



## Pumping Water - Energy Cost Calculator

### The energy costs of pumping water

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The energy cost per hour for pumping water can be calculated in imperial units as

$$C = 0.746 Q h c / (3960 \mu_p \mu_m) \quad (1)$$

where

$C$  = cost per hour (USD/hour, EUR/hour, ...)

$Q$  = volume flow (US gpm)

$h$  = differential head (ft)

$c$  = cost rate per kWh (USD/kWh, EUR/kWh, ....)

$\mu_p$  = pump efficiency (0 - 1)

$\mu_m$  = motor efficiency (0 - 1)

Alternative calculation in metric units

$$\begin{aligned} C &= q \rho g h c / (3.6 \cdot 10^6 \mu_p \mu_m) \\ &= q p c / (3.6 \cdot 10^6 \mu_p \mu_m) \end{aligned} \quad (2)$$

where

$q$  = volume flow ( $m^3/h$ )

$\rho$  = *density* ( $1000 \text{ kg}/m^3$ )

$h$  = differential head, height (m)

$g$  = *acceleration of gravity* ( $9.81 \text{ m}/s^2$ )

### Example - Pumping Energy Cost

10 US gpm is lifted 10 ft. The electricity cost is 0.1 USD/kWh and the pump and motor efficiency 90% (0.9). The cost per hour can be calculated as

$$C = 0.746 (10 \text{ US gpm}) (10 \text{ ft}) (0.1 \text{ USD/kWh}) / (3960 \cdot 0.9 \cdot 0.9)$$

$$= \underline{0.002 \text{ USD/hour}}$$

### Pumping Energy Cost Calculator

Q - Volume flow (US gpm)

h - head (ft)

c - cost rate per kWh (USD/kWh, EUR/kWh, ....)

$\mu_p$  = pump efficiency

$\mu_m$  = motor efficiency

**Calculate!**

- 1 US gpm = 0.227 m<sup>3</sup>/h
- 1 ft = 0.305 m

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Pipe Flow Software

## Related Topics

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- **Pumps** - Piping systems and pumps - centrifugal pumps, displacement pumps - cavitation, viscosity, head and pressure, power consumption and more

## Related Documents

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- **Centrifugal Pumps** - An introduction to Centrifugal Pumps
- **Classifications of Pumps** - Selecting between Centrifugal Pumps and Positive Displacement Pumps
- **Pump - Volume Flow and Temperature Rise** - Calculate temperature rise in pumps
- **Pump Power Calculator** - Calculate pump hydraulic and shaft power
- **Pumping Water - Required Horsepower** - Horsepower required to pump water
- **Pumps in Parallel or Serial** - For pumps connected in serial - add head, for pumps connected in parallel - add flowrates
- **Water - Thermophysical Properties** - Thermal properties of water - density, freezing temperature, boiling temperature, latent heat of melting, latent heat of evaporation, critical temperature and more

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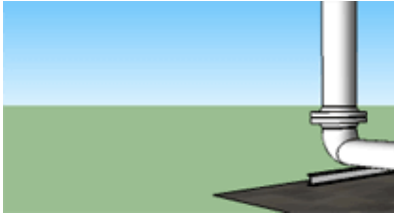
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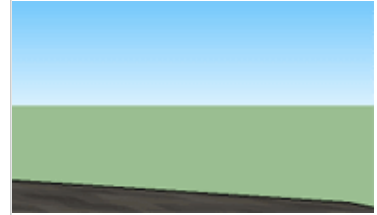
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### Unit Converter

#### Temperature

0.0

☒ °C

☐ °F

Convert!

#### Length

1.0

☒ m

☐ km

☐ in

☐ ft

☐ yards

☐ miles

☐ naut miles

Convert!

#### Area

1.0

☒ m<sup>2</sup>

☐ km<sup>2</sup>

☐ in<sup>2</sup>

☐ ft<sup>2</sup>

☐ miles<sup>2</sup>

☐ acres

**Convert!**

## Volume

1.0

- ☒  $m^3$
- ☐ *liters*
- ☐  $in^3$
- ☐  $ft^3$
- ☐ *us gal*

**Convert!**

## Weight

1.0

- ☒  $kg_f$
- ☐  $N$
- ☐  $lb_f$

**Convert!**

## Velocity

1.0

- ☒  $m/s$
- ☐  $km/h$
- ☐  $ft/min$
- ☐  $ft/s$
- ☐  $mph$
- ☐ *knots*

**Convert!**

## Pressure

1.0

- ☒  $Pa (N/m^2)$
- ☐ *bar*
- ☐  $mm H_2O$
- ☐  $kg/cm^2$
- ☐ *psi*
- ☐ *inches*

 $H_2O$ **Convert!**

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Flow

1.0

- ☒  $m^3/s$
- ☐  $m^3/h$
- ☐ US gpm
- ☐ cfm

Convert!

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