Energy absorption: $E_{in} = (1-\alpha)S_0 A_{sun} = (1-\alpha)S_0 \pi R^2 = 1.2247 \cdot 10^{11}\ W$

Boltzmann's law: $E_{out} = \sigma T^4 A_{earth} = \sigma T^4 4\pi R_{earth}^2 = 1.2247 \cdot 10^{11}\ W$

Water isotopes: $\delta^{18}O = \frac{\%^{18}O\ in\ vapour - \%^{18}O\ in\ water}{\%^{18}O\ in\ water} = \frac{0.208\% - 0.210\%}{0.210\%} = -0.01 = -1\%$

Doubling time: $T_2 = \frac{\ln 2}{rate\ of\ growth}$ **Heat flow:** $\dot{Q} = -A\frac{\Delta T}{R_{total}}$ **Wing load:** $WL = \frac{W}{S}$

Combustion: $C_xH_y + \left(x + \frac{y}{4}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O + heat$ **Power:** $P = D \cdot V = \frac{1}{2}\rho V^3 S C_D$

Fischer-Tropsch: $(2n+1)H_2 + nCO \rightarrow C_nH_{2n+2} + nH_2O$ **Drag coefficient:** $C_D = C_{D_0} + \frac{C_L^2}{\pi Ae}$

Photosynthesis: $6CO_2 + 6H_2O + light \rightarrow C_6H_{12}O_6 + 6O_2$ **Lift coefficient:** $C_L = \frac{W}{\frac{1}{2}\rho V^2 S}$

Plank's radiation: $E(\lambda, T) = \frac{2hc^2}{\lambda^5}\frac{1}{e^{\frac{hc}{\lambda kT}} - 1}$ **Boltzmann's law:** $E(T) = \int_0^\infty E(\lambda,T)d\lambda = \sigma T^4 = \varepsilon\sigma T_s^4$

Solar power: $P_{sun} = I_{sun}A_f = I_{sun}\pi R_{earth}{}^2 = 1.74 \times 10^{15}$ **Aspect ratio:** $A = \frac{b^2}{S}$

Intensity: $I_{ground,av} = \frac{P_{sun}}{4\pi R^2} = \frac{I_{sun}}{4} = 342\ W/m^2$ **Sun hours:** $sh = \frac{2}{15}\cos^{-1}[-\tan\delta\tan\varphi]$

Tip speed: $U = \Omega R = \frac{2\pi RN}{60}$ **Tip speed ratio:** $\lambda = \frac{U}{V} = \frac{\Omega R}{V}$ $\left(\frac{\mathbf{C_D}}{\mathbf{C_L}}\right)_{\mathbf{min}} \rightarrow C_L = \sqrt{C_{D_0}\pi Ae}$

Wind power: $P = E_{kin} = \frac{1}{2}\rho A V^3$ **Annual electricity production:** $E = KV_m^3 A_t T\ with\ K = 3.2$

Air mass: $air\ mass = \frac{actual\ distance\ atmosphere}{minimal\ distance\ atmosphere} = \frac{1}{\cos\theta_i}$ $\delta = -23.45\sin\left[\frac{360}{365}(284+n)\right]$

Incidence angle: $\cos\theta_i = (\cos\varphi\cos\beta + \sin\varphi\sin\beta\cos\gamma)\cos\delta\cos\omega + \cos\delta\sin\omega\sin\beta\sin\gamma + \sin\delta(\sin\varphi\cos\beta - \cos\varphi\sin\beta\cos\gamma)$ **for $\boldsymbol{\beta = 0}$:** $\cos\theta_i = \cos\varphi\cos\delta\cos\omega + \sin\delta\sin\varphi$

	Conduction	Convection
Heat flow	$\dot{Q} = -kA\frac{dT}{dt}$	$\dot{Q} = hA\Delta T$
Thermal resistance	$R = \frac{t}{k}$	$R = \frac{1}{h}$
Thermal diffusivity	$\alpha = \frac{heat\ conducted}{heat\ stored} = \frac{k}{\rho c_p}$	
Constants	k = thermal conductivity	h = local heat transfer coefficient

Sun's black body temp.: $T = 5777\ K$ **Sun's diameter:** $d_s = 1.4 \cdot 10^6\ km$

Plank's constant: $h = 6.626 \cdot 10^{-34}\ Js$ **Speed of light:** $c = 2.998 \cdot 10^8\ {}^m/_s$

Boltzmann's constant: $k = 1.381 \cdot 10^{-23}\ {}^J/_K$ **Stefan's constant:** $\sigma = 5.670 \cdot 10^{-8}\ {}^W/_{m^2K^4}$

Solar intensity: $S_0 = I_{sun} = 1366\ {}^W/_{m^2}$ **Earth's radius:** $R_{earth} = 6371\ km$

Earth's rotation: $\omega = 15\ {}^\circ/_{hr}$ **Earth's albedo:** $\alpha = 30\% = 0.30$

Equilibrium temperature: $T_{eq} = -17.9°C$ **kWh/y to kW:** $E = \frac{x}{365 \cdot 24}$

From/to	Chemical	Electrical	Heat	Light	Mechanical
Chemical	Reaction	Battery/fuel cell	Fire	Fire	Engine/rocket
Electrical	Battery	Transformer	Radiator	Light bulb	Electric engine
Heat	Gasification	Thermocouple	Heat exchanger	Fire	Steam engine
Light	Photosynthesis	Solar cell	Radiation	Prisma	Solar sail
Mechanical	Heat cell	Dynamo/Generator	Friction	Flint spark	Gearbox