Bicycle Power Calculator - Equations

$E_{in} = E_{out} + \Delta$ Energy Stored E = Energy

W_{IN} = INPUT POWER FROM RIDER

$$E_{in} = W_{IN} \times \Delta t \times \left(1 - \frac{n}{100}\right)$$

n = mechanical losses %

v = bicycle velocity

E_{OUT} is due to external forces such as wind drag, rolling resistance

these have form of Force × distance traveled (d)

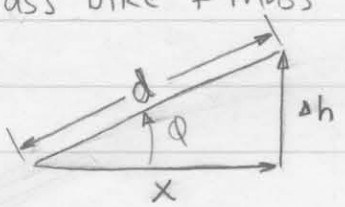
Wind Drag	Rolling Resistance
Fdrag · distance	Frr · distance
$F_{drag} = C_d A v^2$ (drag coeff)	$F_{rr} = C_{rr}$ Weight (rolling resistance coeff)
3.5 # @ 20 mph	.004 racing, .014 Knobby tires

Δ Energy Stored = Δ Kinetic energy + Δ Potential Energy

(Steady speed)

$= 0 + mg \cdot \Delta h$ (m = mass bike + mass rider)

$$\% \text{ Grade} = \frac{\Delta h}{x} \times 100$$



$$W_{in} \cdot \Delta t \times \left(1 - \frac{n}{100}\right) = C_d A v^2 \cdot d + C_{rr} mg \cdot d + mg \cdot d \sin\theta$$

$$\Delta h = d \sin\theta \qquad \tan\theta = \frac{\Delta h}{x} \qquad \theta = \tan^{-1}\left(\frac{\text{Grade}}{100}\right)$$

$$W_{in}\left(1 - \frac{n}{100}\right) = C_d A v^2 \cdot \frac{d}{\Delta t} + C_{rr} mg \cdot \frac{d}{\Delta t} + mg \cdot \frac{d}{\Delta t} \sin\theta$$

$$W_{IN}\left(1 - \frac{n}{100}\right) = C_d A v^3 + \left[C_{rr} mg + mg \sin\theta\right] v$$