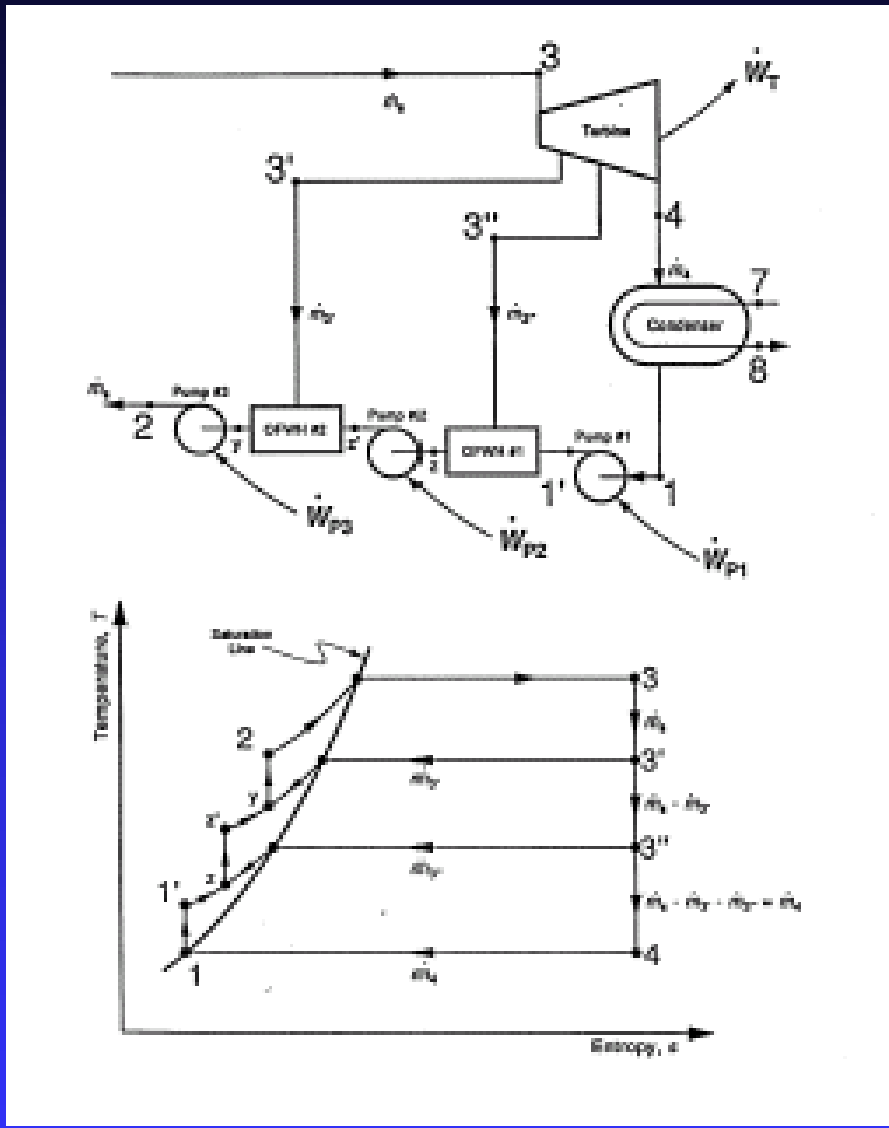


Figure 6-14 Thermal efficiency of Rankine cycle for a saturated turbine inlet state for varying turbine outlet pressure. Turbine inlet: 7.8 MPa saturated vapor.

Thermal Efficiency – Open Configuration



Thermal Efficiency – Open Configuration

OPEN FEED WATER HEATERS

$$W_T = \dot{m}_5 (h_5 - h_6) + (\dot{m}_5 - \dot{m}_3)(h_3 - h_{3'}) + \dot{m}_4 (h_{3'} - h_4)$$

$$h_2 = \frac{\dot{m}_{3'} h_{3'} + \dot{m}_4 h_{4'}}{\dot{m}_{3'} + \dot{m}_4} = \frac{\dot{m}_{3'} h_{3'} + \dot{m}_4 h_{4'}}{\dot{m}_5 - \dot{m}_{3'}}$$

$$h_7 = \frac{\dot{m}_{3'} h_{3'} + (\dot{m}_5 - \dot{m}_{3'}) h_{2'}}{\dot{m}_5}$$

