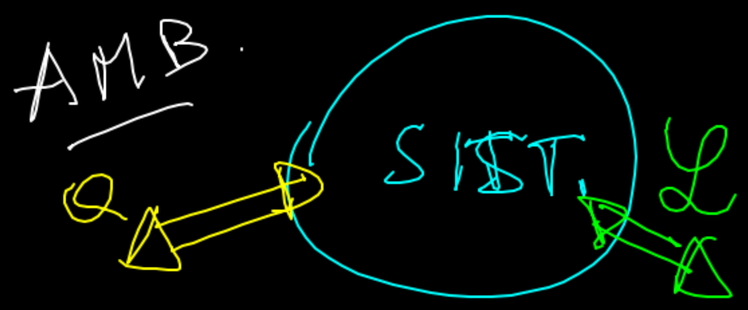
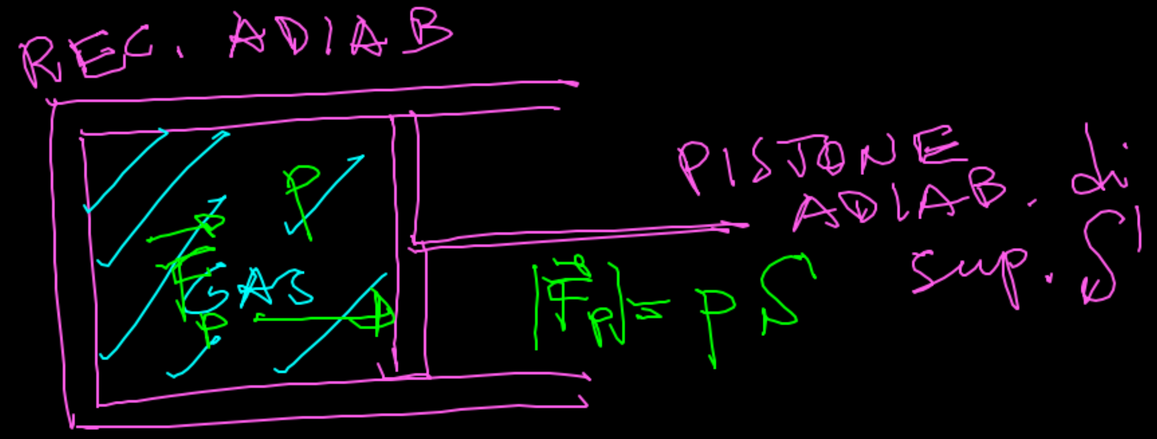
LAVORO IN TERMODINAMICA



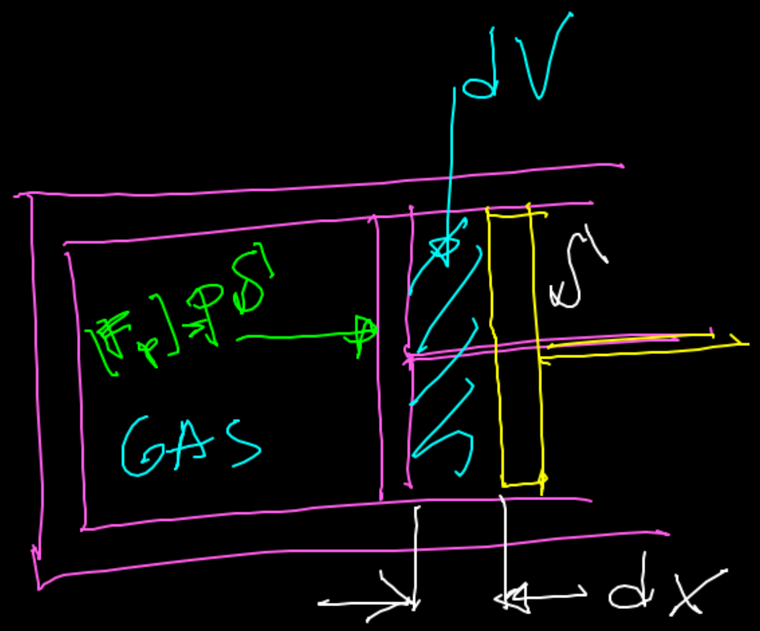


CALORE - Energia scambiata per solo ΔT

LAVORO - Energia scambiata solo attraverso spostamenti meccanici

GAS $\equiv$ SISTEMA

TUTTO IL RESTO $\equiv$ AMBIENTE



$\int dx = dV$ Variazione di volume del gas

$$dL = p\,dV$$

LAVORO IN TERMOD.

