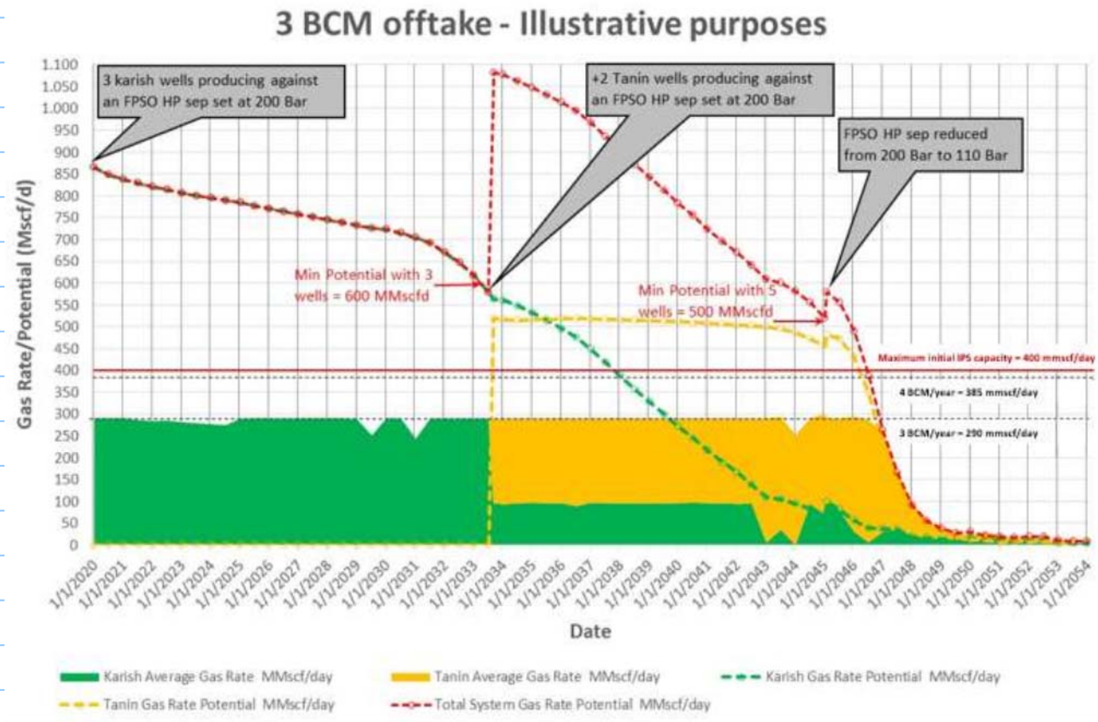
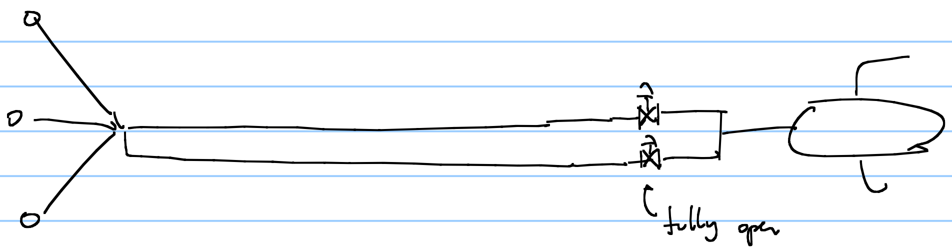
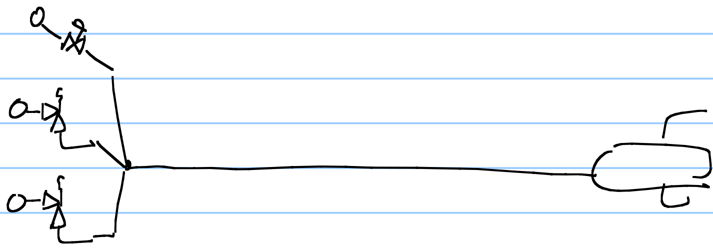
Notes to Youtube video nr. 9

