Hydro-Electric Generation System

* Moving water to produce mechanical/electrical energy
* BC Hydro – 43 000 gigawatt hours annually to 1.6 million residents
* 73 000 km of transmission and distribution lines
* Hydroelectric dams
	+ Potential energy is stored in a reservoir behind the dam
	+ Potential energy is transformed into kinetic energy when the water starts moving
	+ The kinetic energy is used to spin a turbine
* Generator
	+ The kinetic energy is turned into mechanical energy when the water hits a series of blades
	+ The turbine, which is connected to a generator, rotates, turning the mechanical energy into electrical energy
* Step-up Transformer
	+ Generators use a low voltage to produce electricity
	+ However, it takes a high voltage to transport the electricity
	+ The transformer ups the low voltage of the generator
* Grid High Voltage Transmission Lines
	+ Transport the electricity from the step-up transformer over long distances
* Terminal Stations
	+ Control the power flow
	+ Reduce the voltage to “sub transmission voltage”
* Sub-transmission Lines
	+ Take power from the terminal stations to distribution centres
* Use of the Customer
	+ Most take the power and put into a transformer for their household
	+ Some take the energy at transmission voltage level, like large companies
* Distribution Substation
	+ Transformers, meters, control and protective devices
	+ Transmission voltage is reduced to proper levels for residential and small companies
* <https://www.bchydro.com/energy-in-bc/our_system/generation/electric_generation.html>
* Efficiency is an average of 90%

Hydropower Plants Work

* 675 000 megawatts (the total world output) = 3.6 billion barrels of oil
* Largest source of renewable energy in the United States of America
* Pumped storage plants
	+ Upper Reservoir
		- Flows through the plant to create electricity
	+ Lower Reservoir
		- Keeps the water from entering back into the lake/river
	+ Reversible turbine
		- Pump the water BACK into the upper reservoir
		- Gives the plant more water to make electricity during peak season
	+ Generator
		- Heart of the plant
		- Generates the electricity
		- Rotate magnets inside coils of wire
			* Moves electrons to produce electricity
	+ Excitor
		- Send electrical currents to the rotor
	+ Rotor
		- Large electromagnets that spin inside the stator (tightly-wound coils of copper wire)
* <http://science.howstuffworks.com/environmental/energy/hydropower-plant3.htm>

Thermal Power Stations

* Fuel (coal, oil, gas, etc…) is burned into a furnace to produce heat or chemicals to produce heat
* The heat changes the water in the boiler into steam
	+ The steam turns the turbine
	+ The turbine powers a generator that turns kinetic energy into electrical energy
* <http://www.bbc.co.uk/bitesize/standard/physics/energy_matters/generation_of_electricity/revision/1/>
* The steam is condensed and recycled to where it was heated
* Efficiency is normally between 33-48%
* Typically found in desert countries where natural gas is plentiful
* Cost is quite large due to need for workers and proper disposal
* If plant produces more than 200MW, fans must be included
* Plants can range from 60MW – 5500MW
* <https://en.wikipedia.org/wiki/Thermal_power_station>