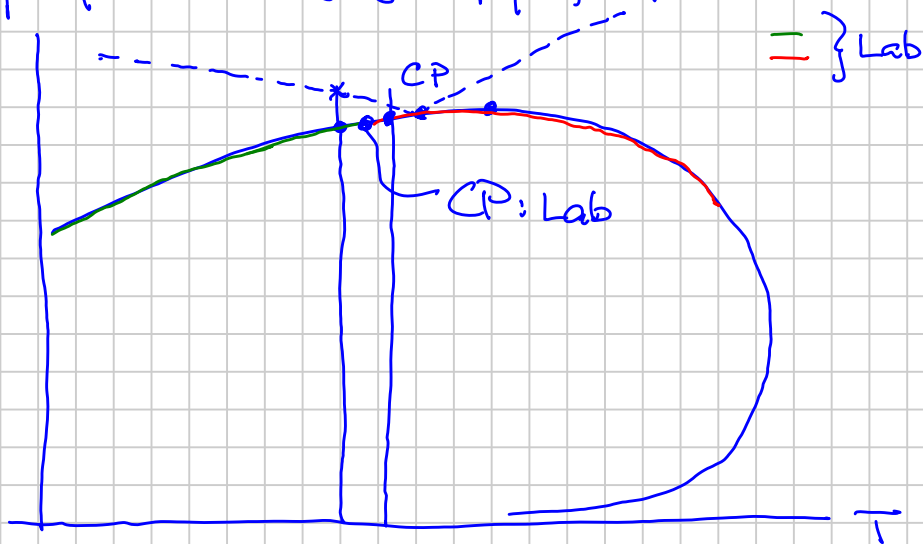


For a given set of components (i)
 with component properties $\theta_i (T_{ci}, p_{ci}, w_i)$
 and A_0 fixed p
 and z_i

\Rightarrow L.P. (T_c, p_c)

$T > T_c$: Calc. DP

$T < T_c$: Calc BP



APPLICATIONS OF FLASH CALCULATIONS

Multi-Stage Surface Separation } 2-5 stages
 "Separator Calcs" } (3+) stages

Quantities of SELLABLE PRODUCTS

- (1) Produced Wellstream Composition Z_{wi} "o"
- (2) * Stock-Tank (Surface) Oil STO (So) V_o
 ↳ Condensate STC
- (3) * Sales / Pipeline Gas
 - NGLs (C_3 C_4 C_5) } from Surface Gas Product
 - LPG (C_2 C_3) }

Investment
to
"Cool"

Petroleum Engineers : Maximize V_o +1% Control @ Surface
 # Stages
 Minimize V_g (P, T) stages

