

# Solar Thermal Energy

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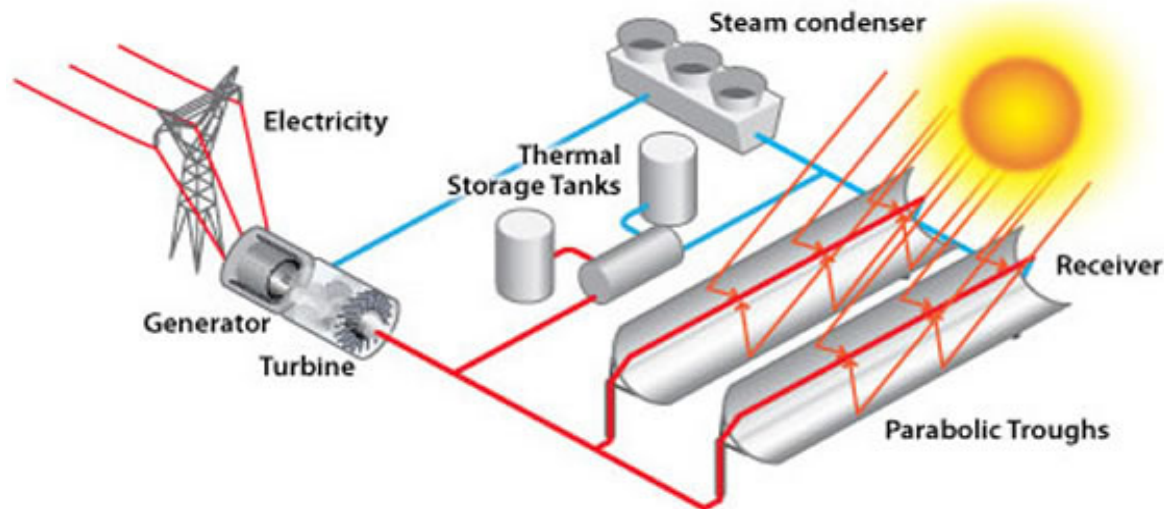
# What is Solar Thermal Energy ?

- ▶ A large-scale renewable energy technology
- ▶ Indirectly produces electricity using sunlight