Thermal Efficiency – Closed Configuration

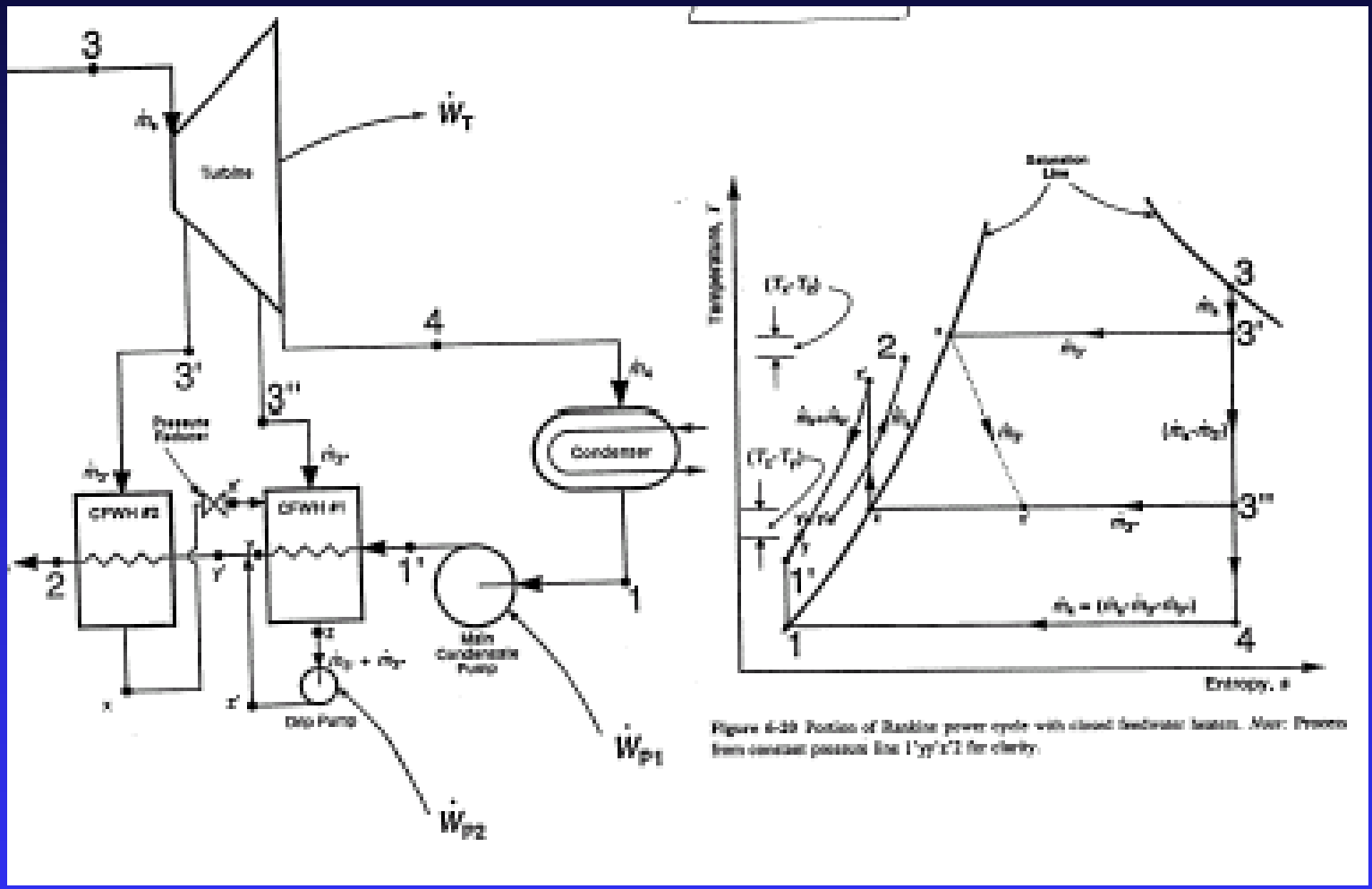
