







Memorandum





$1/e^{m/n} \approx 1/e^{m/n} + 1/e^{m/n}$



$$\text{Mean source} / K = \text{Tree} + \text{Env} + B_s * e^{-T} * B$$





$$T_B = T_{cal} * \frac{(Mean_source - Mean_atm)}{(Mean_load - Mean_atm)}$$

$$I_{cal} = (I_{load} - I_{emi}) \frac{e^{\tau}}{B_s}$$

$$T_{sys} = \frac{T_{cal} * Mean_{atm}}{Mean_{load} - Mean_{atm}}$$



$$T_{emi} = \frac{(T_{load} + T_{rec}) * Mean_{atm}}{Mean_{load}} - T_{rec}$$

$$T_{sky} = \frac{T_{emi} - (1. - F_{eff}) * T_{cab}}{F_{eff}}$$







$$T_{sky} = \frac{T_{sky_s} + T_{sky_i} * Gain_i}{(1. + Gain_i)}$$





$$T_{cal} = \frac{(T_{load} * (1. + Gain_i) - T_{emi_s} - Gain_i * T_{emi_i})}{B_s * e^{-Tau_s * Air_mass}}$$











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$$T_{rec} = \frac{T_{load} * Mean_{atm} - T_{emi} * Mean_{load}}{Mean_{load} - Mean_{atm}}$$

$$T_{rec} = \frac{T_{load} * Mean_{cold} - T_{cold} * Mean_{load}}{Mean_{load} - Mean_{cold}}$$







$$I_{sky} = I_{atm} * (1 - e^{-I_{atm} * Air_mass})$$

$$I_{sky_i} = I_{atm_i} * (1 - e^{-I_{atm_i} * Air_mass})$$









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$$1 + \text{Gain}_i * e(T_{\text{avg}} - T_{\text{av}_i}) * \text{Air_mass}$$

es (I am i-I am) *Air mass /
Grown



$$I_{load} I_{load} / I_{rec} = I_{rec} + C_{eff} * I_{load} + (1 - C_{eff}) * I_{em}$$

$$T_{cal} = C_{eff} * \frac{(T_{load} - T_{emi}) * (1. + Gain_i)}{B_s * e^{-\tau_{a_s} * Air_mass}}$$

$$T_{emi} = \frac{(T_{load} + T_{rec}) * Mean_atrn * C_{eff}}{Mean_load - (1 - C_{eff}) * Mean_atrn} - T_{rec}$$

$$T_{rec} = \frac{C_{eff} * Mean_atm * T_{load} - (Mean_load - (1 - C_{eff}) * Mean_atm) * T_{emi}}{Mean_load - Mean_atm}$$

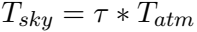


Moderna Inc. vs. Pfizer Inc.

$$T_{emi} = \frac{\eta * (T_{rec} + T_{load}) * Mean_atm}{Mean_load} - T_{rec}$$

$$T_{rec} = \frac{Mean_cold * T_{load} - Mean_load * T_{cold}}{Mean_load - \eta * Mean_cold}$$

$$T_B = e^{\tau} \frac{\eta}{B_s} (T_{load} + T_{rec}) \frac{Mean_sou - Mean_atm}{Mean_load}$$





$$I_{ema} = I_{ef} * I_{om} + (1 - I_{ef}) * I_{ob}$$

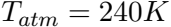
$$\pi = (\pi_{mi} (1 - \pi_{cab}) * \pi_{cab}) / (\pi_{ei} * \pi_{ab})$$

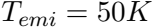
$$I_{\text{col}} = (I_{\text{load}} - I_{\text{env}}) / (1 - \text{Gini}) * B_s$$

$$T_{cal} = C_{eff} \frac{(T_{load} - T_{emi}) * (1 + Gain_i) * T_{atm} * F_{eff}}{B_s * (F_{eff} * (T_{atm} - T_{cab}) + T_{cab} - T_{emi})}$$

$$T_{cal} = C_{eff} \frac{F_{eff} * (1 + Gain_i) * T_{atm}}{B_s * (1 - F_{eff} * \frac{T_{cab} - T_{atm}}{T_{cab} - T_{emi}})}$$