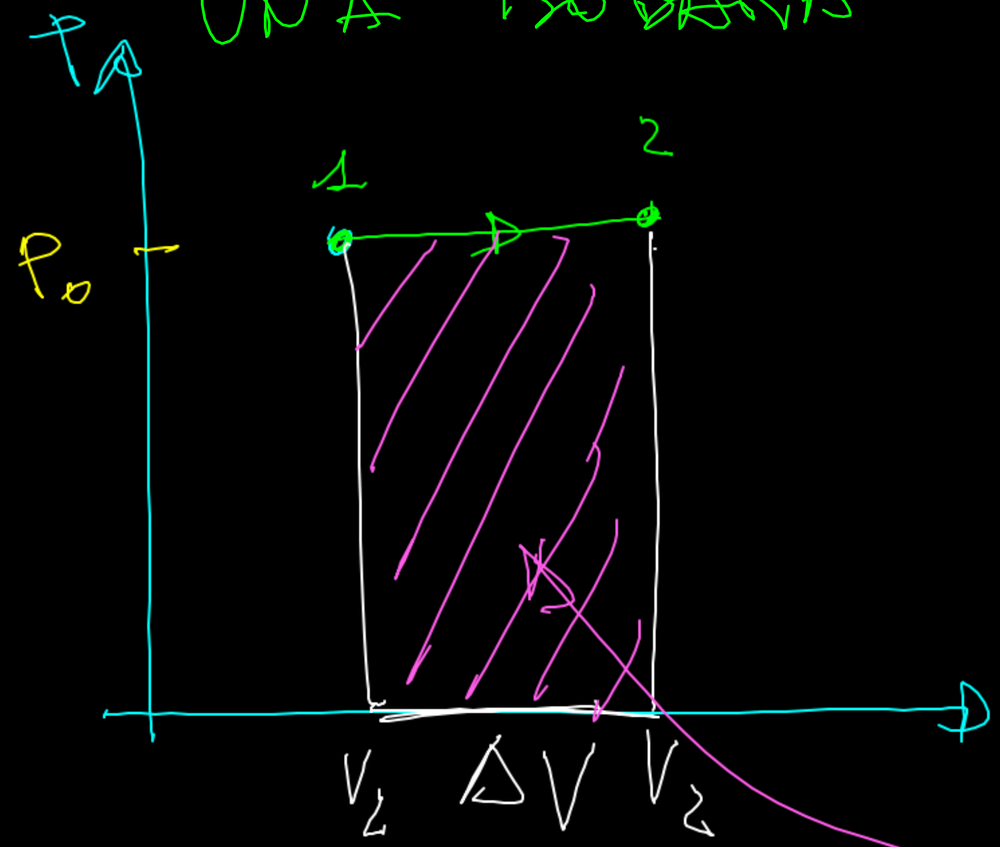
(Vale in generale)

- dx è lo spostamento del pistone
- $\vec{F}_p$ è $\parallel$ a $d\vec{x}$

$$dL = |\vec{F}_p|\,|d\vec{x}| = pS\,dx$$

- $dV > 0 \Rightarrow dL > 0$ il sistema fa lavoro sull'ambiente
- $dV < 0 \Rightarrow dL < 0$ il sistema "riceve" lavoro dall'amb.

