

Wednesday 4th April 2018

Evaluating Energy Sources

ESS 2018

Starter: Energy Background Knowledge Quiz.

Learning objectives

Level 4	Level 5	Level 6
Describe the significant aspects of an energy source	Describe the significant aspects of an energy source and comment on the good and the bad	Describe the significant aspects of an energy source, comment on the good and the bad, and suggest a better alternative

Energy Sources

Non-renewable

- Fossil fuels (coal, oil, natural gas)
- Nuclear fuel (uranium)

Renewable

- Hydroelectric power
- Biomass
- Wood

Energy Sources



Renewable

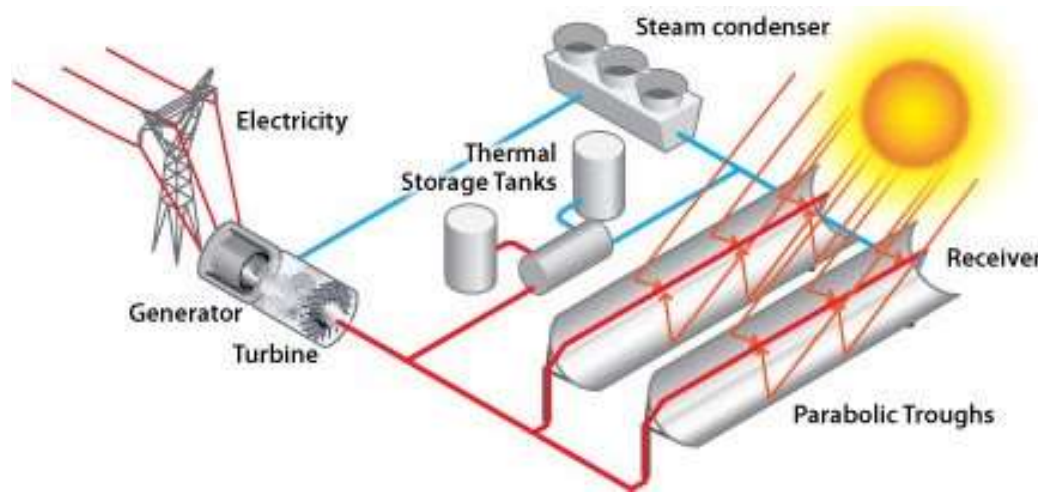
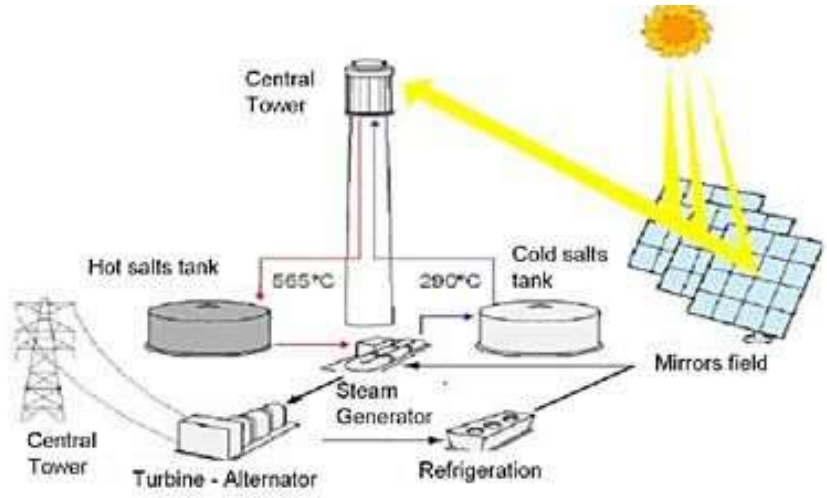
- Solar
 - Photovoltaic cells (electricity)
 - Concentrated power (electricity)
 - Passive (heating water)
- Wind
- Tidal
- Wave
- Geothermal