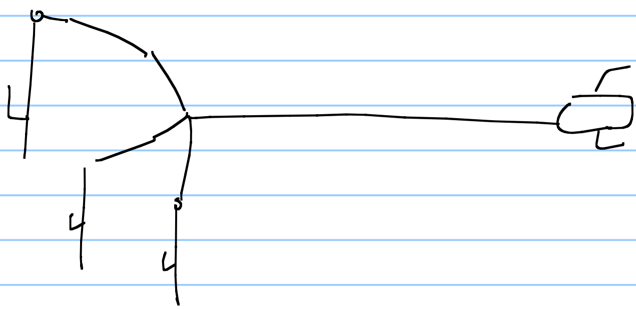


Production potential maximum rate the production system can deliver at a given time





q_{pp} = fully open choke

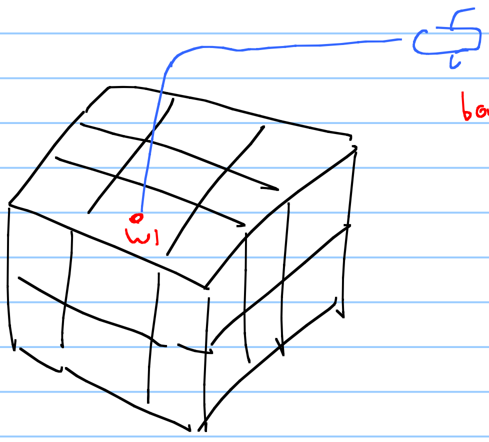


max q_o by changing $q_{g\,inj\,1}$

$q_{g\,inj\,2}$

$q_{g\,inj\,3}$

Production potential is also used in reservoir simulation

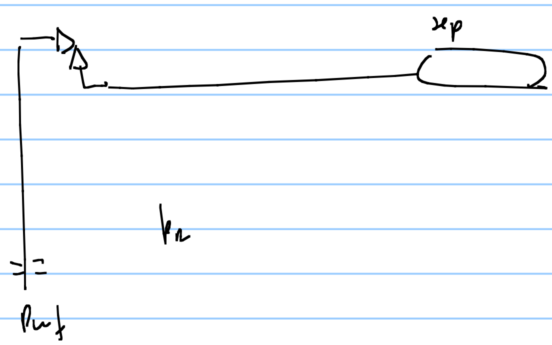


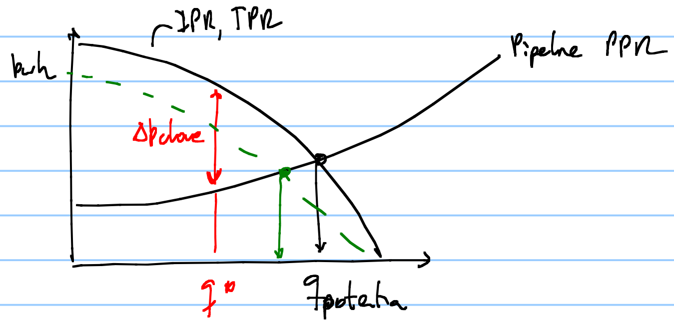
boundary conditions on well 1 → q_{target}

↘ $p_{wf\,min}$

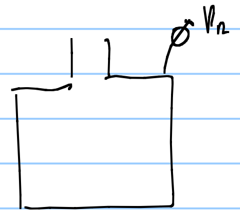
in each time step

- tries $p_{wf\,min}$ → $q_{potential}$
- if $q_{potential} > q_{target}$
  - ↳ q_{target} can be produced
    increase p_{wf} until the
    $q_{well} = q_{target}$
- ↳ if $q_{pot} \leq q_{target}$
  - ↳ q_{target} cannot be produced
    $p_{wf} = p_{wf\,min}$
    $q_{well} = q_{potential}$





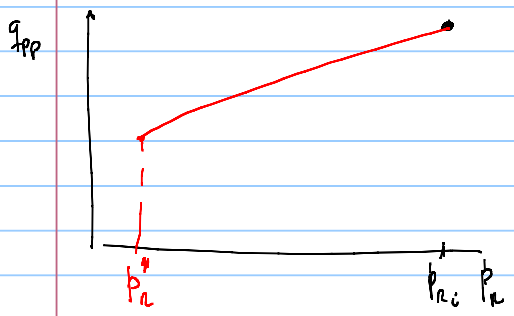
- Production potential is actually a function of p_R
  - ↳ and p_R is usually a function of
    Q_p → G_p (gas)
    ↘ N_p (oil)