LAVORO IN UNA ISOBARA



$$dL = p\,dV$$

$$L_{1\to 2} = \int_1^2 p\,dV$$

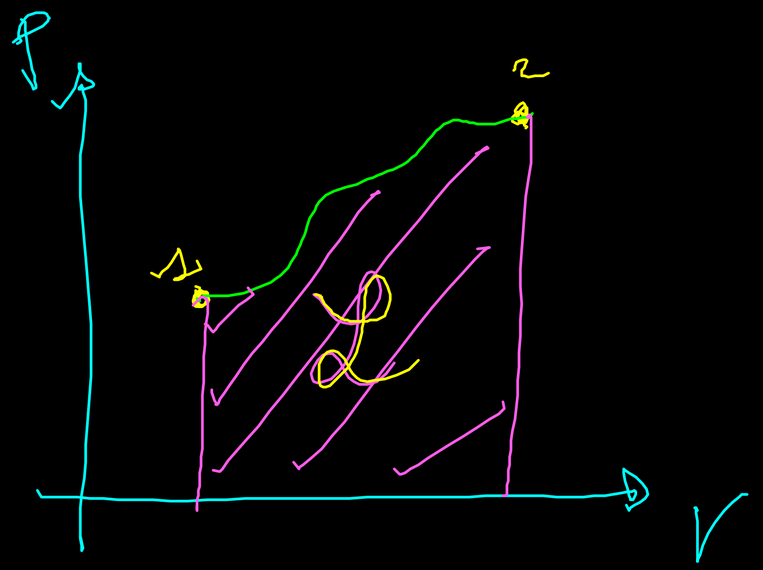
$$L_{1\to 2}\ (\text{ISOB.}) = p_0 \int_1^2 dV = p_0 \Delta V$$

$$= p_0 (V_2 - V_1)$$

$$L_{1\to 2}$$

IN GENERALE

$$\mathcal{L}_{1\to 2} = \int_1^2 p\,dV \quad \Longrightarrow$$

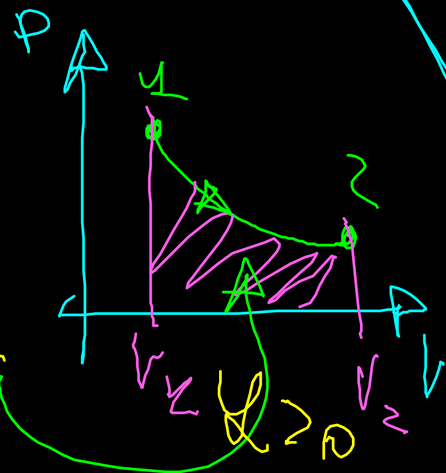


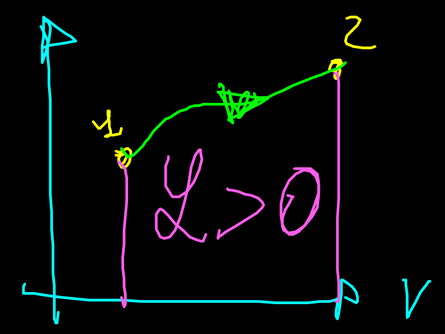
ESEMPIO: GAS PERFETTO

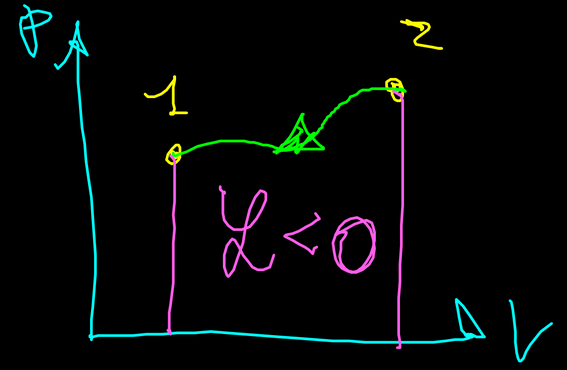
$$p = \frac{nRT}{V}$$

Per una trasf. isoterma $T = T_0$

$$\mathcal{L}_{1\to 2}^{\text{isot}} = \int_1^2 \frac{nRT_0}{V}\,dV = nRT_0 \ln\frac{V_2}{V_1}$$

