Sankey Diagram

The Sankey diagram makes the different aspects of the total power loss visible. What isn't lost is used for the solar car to gain speed.

On a clear day the intensity of the sun is between 600-1000 $W/m^2$. The race is only going to take place on a sunny day. We assumed the intensity of the sun is going to be 900 $W/m^2$. Not all energy from the sun can be used because of diffuse radiation, this is 10-20% of the total radiation of the sun. So we assume the intensity to be used by our car is going to be 800$W/m^2$.

The size of our panel is 0,04 $m^2$ (=A).
$P_{on\ sun\ panel}$= A*intensity of radiaton on panel = 0,04$m^2$ * 800 $W/m^2$ = 32W

$P_{used\ on\ eq}$ = $U_{eq}.I_{eq}$= 7,8V.0,4034A= 3,14W loss of 28,86 W

Assumed average efficiency of the motor and transmission= 70%
3,14.0,7 = 2,20 W loss of 0,942 W

Aerodynamic drag losses:
$P_{aero} = A_{frontal} * C_{drag} * V^3 * \rho_{air}/2$
$A_{frontal}$ = Vehicle frontal area ($m^2$) = (in the part about the solar calculations the angles of the sun in the period the race takes place are calculated, if we assume we race 15:00 the sun light will have an angle of 50 degrees on the racing platform so that's probably going to be the angle of the solar panel on the vehicle[1]) + the frontal area of the body itself = sin50°.0,04$m^2$ + 0,02m (width).0,008m (height of the body material)= 0,0308 $m^2$
$C_D$ = coefficient of drag of vehicle = 0,5 (cone formed)
V = vehicle velocity (m/s) = 4,07 m/s (assumed average)
$\rho_{air}$= atmospheric density, $kg/m^3$ = 1,1 $kg/m^3$
$P_{aero\ loss}$= 0,57 W
P= 2,2W -0,57W = 1,63W loss of 0,57W

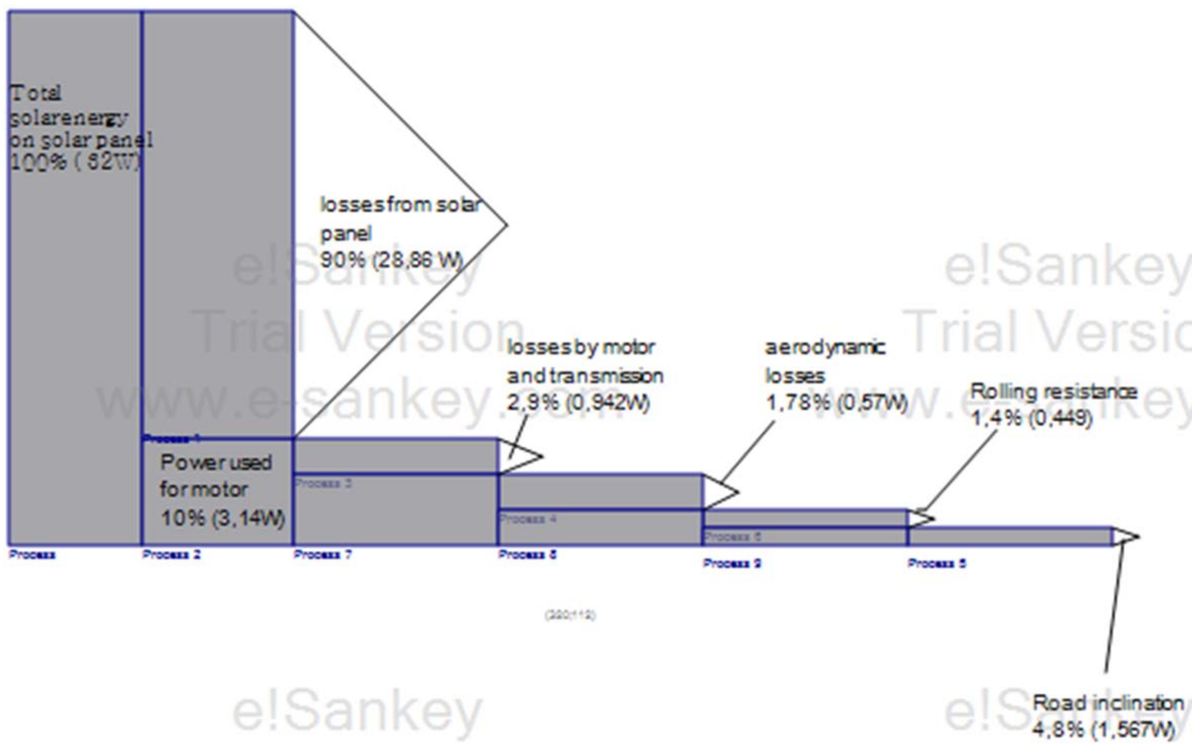
Rolling resistance losses:
$F_{rolling} = C_{rr}.N$ $C_{rr}$=0,015; N = 0,75*9,81= 7,358 N
$F_{rolling}$= 0,11037N
$P_{loss\ rolling}$= 0,11037N * 4,07m/s $P_{lost}$= 0,449 W
P=1,63-0,449W = 1,181W loss of 0,449 W

The car would keep speeding up till right before the slope.

Power losses because of road inclination:
$P_{loss}$ = 9,81m/s.0,75kg.sin3°.4,07m/s = 1,567W
P=1,181W – 1,567W = -0,386W

With the values, used for this sankey diagram, the car would slow down on the slope.

[1] It's the maximum frontal area of the solar panel on that time, because the sun light could come in sideways. Then the frontal area will be smaller.


Total solarenergy on solar panel 100% ( 32W)
losses from solar panel 90% (28,86 W)
Power used for motor 10% (3,14W)
losses by motor and transmission 2,9% (0,942W)
aerodynamic losses 1,78% (0,57W)
Rolling resistance 1,4% (0,449)
Road inclination 4,8% (1,567W)
Process
Process 1
Process 2
Process 3
Process 4
Process 5
Process 6
Process 7
Process 8
Process 9
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