Note Title 9/24/2018

Depletion Project

- Assumptions

(1) M_{Aq} ($M_{Coal} \sim M_{Fridge}$)

(2) $q_g = \alpha$

$$\bar{J} = \alpha \frac{kh}{\ln\frac{r_e}{r_w} - \frac{3}{4} + S} \cdot \lambda_x$$

α: units & Flow Geometry.

$$\lambda_x = \left(\frac{k_{rg}}{\mu_g B_g}\right)_{P_x}$$

SOLUTION GAS DRIVE M.B. (SGD)

Ultimate Abandonment

- Oil $p_R \leq p_b$ or $p_{Ri} \rightarrow p_b \rightarrow p_{Rn}$

- Effect of solution gas being liberated from the RO on oil Recovery

Good / Bad

S_o n~2-4

$k_{ro}/(\mu_o B_o)$ $\lambda_{\bar{o}}$

$\mu_o B_o \uparrow$

If k_{rg} $\lambda_g \sim 0$ Internal Gas Drive - Driving Oil $\lambda_o > 0$

Bad Good

$p_R(N_p)$

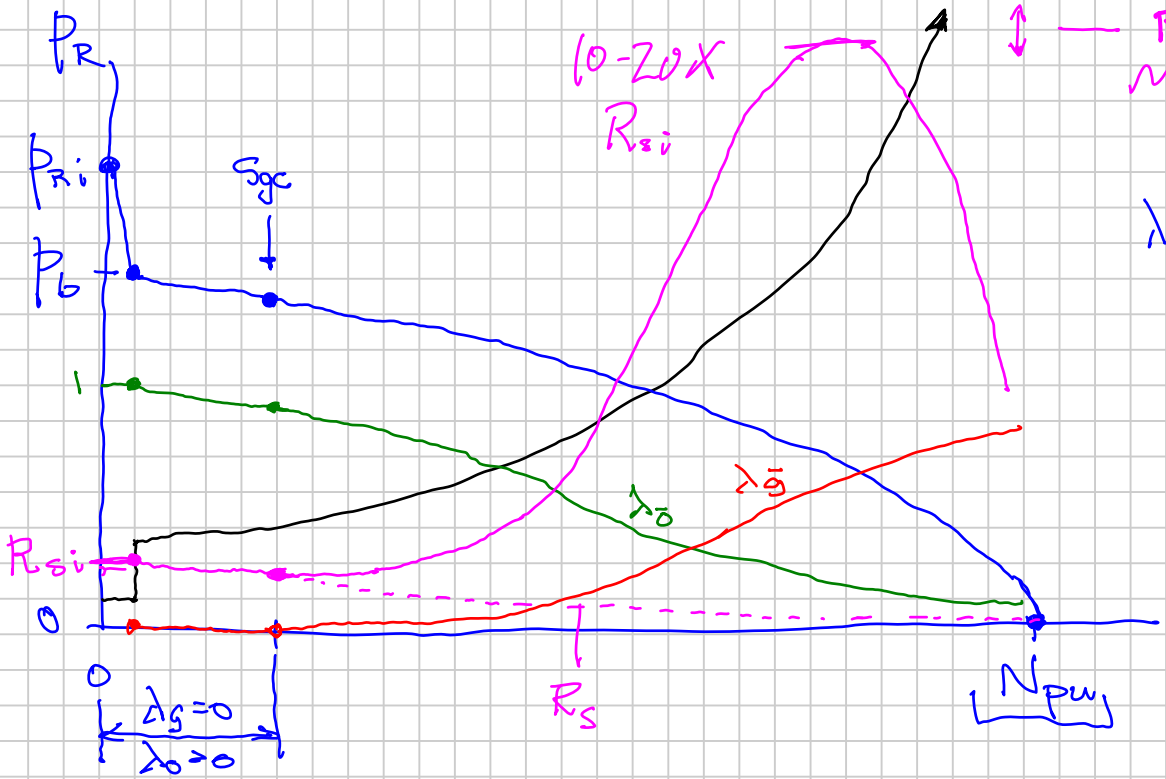
$\lambda_{\bar{o}}(N_p)$

$\lambda_{\bar{g}}(N_p)$

$C_t(N_p)$

$R_s(N_p) = q_{\bar{g}}/q_{\bar{o}}$

$\lambda_{\bar{p}} = \frac{k_{rp}}{\mu_p B_p}$



$$R_p = \frac{q_{\bar{g}}}{q_{\bar{o}}}$$

$$q_{\bar{g}} = q_{\bar{g}R} / B_g = C\,\lambda_{\bar{g}} = C \cdot \frac{k_{rg}}{\mu_g B_g}$$

$q_{\bar{g}R}$: Free Gas Phase $+\ q_{\bar{o}} R_s$

$$q_{\bar{o}} = q_{\bar{o}R} / B_o = C\,\lambda_{\bar{o}} = C \frac{k_{ro}}{\mu_o B_o}$$