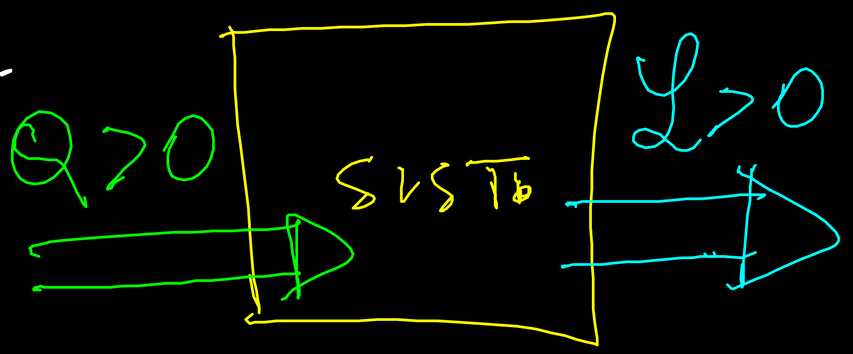


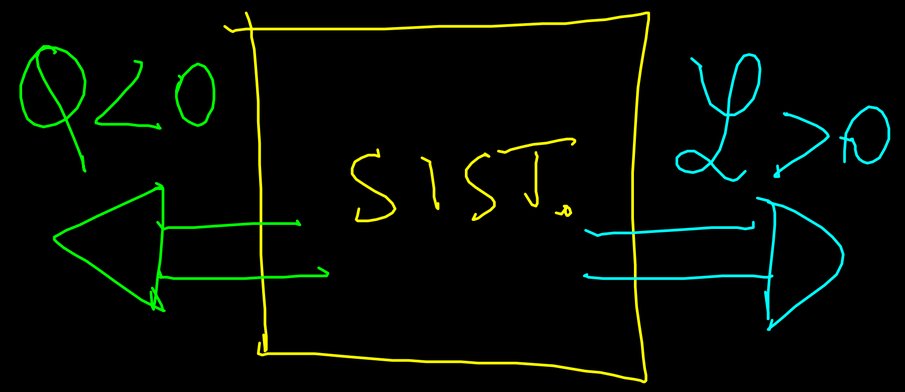


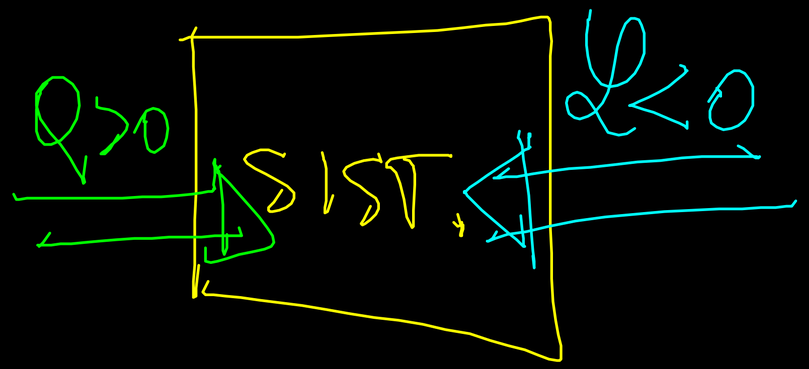


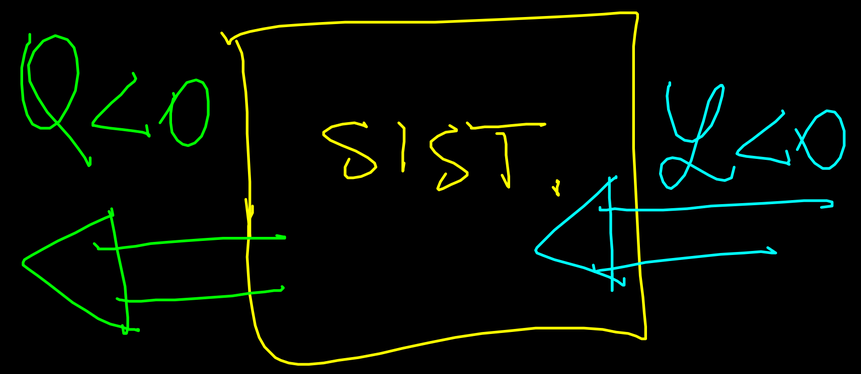
SCAMBI ENERGETICI SIST. $\rightleftarrows$ AMB.