Opt Maximize Value

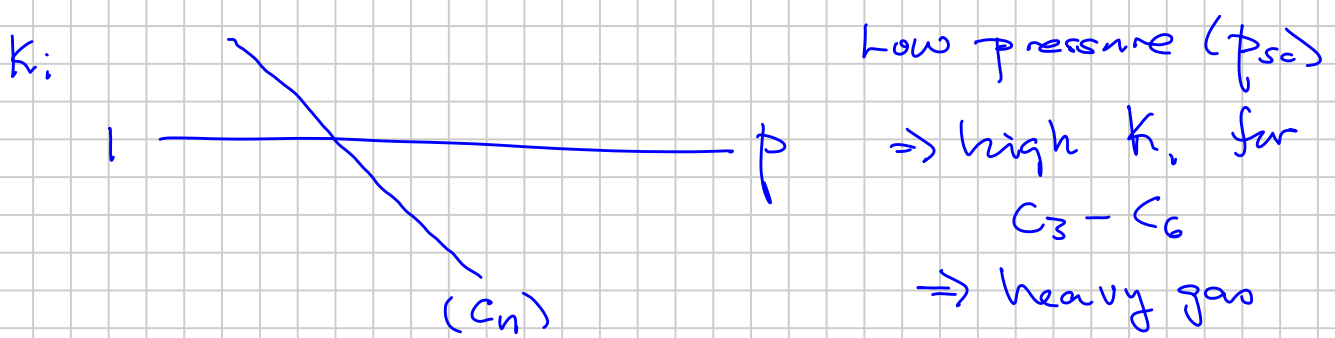
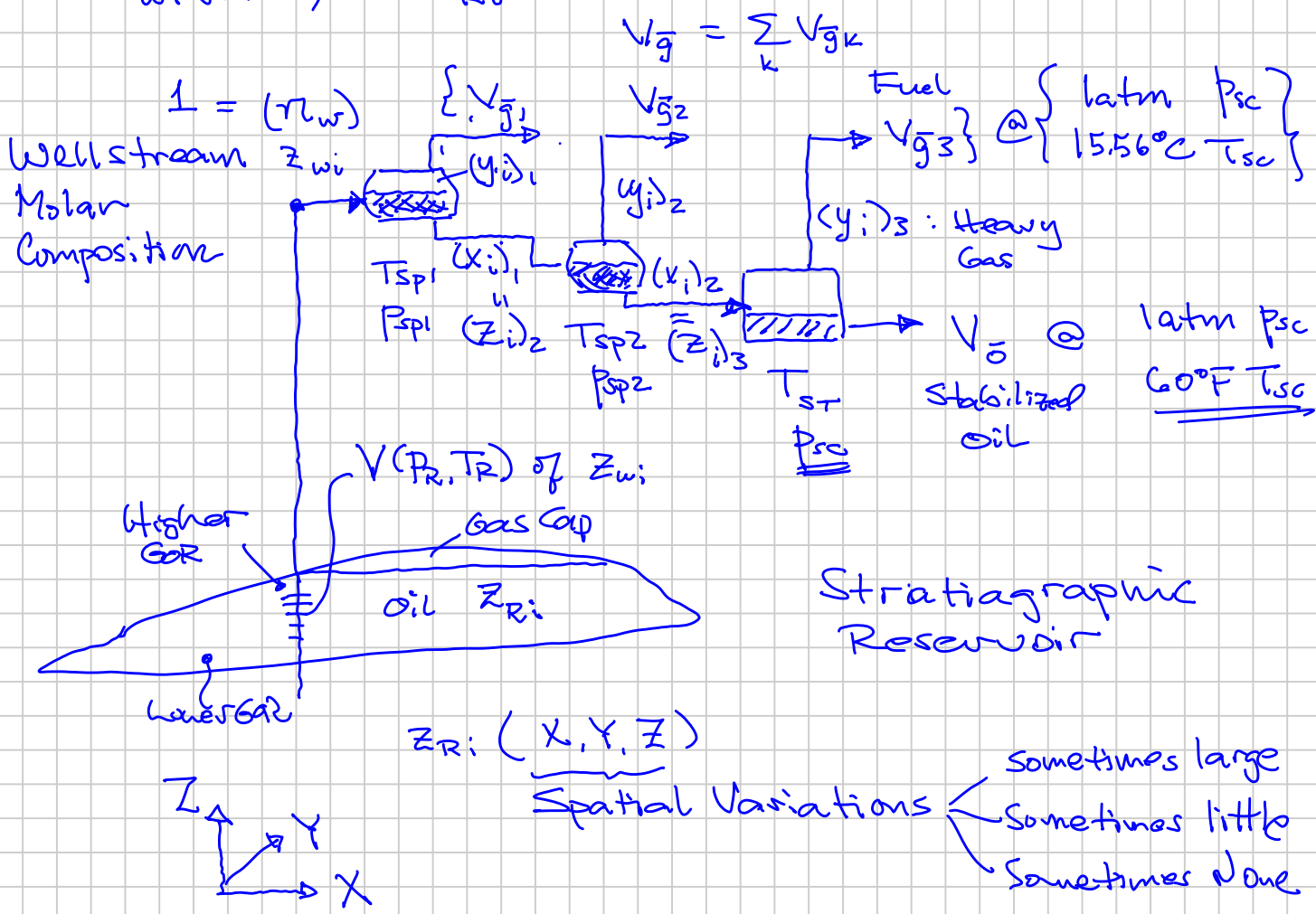
$$\left\{ P_o \cdot V_o + P_g \cdot V_g + P_{NGL} \cdot V_{NGL} \right\}_{Revenue}$$

$C(\#stages, P, T; \text{Refrigeration})$

Cost Model 2

lower K_i
 C_3 C_6
 ↓ ↓ ↓
 liquid (STO)
 \$63.50

$Z_{wi}(t) \neq Z_{Ri}$ often Z_i : Feed



Moles of Feed @ New Stage, k

$$(Z_i)_k = (X_i)_{k-1}$$

$$\text{Feed } n_k = \underbrace{n_w}_{n_2} \cdot \underbrace{(1 - f_{v,1})}_{\dots} \underbrace{(1 - f_{v,2})}_{\dots} \dots \underbrace{(1 - f_{v,k-1})}_{\dots}$$



Oil Price : \$63 / STB

Gas Price : — Canada (USA) \$1.5-2.5 / Mscf
 — Europe \$8-12 / Mscf

6000 scf ~ 1 STB on energy basis

6 Mscf
 x
 \$10 / Mscf

~ \$60 energy \$60 energy

16

Petroleum Engineering Quantities :

Gas-oil Ratios \Rightarrow GOR (R) $\equiv \frac{V_g}{V_o} = R_p$ Producing Wellstream

Oil-gas Ratios \Rightarrow OGR (r) $\equiv \frac{V_o}{V_g} = r_p$
 \equiv CGR

Single Phase Reservoir Volume of z_i $V_R (T_R, P_R)$
 (RG or RO)

"Reservoir" Formation Volume Factor (FVF) $B_o \equiv \frac{V_o (P_R, T_R)}{V_o}$
 Oil Phase @ Res. Cond or Gas Phase — " —

$$B_g \equiv \frac{V_g (P_2, T_2)}{V_g}$$

If Z_n is two-phase @ (T_2, P_2)
FUF

$$B_c \equiv \frac{(V_g + V_o) @ (P_2, T_2)}{V_o}$$

Inverse FUF:

$$b \equiv \frac{1}{B}$$