

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