AMB

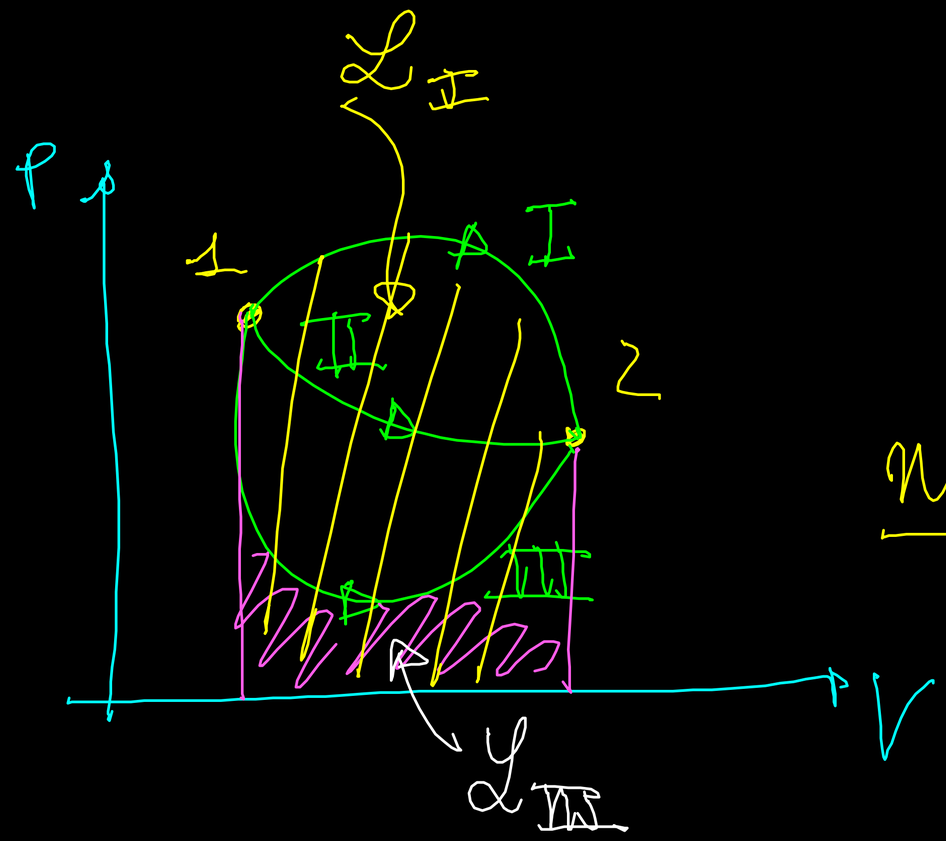








ENERGIA NETTA TRASF. AL SISTEMA $Q - L$



$$\mathcal{L}_{I} \neq \mathcal{L}_{II} \neq \mathcal{L}_{III}$$

$$Q_{I} \neq Q_{II} \neq Q_{III}$$

ma

$$Q_{I} - \mathcal{L}_{I} = Q_{II} - \mathcal{L}_{II} = Q_{III} - \mathcal{L}_{III}$$

L'energia netta trasferita dipende solo dagli stati iniziale e finale e NON dalla trasformazione

ESISTE UNA FUNZIONE DI STATO

$U(P,V,T,\dots)$

ENERGIA INTERNA

IN UNA TRASF. $i \to f$

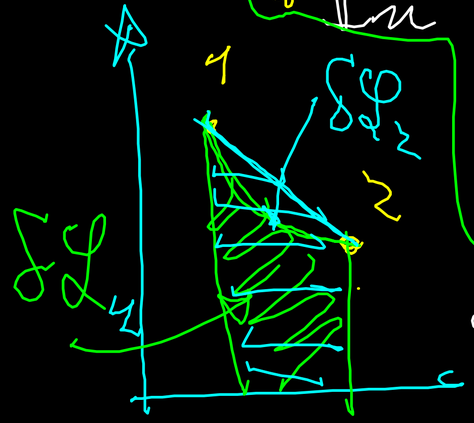
$$\boxed{Q - \mathcal{L} = \Delta U = U(p_f, T_f, V_f, \dots) - U(p_i, T_i, V_i, \dots)}$$

PRIMO PRINCIPIO DELLA TERMODINAMICA

LO PRINCIPIO GEN. DI CONSERVAZIONE DELL'ENERGIA

"In forma "infinitesima"

$$\boxed{\delta Q - \delta \mathcal{L} = dU}$$



$\delta Q_1 \neq \delta Q_2$, ma $dU_1 = dU_2$

δ → DIFF. "ESATTO"