PROBLEM 2 (20 POINTS):

Hanz is a small undersaturated oil reservoir satellite to the Ivar Aasen platform. The initial reservoir pressure is 250 bara. The reservoir will be developed using two producers, a subsea station with a multiphase booster and a pipeline connected to the platform. The pressure drop in the flowline from the subsea station to the platform can be assumed constant, and therefore, it can be considered that the pressure at the discharge of the subsea station has a constant value of 120 bara, regardless of the produced rates.
The temperature of the fluid at the inlet of the subsea station is 70 C.
Reservoir pressure will be maintained constant using water injection. Therefore, the GOR remains constant and equal to 150 Sm3/Sm3. For the years analyzed in this task there is no water breakthrough yet, thus the producing water cut is zero.
The curve of available pressure versus oil rate of the complete system upstream the subsea station (wells, inflow, tubing and manifold) can be approximated with the following expression[1] (in Sm3/d):

$$q_{\bar{o}} = 5200 \cdot \left(1 - 0.4 \cdot \left(\frac{p_{temp}}{200}\right) - 0.6 \cdot \left(\frac{p_{temp}}{200}\right)^2\right)\left(-40 \cdot \left(\frac{N_p}{50E6}\right)^3 + 25 \cdot \left(\frac{N_p}{50E6}\right)^2 - 6 \cdot \frac{N_p}{50E6} + 1\right)$$

Note that this expression depends on the cumulative production at time "t" N_p (in Sm3) and the inlet pressure to the subsea station (p_{temp}, in bara) at time "t".
The subsea station has two components, a choke, and a multiphase booster, and both can be used to control production. If the equilibrium rate is higher than the desired rate, then choking is used. If the equilibrium rate is lower than the desired rate then the multiphase booster is used.

Task. 1. The reservoir team has provided a target production profile for a period of 5 years. Your task is to find the choke pressure drop or the booster pressure increase necessary to produce these rates.

Task. 2. If a booster is needed for any of the years, estimate the maximum boosting power needed.

Comments:

- Use the rectangle integration method to estimate oil cumulative production, assuming that the rate from the previous year remains constant during the following year.
- Instead of reading the value from a chart, the isentropic enthalpy difference for a fluid with GOR = 150 Sm^3/Sm^3 and inlet temperature of 70 C, can be estimated with the VBA function provided "Deltah_s". The input pressure differential should be positive. This equation outputs in kJ/kg.

[1] Available in the Excel file provided as a VBA function «qo_available"