Exercise in Prosper and GAP, TPG4230, Milan Stanko, 20170309.

1. **Subsea oil well modeling in Prosper**

Fluid information:

Use the black oil correlation of Glasø (p_b, R_s, B_o) and Beal (viscosity) to model your PVT behavior.

Solution GOR = 142 Sm^3/Sm3	Formation Water salinity = 23000 ppm
Producing GOR = 142 Sm^3/Sm^3	No H2S, CO2, N2.
Oil gravity = 30 API (876 Kg/m^3)	Heat capacity of oil = 2.219 KJ/Kg/K
Gas gravity = 0.76	Heat capacity of gas = 2.1353 KJ/Kg/K
At initial conditions no water.	Heat capacity of water = 4.1868 KJ/Kg/K

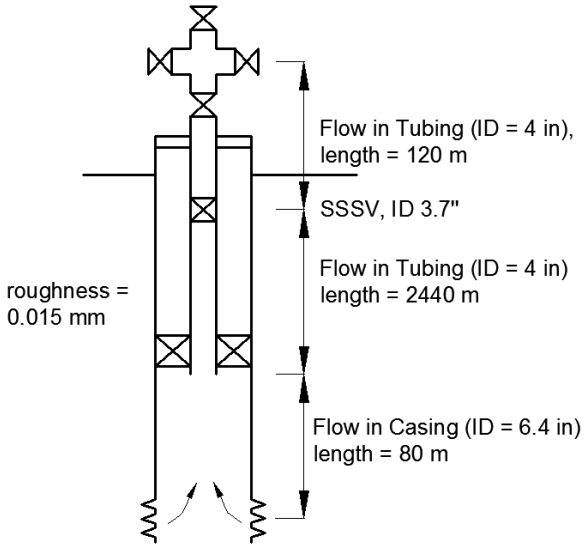
Well layout:

Deviation survey

MD [m]	TVD [m]
0	0
123	122
1059	1036
2164	2103
2640	2560

Geothermal gradient

MD [m]	T [C]
0	4
2640	100



Overall heat transfer coefficient = 45 W/m^2 K

Reservoir info:

Producing from a single layer
Reservoir pressure = 360 bara
Reservoir temperature = 100 C
Water cut = 0%

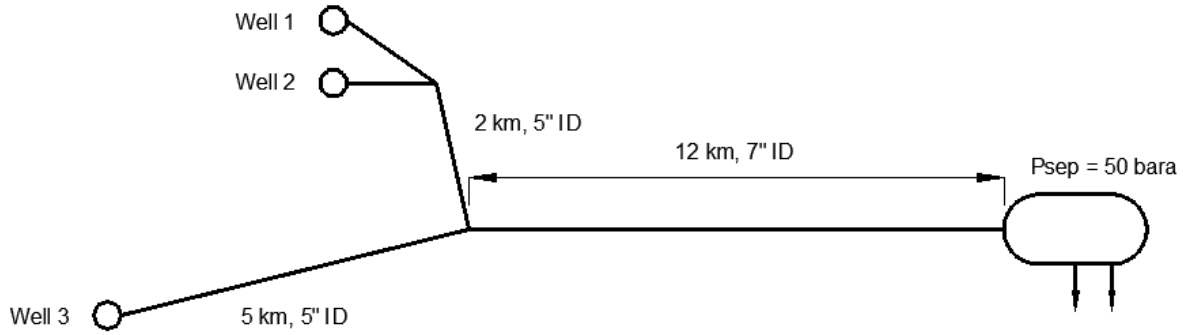
Productivity index = 12 Sm^3/d/bara

Tasks:

- Set up a prosper model of a subsea oil well.
- Report the bubble point pressure at reservoir temperature as predicted by the BO correlation.
- Estimate the producing rate using flow equilibrium assuming that the well is producing against a constant wellhead pressure of 100 bar. Is it correct to assume a linear productivity index?.
- Generate and export lift curves to be used in GAP (in the following exercise). p_{wh} range: 30-150 bara, GOR range: 141 – 500 Sm^3/Sm^3. WC range: 0 – 50 %

2. Modeling of a subsea network with three oil wells in GAP

The layout of the production network layout is shown below. The S riser is not included in the figure. Assume that the water depth is 300 m, and the separator is 30 m above the sea level. The production riser is a lazy "S" riser with a total length of 700 m.



The wells have the same layout as the well created in the previous section, but with different GOR, WC and PI as specified in the table below:

Well	GOR [Sm^3/Sm^3]	WC [%]	PI [Sm^3/d/bara]
Well 1	142	0	12
Well 2	200	40	8
Well 3	250	20	15

Tasks:

- Build the GAP model of three subsea wells producing to a FPSO.
- Calculate the natural equilibrium flow of the network. Report the flow potential of each well and calculate their split factor.
- Now, assume that the system has to be operated at a constant rate of 2000 Sm^3/d. Try the following methods:
    - Adding a constraint to the separator, add a choke pressure drop (controlled), and run an optimization.
    - Adding a constraint to the wells, and run an optimization