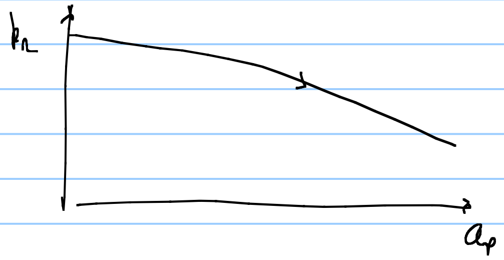


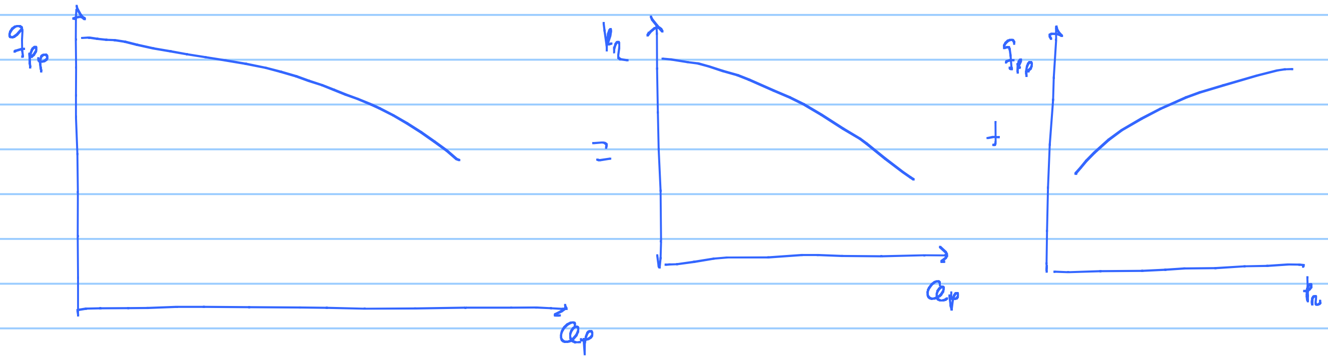
$p_R = f(Q - Q_p)$

$p_R(t) = f(Q - Q_p(t))$

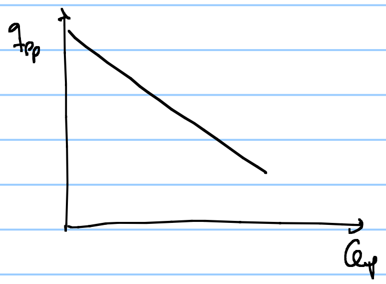
$p_R = f(Q_p)$



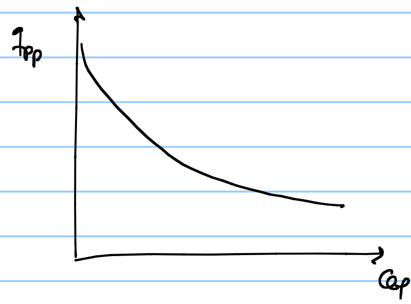




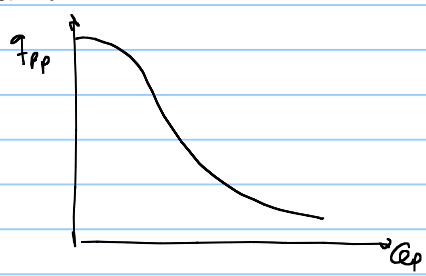
for dry gas and undersaturated oil



for saturated oil

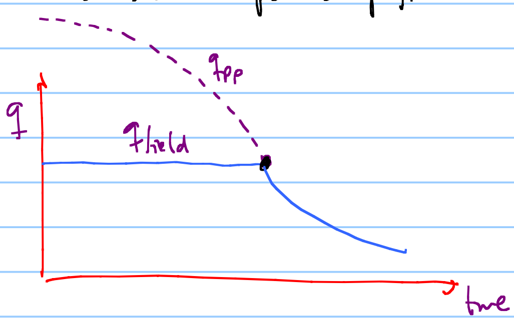


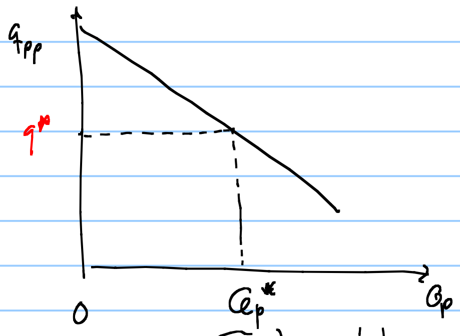
for oil water injection



Production potential curves can be used for

- determine plateau duration
- estimate production profile





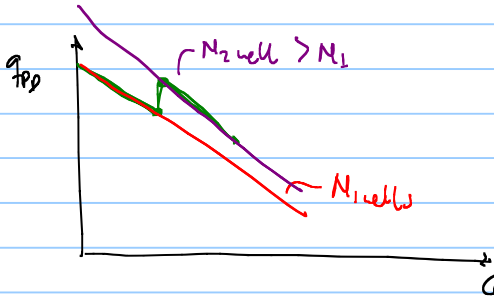
$q_{plateau} = q^*$

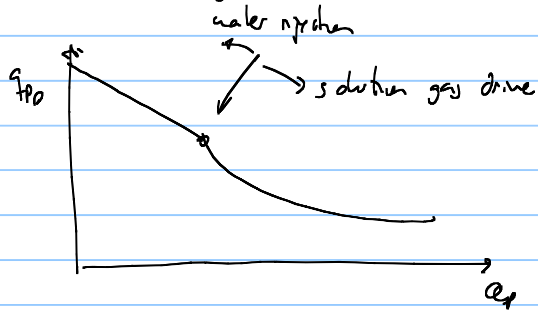
G_p^* — cumulative production at which the end of plateau will occur

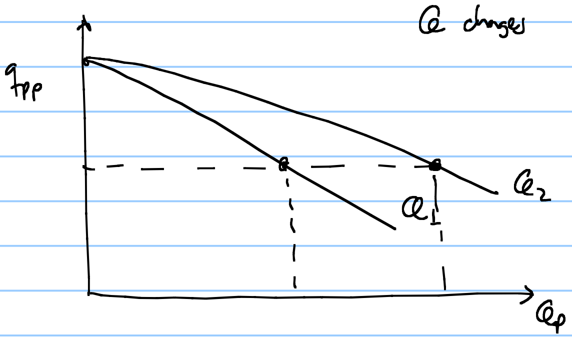
$0 \rightarrow Q_p^*$ has been produced at constant rate q^*

$$t_{plateau} = \frac{Q_p^* \, [Sm^3]}{q^* \, [Sm^3/d] \; t_{uptime}} \longrightarrow \frac{\text{nr. operational days}}{\text{year}}$$

Production potential curve is affected by changes to the production system







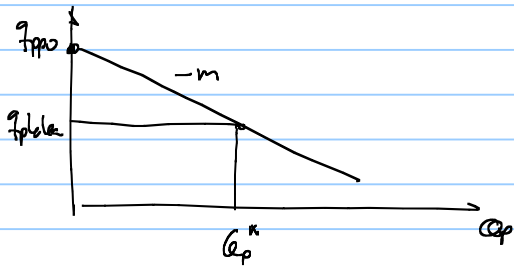
$p_R = f(R_f)$

$R_{f_1} = \frac{Q_p}{Q_1}$ $\quad R_{f_2} = \frac{Q_p}{Q_2}$