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$$T_{cal} = \frac{240 * (1 + Gain_i) * F_{eff}}{B_s * (1 - 0.2 * F_{eff})}$$

$$I_{em} = (1 - F_{ref}) * I_{cab} + F_{ref} * C_{te} * M_{water} * Air_{mass}$$

$$\frac{\partial T_{cal}}{\partial T_{rec}} = \frac{\partial T_{cal}}{\partial T_{emi}} \frac{\partial T_{emi}}{\partial T_{rec}} + \frac{\partial T_{cal}}{\partial T_{au}} \frac{\partial T_{au}}{\partial T_{rec}}$$

$$\frac{\partial T_{cal}}{\partial T_{emi}} = \frac{T_{cal}}{T_{emi} - T_{load}}$$

$$\frac{\partial T_{emi}}{\partial T_{rec}} = -1 + \frac{T_{emi} + T_{rec}}{T_{load} + T_{rec}}$$

$$\frac{\partial T_{cal}}{\partial T_{emi}} = \frac{T_{cal}}{T_{load} + T_{rec}}$$

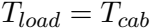
$$\frac{\partial T_{cal}}{\partial T_{av}} = Air_mass * T_{cal}$$

$$\frac{\partial T_{av}}{\partial T_{rec}} = \frac{\partial T_{av}}{\partial T_{emi}} \frac{\partial T_{emi}}{\partial T_{rec}}$$

$$\frac{\partial T_{av}}{\partial T_{rec}} = \frac{1}{Air_{mass} * T_{atm} * F_{eff}} \frac{\partial T_{emi}}{\partial T_{rec}}$$

$$\frac{\frac{\partial T_{cal}}{\partial T_{au}}}{\frac{\partial T_{au}}{\partial T_{rec}}} = \frac{T_{cal}}{T_{atm} * F_{eff}} \frac{T_{emi} - T_{load}}{T_{load} + T_{rec}}$$

$$\frac{1}{T_{cal}} \frac{\partial T_{cal}}{\partial T_{rec}} = \frac{T_{atm} * F_{eff} - T_{load} + T_{emi}}{F_{eff} * T_{atm} * (T_{load} + T_{rec})}$$



$$\frac{1}{T_{cal}} \frac{\partial T_{cal}}{\partial T_{rec}} = \frac{F_{eff} - 1}{F_{eff}} \frac{1}{T_{load} + T_{rec}}$$







$$\frac{1}{T_{cal}} \frac{\partial T_{cal}}{\partial T_{cab}} = \frac{(T_{atm} - T_{emi})}{(T_{cab} - T_{emi}) * (T_{cab} - T_{emi} - F_{eff} * (T_{cab} - T_{atm}))}$$



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$$\frac{1}{T_{cal}} \frac{\partial T_{cal}}{\partial F_{eff}} = \frac{1}{F_{eff}} + \frac{1}{\frac{T_{cab} - T_{emi}}{T_{cab} - T_{atm}} - F_{eff}}$$

$$\frac{\partial T_{cal}}{\partial C_{eff}} = \frac{T_{cal}}{C_{eff}} - \frac{T_{cal}}{T_{load} - T_{emi}} \frac{\partial T_{emi}}{\partial C_{eff}}$$

$$\frac{\partial T_{emi}}{\partial C_{eff}} = \frac{(T_{emi} + T_{rec})^2}{T_{load} + T_{rec}}$$

$$\frac{1}{T_{cal}} \frac{\partial T_{cal}}{\partial C_{eff}} = \frac{1}{C_{eff}} - \frac{(T_{emi} + T_{rec})^2}{C_{eff}^2 * (T_{load} + T_{rec}) * (T_{load} - T_{emi})}$$

$$\frac{\partial T_{cal}}{\partial \eta} = \frac{T_{cal}}{\eta} + \frac{\partial T_{av}}{\partial \eta} \frac{\partial T_{cal}}{\partial T_{av}} + \frac{\partial T_{rec}}{\partial \eta} \frac{\partial T_{cal}}{\partial T_{rec}}$$

$$\frac{\partial T_{av}}{\partial \eta} = \frac{1}{T_{atm} * F_{eff}} \frac{\partial T_{emi}}{\partial \eta}$$

$$\frac{\partial T_{emi}}{\partial \eta} = - \frac{T_{emi} + T_{rec}}{\eta^2} + \frac{\partial T_{rec}}{\partial \eta} \frac{T_{emi} - T_{load}}{T_{load} + T_{rec}}$$

$$\frac{1}{T_{cal}} \frac{\partial T_{cal}}{\partial \eta} = \frac{\eta * T_{atm} * F_{eff} - T_{emi} - T_{rec}}{\eta^2}$$

$$\frac{\partial T_{rec}}{\partial \eta} = T_{rec} \frac{T_{rec} - T_{cold}}{T_{load} - \eta * T_{cold} + (1 - \eta) * T_{rec}}$$