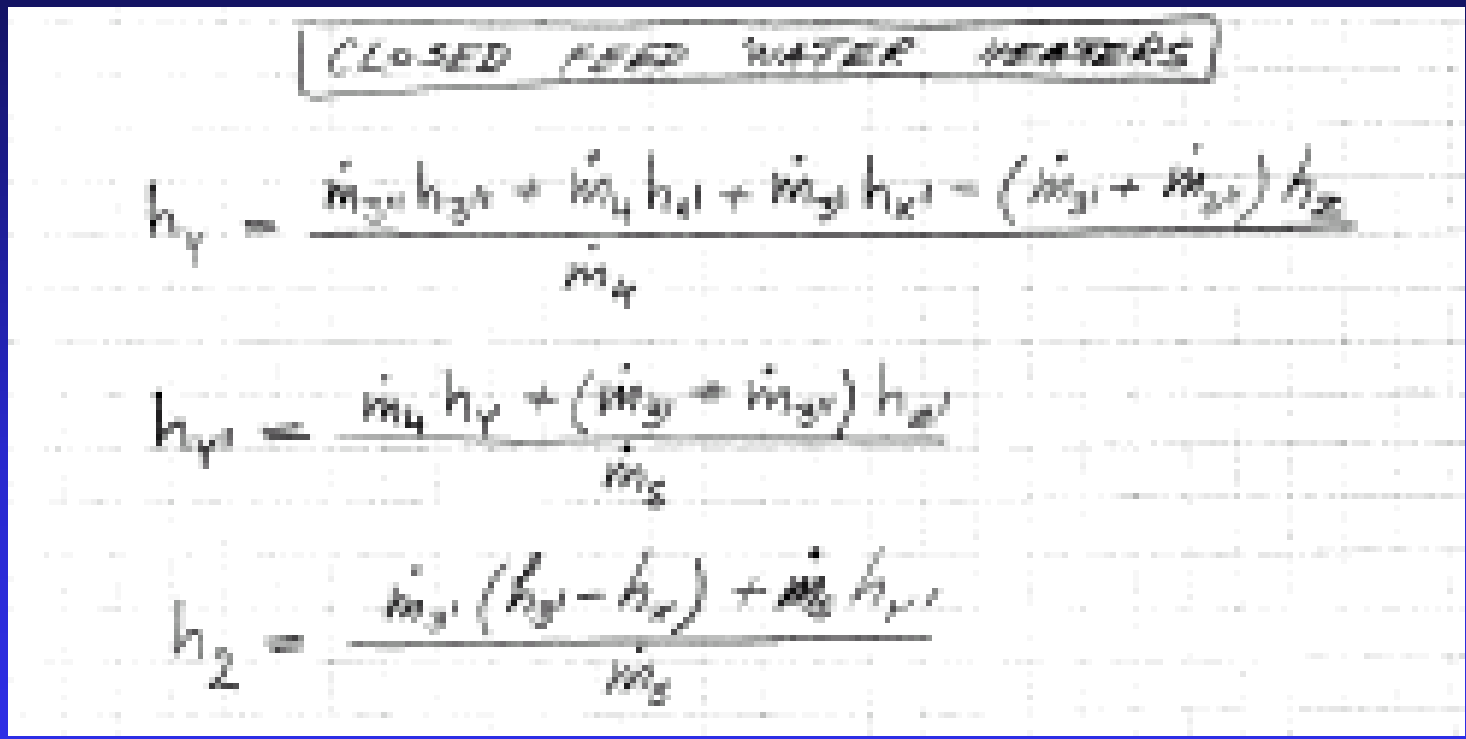
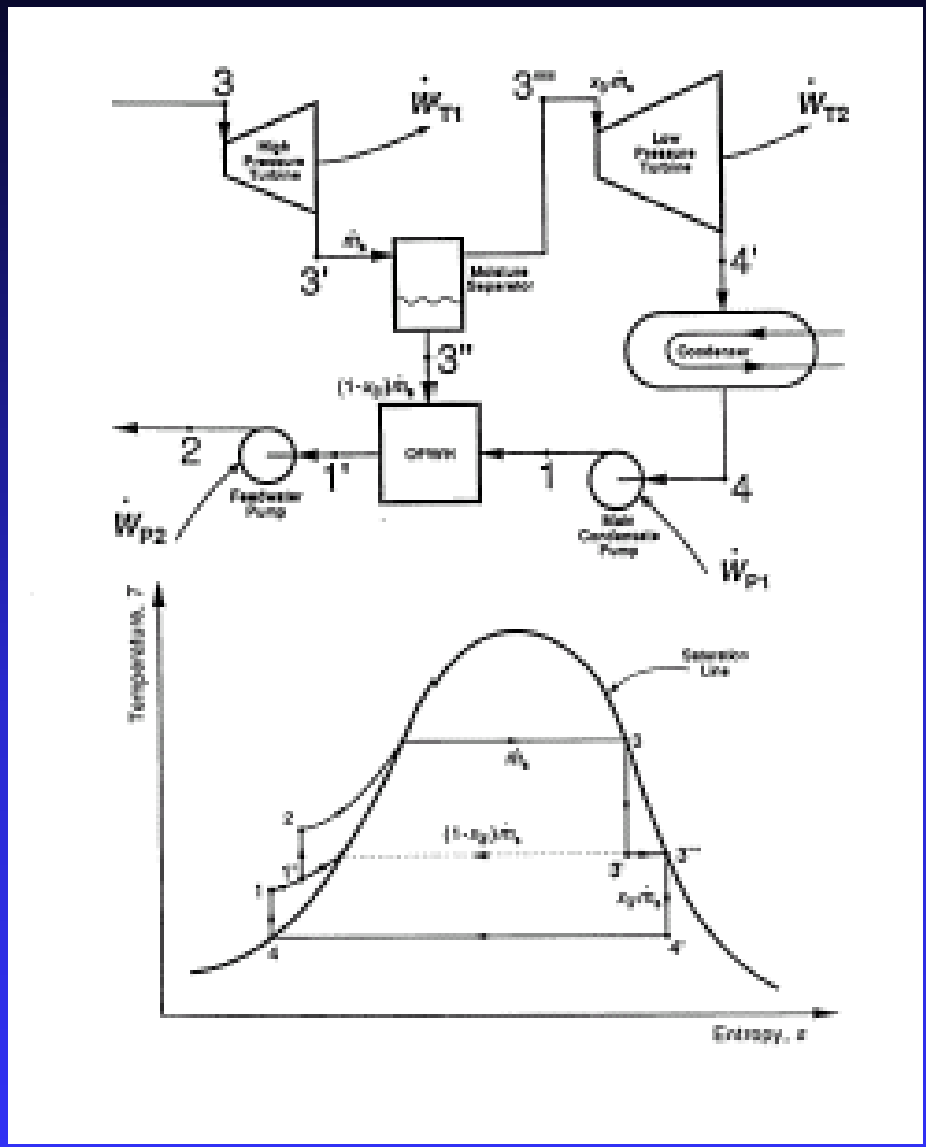


