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Hydroelectric Power Generation Formulas

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List of 15 Hydroelectric Power Generation Formulas

Hydroelectric Power Generation

1) Flow Rate for Power obtained from Water Flow in Horsepower

$$\text{fx } Q_t = \frac{P \cdot 8.8}{\eta \cdot H}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 0.460194\text{m}^3/\text{s} = \frac{170\text{W} \cdot 8.8}{14 \cdot 232.2\text{m}}$$

2) Flow Rate given Power in Kilowatt

$$\text{fx } Q_t = \frac{P \cdot 11.8}{\eta \cdot H}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 0.617079\text{m}^3/\text{s} = \frac{170\text{W} \cdot 11.8}{14 \cdot 232.2\text{m}}$$

3) Flow Rate given Power obtained from Water Flow in Horsepower

$$\text{fx } F = \frac{P \cdot 550}{\eta \cdot H \cdot \gamma_w}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 0.002932\text{m}^3/\text{s} = \frac{170\text{W} \cdot 550}{14 \cdot 232.2\text{m} \cdot 9.81\text{kN}/\text{m}^3}$$



4) Flow Rate given Power obtained from Water Flow in Kilowatt

$$\text{fx } F = \frac{P \cdot 738}{\eta \cdot H \cdot \gamma_w}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 0.003934 \text{m}^3/\text{s} = \frac{170 \text{W} \cdot 738}{14 \cdot 232.2 \text{m} \cdot 9.81 \text{kN}/\text{m}^3}$$

5) Potential Energy of Volume of Water in Hydroelectric Power Generation

$$\text{fx } PE = \gamma_w \cdot h$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 117.72 \text{J} = 9.81 \text{kN}/\text{m}^3 \cdot 12 \text{m}$$

6) Total Weight of Water given Potential Energy in Hydroelectric Power Generation

$$\text{fx } \gamma_w = \frac{PE}{h}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{ex } 9.766667 \text{kN}/\text{m}^3 = \frac{117.2 \text{J}}{12 \text{m}}$$



Effective Head

7) Effective Head for Power in Kilowatt

$$\text{fx } H = \frac{P \cdot 11.8}{Q_t \cdot \eta}$$

[Open Calculator !\[\]\(23d9fc146e83b5c3013cfa32c784f8d5_img.jpg\)](#)

$$\text{ex } 311.4907\text{m} = \frac{170\text{W} \cdot 11.8}{0.46\text{m}^3/\text{s} \cdot 14}$$

8) Effective Head for Power obtained from Water Flow in Horsepower

$$\text{fx } H = \frac{P \cdot 8.8}{Q_t \cdot \eta}$$

[Open Calculator !\[\]\(aa53ad6fea213b8b2226d3077e30533a_img.jpg\)](#)

$$\text{ex } 232.2981\text{m} = \frac{170\text{W} \cdot 8.8}{0.46\text{m}^3/\text{s} \cdot 14}$$

Efficiency of Turbine

9) Efficiency of Turbine and Generator for Power obtained from Water Flow in Horsepower

$$\text{fx } \eta = \frac{P \cdot 8.8}{Q_t \cdot H}$$

[Open Calculator !\[\]\(a8f9309f944226d1420f5fed22e2b6e6_img.jpg\)](#)

$$\text{ex } 14.00592 = \frac{170\text{W} \cdot 8.8}{0.46\text{m}^3/\text{s} \cdot 232.2\text{m}}$$



10) Efficiency of Turbine and Generator given Power in Kilowatt

$$\text{fx } \eta = \frac{P \cdot 11.8}{Q_t \cdot H}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 18.78066 = \frac{170\text{W} \cdot 11.8}{0.46\text{m}^3/\text{s} \cdot 232.2\text{m}}$$

11) Efficiency of Turbine and Generator given Power obtained from Water Flow in Horsepower

$$\text{fx } \eta = \frac{P \cdot 550}{Q_t \cdot H \cdot \gamma_w}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 89.2324 = \frac{170\text{W} \cdot 550}{0.46\text{m}^3/\text{s} \cdot 232.2\text{m} \cdot 9.81\text{kN}/\text{m}^3}$$

12) Efficiency of turbine and generator given Power obtained from water flow in Kilowatt

$$\text{fx } \eta = \frac{P \cdot 738}{F \cdot H \cdot \gamma_w}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 11.0155 = \frac{170\text{W} \cdot 738}{0.005\text{m}^3/\text{s} \cdot 232.2\text{m} \cdot 9.81\text{kN}/\text{m}^3}$$



Power obtained from Water Flow

13) Power obtained from Water Flow in Horsepower

$$\text{fx } P = \frac{\eta \cdot Q_t \cdot H \cdot \gamma_w}{550}$$

[Open Calculator !\[\]\(950a62bbddad88d64435fd35607dfc42_img.jpg\)](#)

$$\text{ex } 26.67193\text{W} = \frac{14 \cdot 0.46\text{m}^3/\text{s} \cdot 232.2\text{m} \cdot 9.81\text{kN}/\text{m}^3}{550}$$

14) Power obtained from Water Flow in Kilowatt

$$\text{fx } P = \frac{H \cdot Q_t \cdot H \cdot \gamma_w}{738}$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

$$\text{ex } 329.6818\text{W} = \frac{232.2\text{m} \cdot 0.46\text{m}^3/\text{s} \cdot 232.2\text{m} \cdot 9.81\text{kN}/\text{m}^3}{738}$$

15) Power obtained from Water Flow in Kilowatt given Effective Head

$$\text{fx } P = \frac{\eta \cdot Q_t \cdot H}{11.8}$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$\text{ex } 126.7261\text{W} = \frac{14 \cdot 0.46\text{m}^3/\text{s} \cdot 232.2\text{m}}{11.8}$$



Variables Used

- **F** Flow rate (*Cubic Meter per Second*)
- **h** Vertical Distance Water can Fall (*Meter*)
- **H** Effective Head (*Meter*)
- **P** Hydroelectric Power (*Watt*)
- **PE** Potential Energy (*Joule*)
- **Q_t** Discharge from Dam (*Cubic Meter per Second*)
- **γ_w** Unit Weight of Water (*Kilonewton per Cubic Meter*)
- **η** Efficiency of Turbine



Constants, Functions, Measurements used

- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Energy** in Joule (J)
Energy Unit Conversion 
- **Measurement: Power** in Watt (W)
Power Unit Conversion 
- **Measurement: Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
Volumetric Flow Rate Unit Conversion 
- **Measurement: Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
Specific Weight Unit Conversion 



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