$q_{\bar{o}R}$: $+\ \cancel{q_{\bar{o}\bar{g}}}^{\,0}$

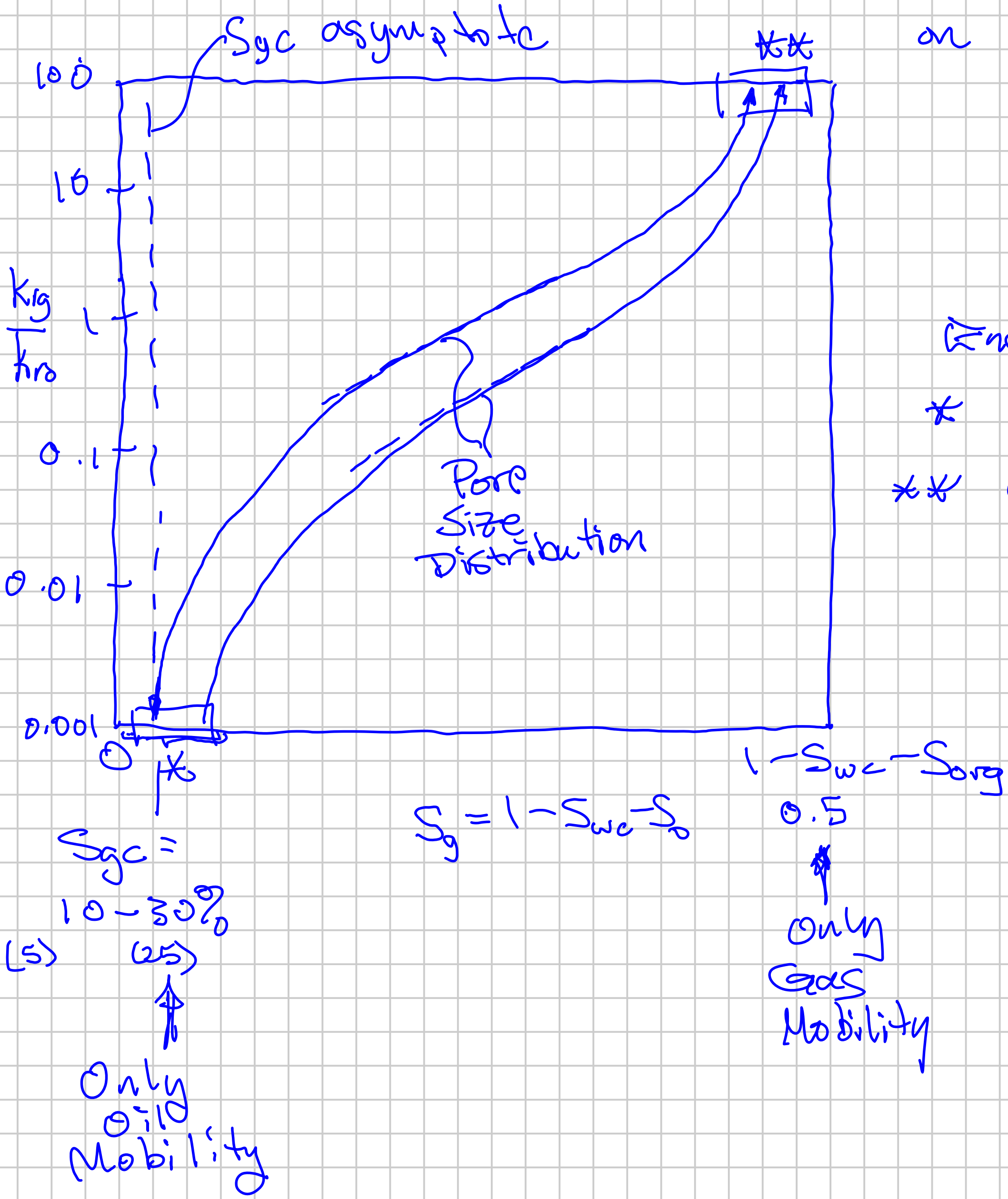
$$R_p = \frac{q_{\bar{g}}}{q_{\bar{o}}} = \frac{q_{\bar{g}\bar{g}} + q_{\bar{g}\bar{o}}}{q_{\bar{o}\bar{o}} + \cancel{q_{\bar{o}\bar{g}}}^{\,0}}$$

$$= R_s + \frac{k_{rg} / \mu_g B_g}{k_{ro} / \mu_o B_o}$$

$$= R_s(\bar{p}_R) + \left(\frac{\mu_o B_o}{\mu_g B_g}\right)_{\bar{p}_R} \cdot \underbrace{\frac{k_{rg}}{k_{ro}}(S_g)}_{\text{Relative Permeability Ratio}}$$

$$\approx R_s + \frac{\lambda_{\bar{g}}}{\lambda_{\bar{o}}}$$

GAS-OIL REL. PERM. RATIO – 1st Order Impact on $p_R(N_p)$



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N_{pu}

10% 25-30%

End-Point Sat.

* S_{gc}

** S_{org}

Estimation of S_o from knowledge of p_R & N_p $p_R(N_p)$

Assume HCPV = constant

$$V_{oi} = HCPV_i = HCPV = N \cdot B_{oi}$$

OIIP

$$HCPV = N B_{oi}$$

STB

Sm^3

$$V_o\,(@P_R) = \underbrace{(N - N_p)}_{\text{STB Remaining in Reservoir}} \cdot B_o\,(@P_R)$$

$$S_o \equiv \frac{V_o}{HCPV} = \frac{(N - N_p)\,B_o}{N\,B_{oi}}$$

$$\boxed{S_o = \left(1 - \underbrace{\frac{N_p}{N}}_{RF_o}\right)\frac{B_o}{B_{oi}}} \longrightarrow \frac{k_{rg}}{k_{ro}}(S_o)$$

Saturation Relationship used in conventional SCAL M.B

- HCPV = constant
- q_{sc_o}, N_p } only from Res. Oil Production

$q_{sc_g} \sim 0$