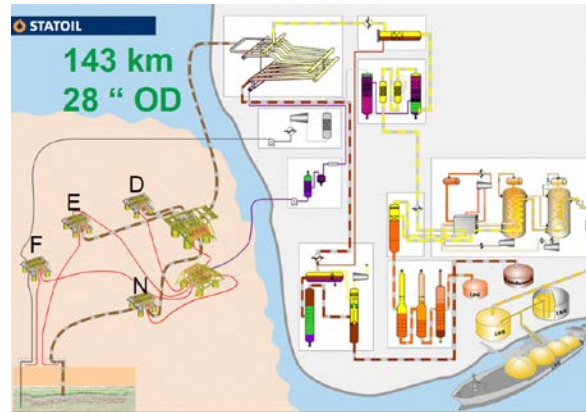


**SOLVE THIS PROBLEM USING THE EXCEL FILE PROVIDED**

**PROBLEM 4 (25 POINTS).** Flow equilibrium in the Snøhvit CO<sub>2</sub> injection well using the equations for incompressible liquid flow.

The Snøhvit field is a subsea dry gas field, located in the Barents Sea. The field produces to a LNG facility on the island of Melkøya through a pipeline that is 140 km long. In the LNG plan, CO<sub>2</sub> is captured, it is then pumped and transported for 140 km back to the field and injected in a deep formation (Tubåen). The CO<sub>2</sub> is injected in an aquifer, but in this problem, we will assume that the layer has only CO<sub>2</sub>.



**Task (25 POINTS).** Perform a flow equilibrium calculation in the Snøhvit CO<sub>2</sub> injection well to find the equilibrium rate. Use the well bottom-hole as equilibrium point. Plot the IPR and TPR. Explain how you have performed this task.

**Additional information:**

- The maximum allowed flowing bottom-hole pressure is 390 bara (to avoid fracking the reservoir)
- For the IPR use a linear equation with  $J = 240$  [t/d/bar]. Assume a reservoir pressure equal to 300 bara.
- Assume the wellhead pressure is kept fixed at a value of 100 bara.
- For the TPR use the Bernoulli equation for pressure drop in conduit for incompressible liquid flow. Two VBA equations are provided in the Excel file:
  - “pin” that allows to calculate required inlet pressure if outlet pressure and mass flow are given
  - “pout” that allows to calculate available pressure at the discharge of the pipe if inlet pressure and mass flow are given
- It is recommended you perform your flow equilibrium calculations using mass flow rate instead of standard conditions volumetric rates or local conditions volumetric rates.