Concentrated Solar Power

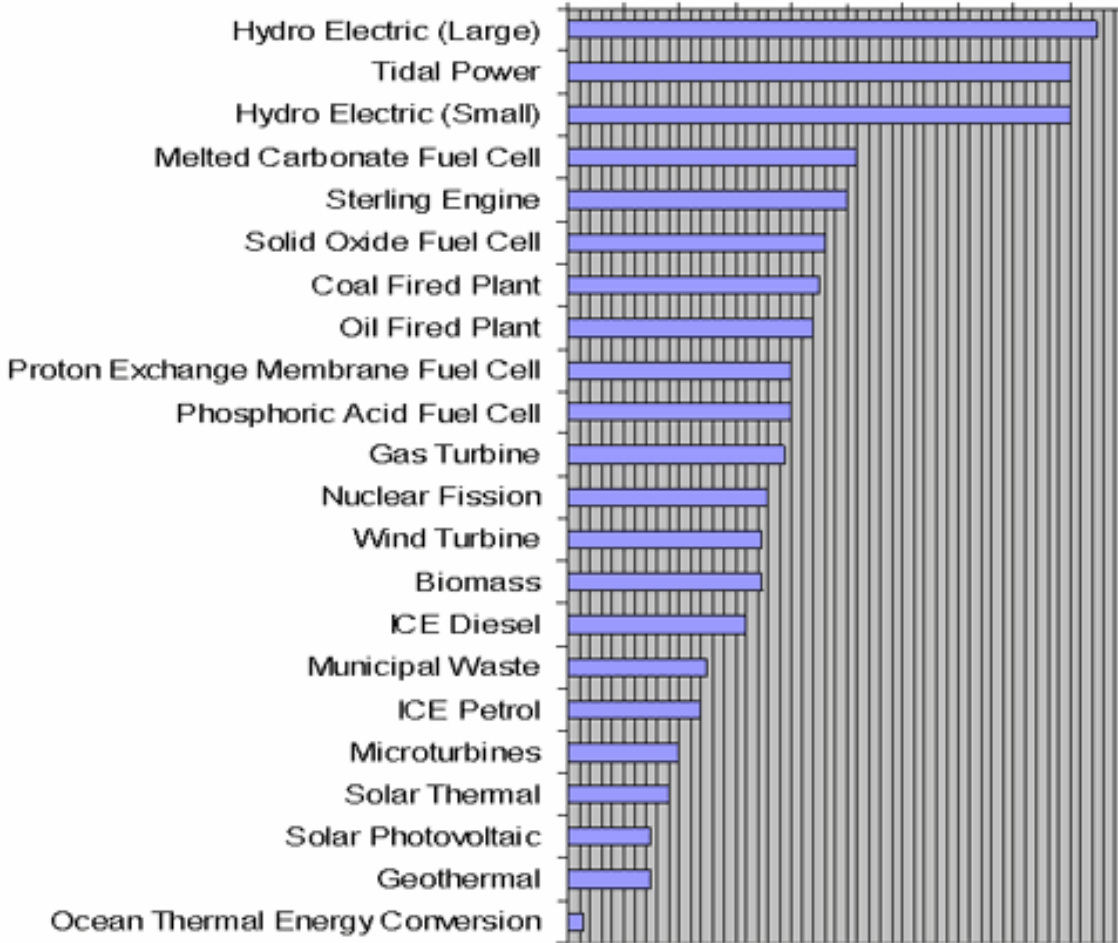
Mirrors focus sunlight (heat energy) to melt salt
Salt can absorb a lot of energy and as a liquid store it for a longer time e.g. night
Spain ($\approx 2300\text{MW}$), USA ($\approx 1740\text{MW}$)

1 MW \approx 650 homes



Electricity Generation Efficiencies (%)

0 10 20 30 40 50 60 70 80 90 100



Efficiency = **useful electricity output** ÷ **total energy input**
ratio (%) over a specific time period

E.g. steam turbines, 65% of all energy is wasted as heat. Maximum theoretical efficiency is about 40% for modern systems (less for older)

For domestic lighting, overall efficiency is...
Less than 1%

More than 99% is lost in production and transfer

How reliable is this efficiency measure?

(http://www.mpoweruk.com/energy_efficiency.htm)

PV	CSP
Residential and power plant ✓	Only power plant
Scales up and down ✓	Difficult to scale
No need for transmission cables ✓	Transmission cables essential
Works with diffuse/indirect irradiation ✓	Works with direct irradiation
Difficult to store and use stored energy	More efficient storage and use ✓
Simpler technology ✓	More complex systems
Higher market and investment ✓	Restricted market and investment
Lower costs ✓	Higher costs
Less land needed (32375 m ² /MW) ✓	More land needed (40469 m ² /MW)
Requires rare metals ✗	Needs large amounts of steel and cement ✗

The better alternative seems to be PV especially because of lower costs that may make it more successful economically and culturally, and that it can be used on individual homes that is easier to implement. Although both do not produce pollution at source, both have negative impacts due to high land-use and destroy habitats due to extraction of materials. Also, indirectly, CSP contributes to climate change as cement production produces a lot of CO₂.