$R_{f_2} < R_{f_1}$

if curve q_{pp} is linear $q_{pp} = -m\, Q_p + q_{ppo}$

derive analitically $q_f(t)$ from q_{pp}



$$q_f(t) \begin{cases} q_{plateau} & \text{for } t \le t_{plateau} = \left(\frac{q_{ppo}}{q_{plateau}} - 1\right)\frac{1}{m} \\ q_{field} = q_{pp} & \text{for } t > t_{plateau} \end{cases}$$

$q_{plateau} = q_{pp} = -m\, Q_p^* + q_{ppo}$

$$Q_p^* = \frac{q_{ppo} - q_{plateau}}{m}$$

$$q_{pp} = -m\left(Q_p^* + \int_{t_{plateau}}^{t} q_{pp}\, dt\right) + q_{ppo}$$

$$t_{plateau} = \frac{Q_p^*}{q_{plateau}} = \left(\frac{q_{ppo}}{q_{plateau}} - 1\right)\frac{1}{m}$$

$$q_{pp} = -m\,\frac{(\cancel{q_{ppo}} - q_{plateau})}{m} - m\int_{t_{plateau}}^{t} q_{pp}\, dt + \cancel{q_{ppo}}$$

$$q_{pp} = q_{plateau} - m\int_{t_{plateau}}^{t} q_{pp}\, dt \longrightarrow \text{a solution to this equation is}$$

$$q_{pp} = q_{field} = q_{plateau} \cdot e^{-m(t - t_{plateau})}$$

$$q_f(t) \begin{cases} q_{plateau} & \text{if } t \leq t_{plateau} = \left(\frac{q_{ppo}}{q_{plateau}} - 1\right)\frac{1}{m} \\ q_{plateau}\, e^{-m(t-t_{plateau})} & \text{if } t > plateau \end{cases}$$

$$= e^{\frac{1}{m}(t-t_{plateau})}$$