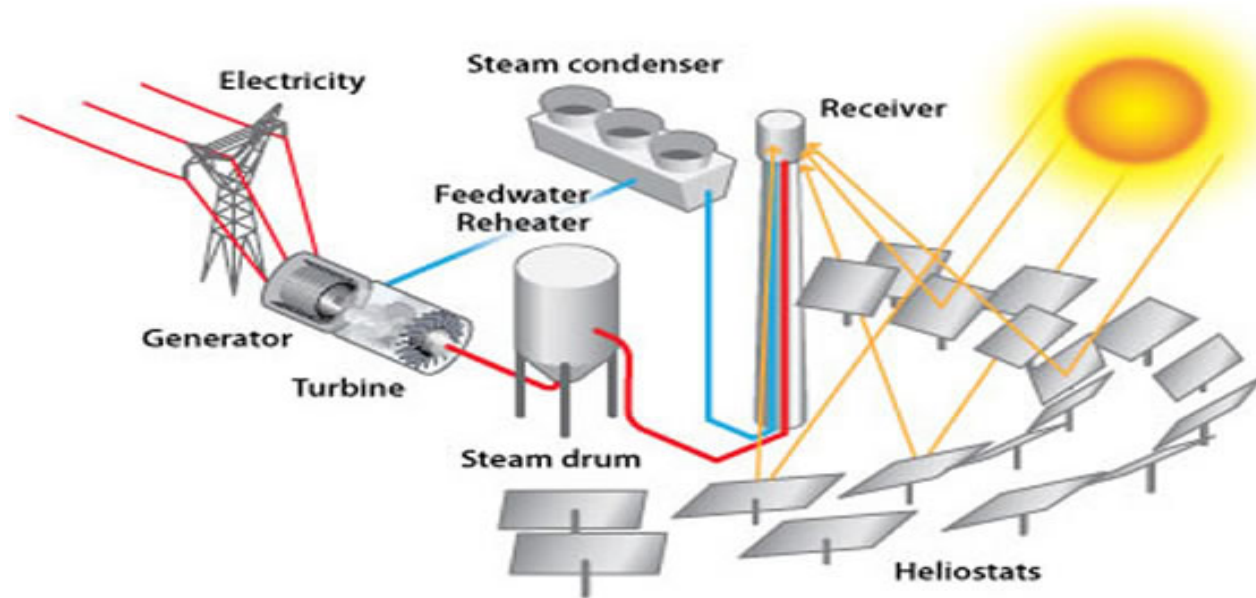
# How Solar Thermal Power works

1. Parabolic trough
  - ▶ Collector → Linear concentrator system
  - ▶ Concentrates sun's rays 30 to 100 times
  - ▶ Operating temperature can heat the fluid up to 400 °C
  - ▶ Produces 10 to 300 MW



## 2. Solar power tower system

- ▶ Uses two-axis tracked mirror called **heliostats**
- ▶ Concentrates sun's rays up to 1,500 times
- ▶ Operating temperature  $\rightarrow 1000\text{ }^{\circ}\text{C}$
- ▶ An individual commercial plant can produce up to 200 MW



### 3. Solar dish/ engine

- ▶ Produces a small amount of electricity compared to other solar thermal energy system
- ▶ Concentrates sun's rays up to 2,000 times
- ▶ Produces 3 to 25 KW



# Worldwide solar thermal power generation

- ▶ Spain and united states are the market leaders
- ▶ In 2013, 142 GW power electricity was produced worldwide
  - ▶ Only 2.4 % (3.4GW) was generated by solar thermal energy and the rest was generated by photovoltaic (PV)
- ▶ Solar thermal energy production increased by 36% in 2013

# Advantages

- ▶ Doesn't require any fuel
- ▶ Uniform and reliable power source
  - ▶ generates power 24 hours a day
- ▶ Doesn't pollute the atmosphere
- ▶ Uses an existing industrial base

# Disadvantages

- ▶ High cost
- ▶ Future technologies
  - ▶ has a high probability of being outdated
- ▶ Water issues
  - ▶ using non-water cooler increases the cost
- ▶ Location and size limitations

Questions ?

# Reference

[1] Schott Solar, parabolic trough technology, Schott Solar. [Online]. Available:

<http://www.us.schott.com/csp/english/parabolic-through-technology.html> [Accessed Nov. 7 2015]

[2] E. Zarza, Medium Temperature Solar Concentrators (Parabolic - Troughs Collectors), Solar Energy Conversion and Photoenergy Systems, Vol. 1. [Online]. Available: Encyclopedia of life support systems <http://www.eolss.net/sample-chapters/c08/e6-106-05.pdf> [Accessed Nov. 07 2015]

[3] renewable Energy world, Solar thermal power plants, Volker-Quaschning, Jun 2003. [Online]. Available: [http://www.volker-quaschning.de/articles/fundamentals2/index\\_e.php](http://www.volker-quaschning.de/articles/fundamentals2/index_e.php) [Accessed Nov. 8 2015]

[4] Office of Energy Efficiency & Renewable Energy, Concentrating Solar power, Office of Energy Efficiency & Renewable Energy, Aug. 2013. [Online]. Available: <http://energy.gov/eere/energybasics/articles/concentrating-solar-power-dishengine-system-basics> [Accessed Nov. 08 2015]

[5] REN21, renewable 2014 global status report, REN21. [Online]. Available:

[http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014\\_full%20report\\_low%20res.pdf](http://www.ren21.net/Portals/0/documents/Resources/GSR/2014/GSR2014_full%20report_low%20res.pdf) [Accessed Nov. 7 2015]