



## How It Works

- Water is stored behind the Dam in a reservoir
- A gate in the dam opens and closes allowing the water to flow down the penstock
- The water flows down the penstock and spins a turbine
- The turbine spins the rotor, which has large electromagnets located within coils of copper wire.
  - this creates a flow of electrons (current) and therefore, creating electricity that can then be stepped up in voltage using transformers
- The water then goes back into the river and electricity is made from the spinning turbine



## Advantages



- Renewable Power
- Non-polluting
- Prevents floods (unless the dam breaks)
- Once the dam is built, the energy is virtually free.
- Hydro-electric power stations can increase to full power very quickly, unlike other power stations.
- Electricity can be generated constantly.
- Much more reliable than wind, solar or wave power.

## Quiz Time!

Hydroelectric power means using water.  
Nowadays this turns a turbine which runs  
a \_\_\_\_\_ to make electricity.

- a) Turbine
- b) Rotor
- c) Dam
- d) Electromagnet

A \_\_\_\_\_ creates a large amount of stored water called a “reserve” that the hydroelectric power plant can draw water from.

- a) Wall
- b) Lake
- c) Dam
- d) River

## Where is Hydroelectricity Used?

- Top Producing Countries
  - China: 585.2 Gigawatt hours
  - Canada: 369.5 Gigawatt hours
  - Brazil: 363.8 Gigawatt hours
- Top Producing Countries by Percentage
  - Paraguay: ≈100%
  - Norway: 98%
  - Brazil: 85%



Three Gorges Dam:  
-Yangtze river  
-Largest Hydroelectric plant in the World  
-Estimated 39 billion U.S. Dollars to build  
-22,500 megawatt capacity  
-construction displaced approximately 1.25 million Chinese citizens

## Hydroelectricity in the U.S.

Highest Producing  
Hydroelectric Plants in  
the United  
States:

- Grand Coulee Dam:
  - Columbia River
  - 6,809 megawatt capacity
- Chief Joseph Dam:
  - Columbia River
  - 2,620 megawatt capacity
- Robert Moses Niagara  
Power Plant
  - Niagara River
  - 2,515 megawatt capacity



Grand Coulee Dam,  
Coulee City, WA



Niagara Power Plant  
Lewiston, NY



Chief Joseph Dam:  
Bridgeport, WA

## Where can Hydroelectric Power be Used?

-Since all that is required to harness hydroelectric power is moving water this means that hydroelectric power can be employed nearly everywhere.

-New technologies are opening up possibilities to harness electricity from nearly any body of water.

Examples:

- Oceans
  - tidal power
  - wave power
  - marine current power
  - hydrothermal energy conversion
- Rivers
  - hydroelectric dams
  - damless hydro
- Standing bodies (Lakes)
  - vortex power

## Hydroelectric Power Efficiency

Overall hydroelectric power is extremely efficient as it directly converts mechanical (kinetic) energy of moving water into electric power. This is significantly different from many other forms of producing energy as it has no intermediary thermodynamic or chemical processes that result in heat losses.

- Hydroelectric dams:
  - 80-95%
- Tidal Power
  - 85-90%



## Disadvantages

- The dams are very expensive to build. However, many dams are also used for flood control or irrigation, so building costs can be shared.
- Building a large dam will flood a very large area upstream, causing problems for animals that used to live there.
- Finding a suitable site can be difficult - the impact on residents and the environment may be unacceptable.
- Water quality and quantity downstream can be affected, which can have an impact on plant life.

## Extra Cool Stuff!

- Hydroelectric footwear!
- <http://science.howstuffworks.com/hydropower-plant4.htm>

## Quiz Time!

True or False?

Hydroelectric energy is renewable.

Which one of the following is not a disadvantage?

- a) Dams are expensive to build
- b) Large dams can create flooding upstream which impacts the wildlife
- c) Water quality and quantity downstream can be affected
- d) It can be used to control excessive flooding on some rivers

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