Figure 4-20 Portion of Rankine power cycle with closed feedwater heaters. Note: Process lines constant pressure line 1'yy'x'2 for clarity.

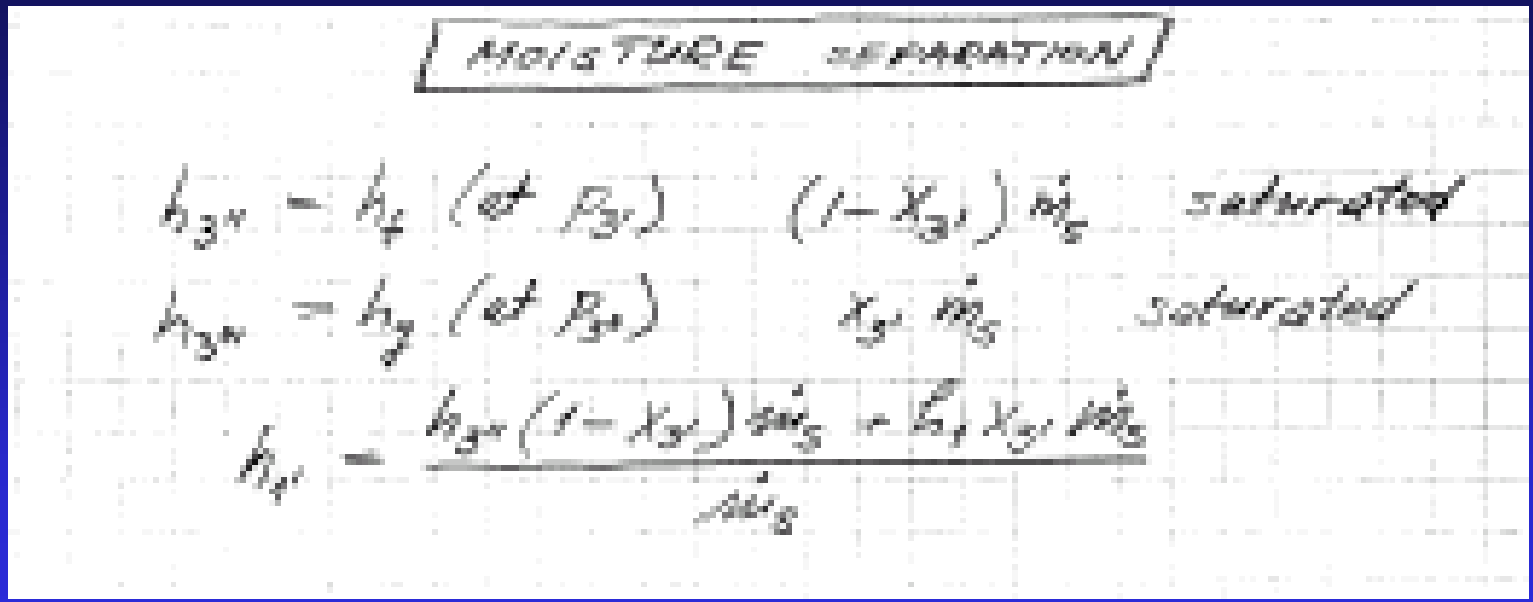
Thermal Efficiency – Closed Configuration



