

Solar Chimney Operating Conditions.

Energy calculations for two solar chimney plants. Ambient surface air conditions:
 $P = 100 \text{ kPa}$, $T = 25 \text{ }^\circ\text{C}$, $U = 0\%$, $s = 87.98 \text{ J kg}^{-1} \text{ K}^{-1}$, $h = 25117 \text{ J kg}^{-1}$. Pressure at the top of the chimney based on $25 \text{ }^\circ\text{C}$ surface temperature and dry-adiabatic lapse rate.

<u>Properties</u>	<u>Manzanares</u>	<u>Enviromission</u>
P_1 (kPa)	100	100
T_1 ($^\circ\text{C}$)	45	55
h_1 (J kg^{-1})	45210	55257
$s_1=s_2=s_4$ ($\text{J K}^{-1}\text{kg}^{-1}$)	153.2	184.3
P_2 (kPa)	99.856	98.957
T_2 ($^\circ\text{C}$)	44.869	54.02
h_2 (J kg^{-1})	45079	54271
P_4 (kPa)	97.729	89.010
T_4 ($^\circ\text{C}$)	42.92	44.26
z_4 (m)	200	1000
h_4 (J kg^{-1})	43119	44471
h_4+gz_4	45079	54271
$q = \Delta h$ (J kg^{-1})	20093	30141
$w_{12} = \Delta h_{12}$ (J kg^{-1})	131.5	986.1
v_x (m s^{-1})	16.2	44.4
$n=100w_{12}/q_{01}$ (%)	0.65	3.25
Exit loss, $v^2/2$ (J kg^{-1})	50	200
Misc. loss, (J kg^{-1})	23	26
Collector Area (km^2)	0.06	40
Chimney diameter, d (m)	10	130
Chimney area, A (m^2)	78	13300
Velocity, v (m s^{-1})	10	20
Mass Flow $M = \rho v A$ (kg s^{-1})	860	282000
Power Ideal $P_i = M w_{12}$ (kw)	113	278000
Power Actual P_a Ideal - Loss (kw)	50	214000