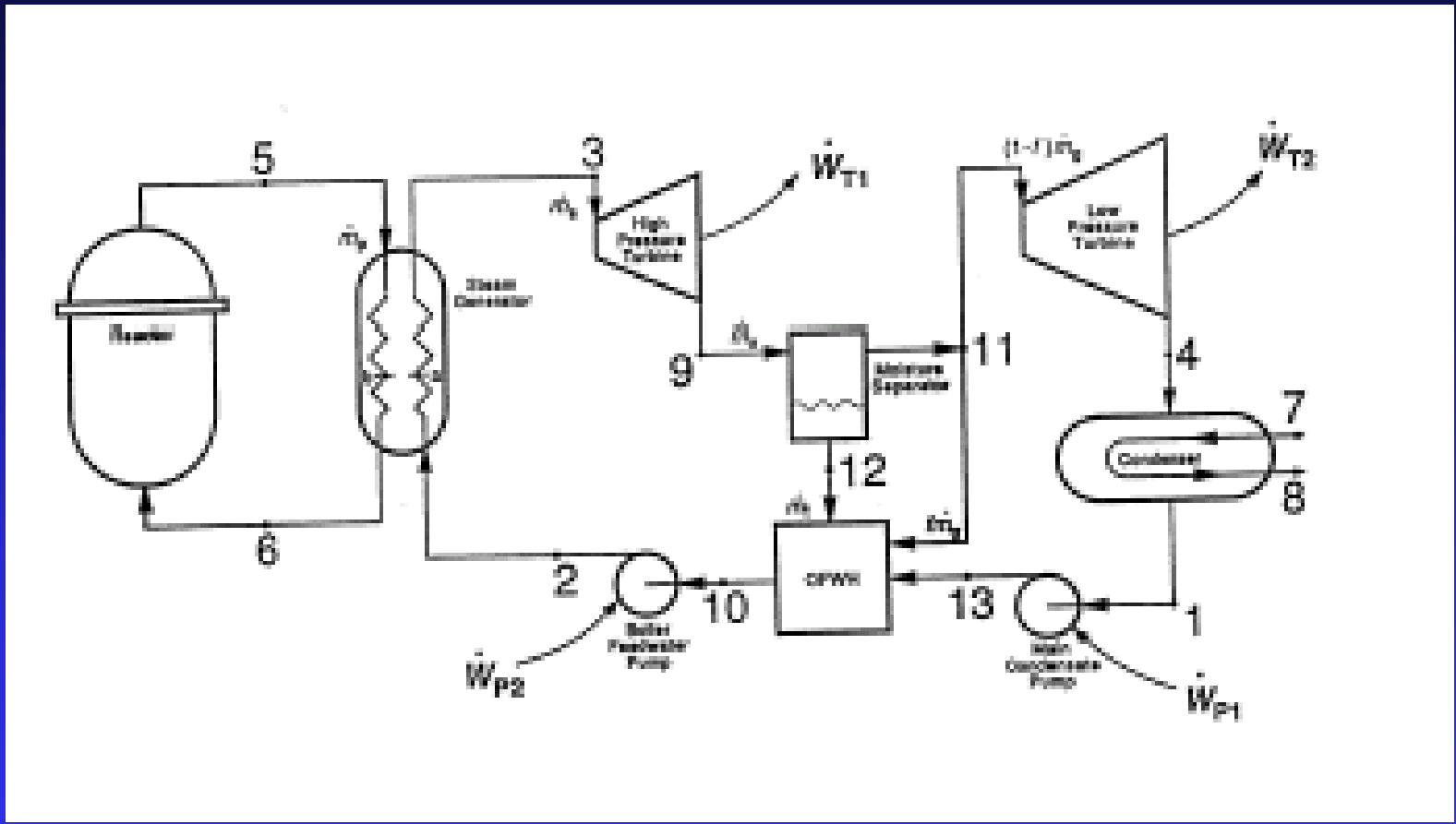
Thermal Efficiency – Moisture Separation



Thermal Efficiency – Open Configuration



Thermal Efficiency – Simple PWR



Thermal Efficiency – CANDU 6