

Red de colaboración docente para el desarrollo, puesta en práctica y comunicación de sistemas de generación y consumo energético medioambientalmente sostenibles y socialmente justos

Introduction to Renewable Energies

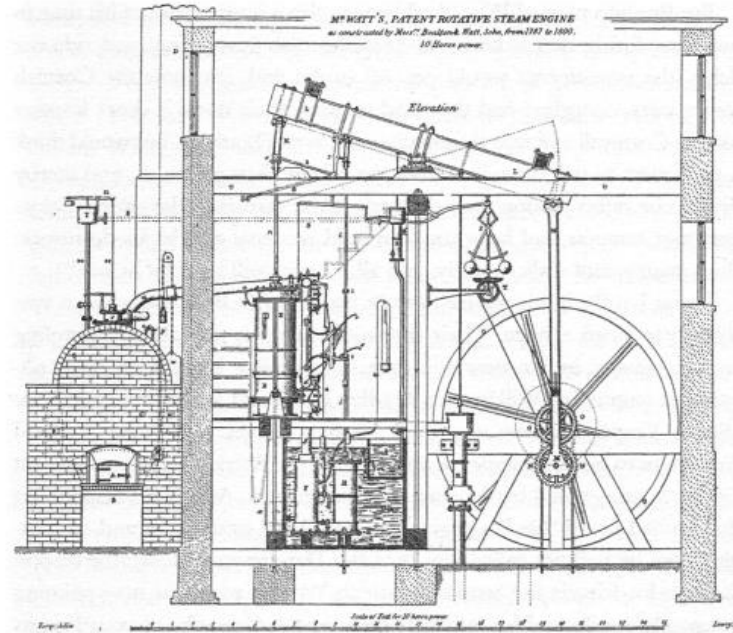


- Climate change
- Energy independence
- Cost





Herón, 75 a.D.



Patente de J. Watt (ca 1770) 10 BHP



Nuclear open rotor



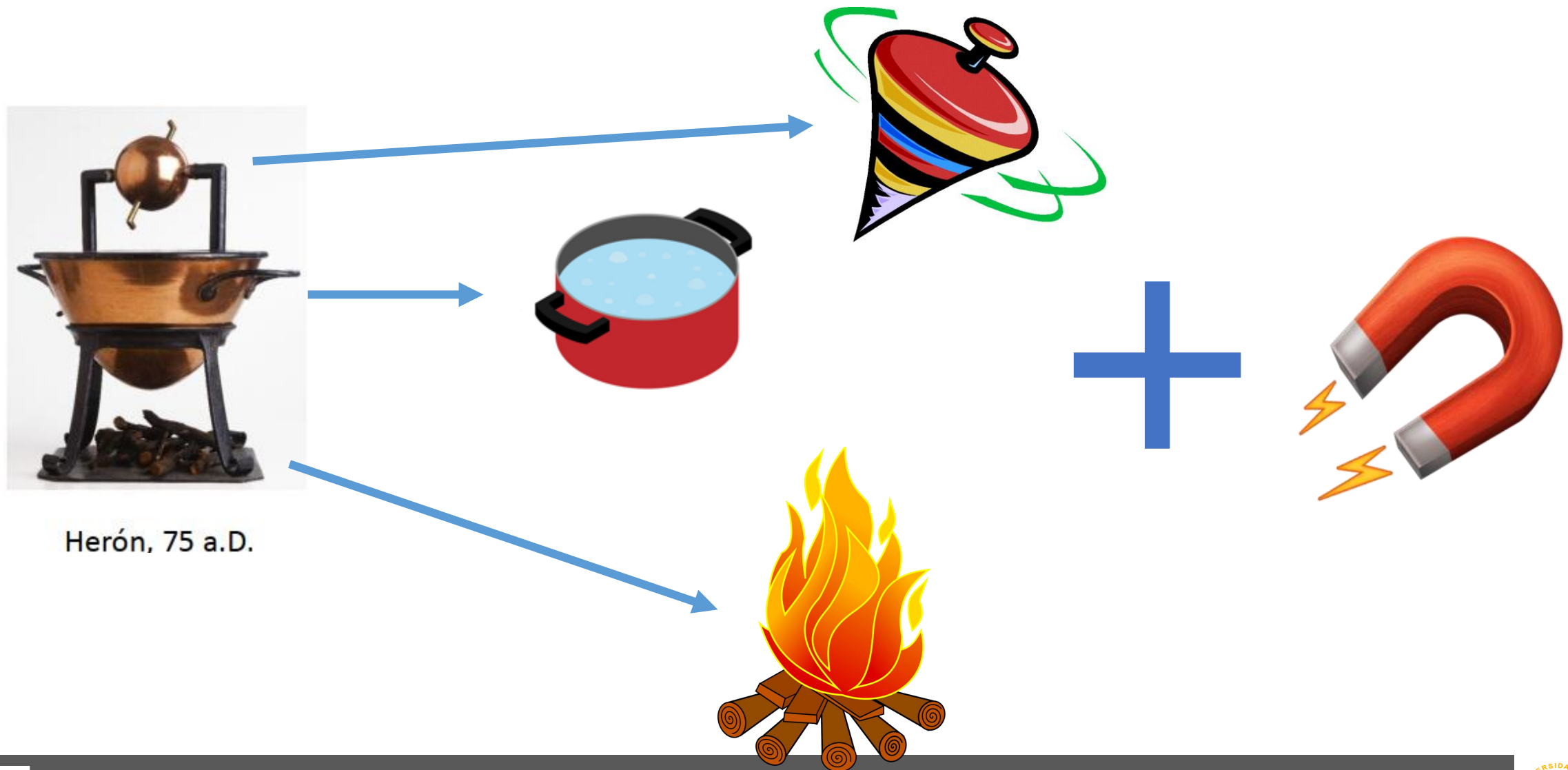
Herón, 75 a.D.



Generador Itaipú

Generador Guillena





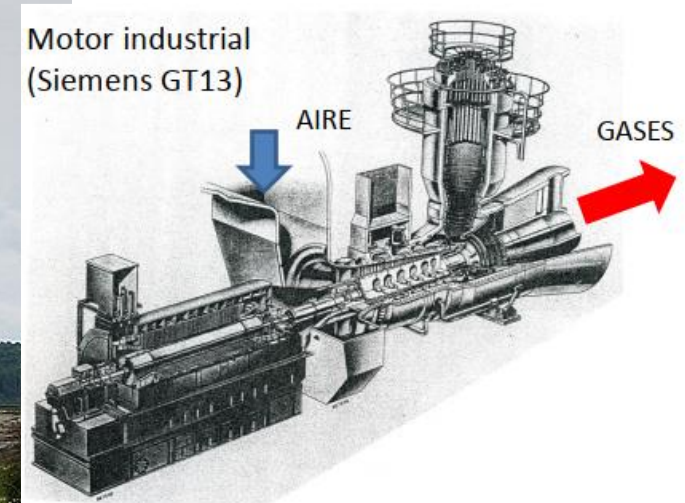
Herón, 75 a.D.

- No residues

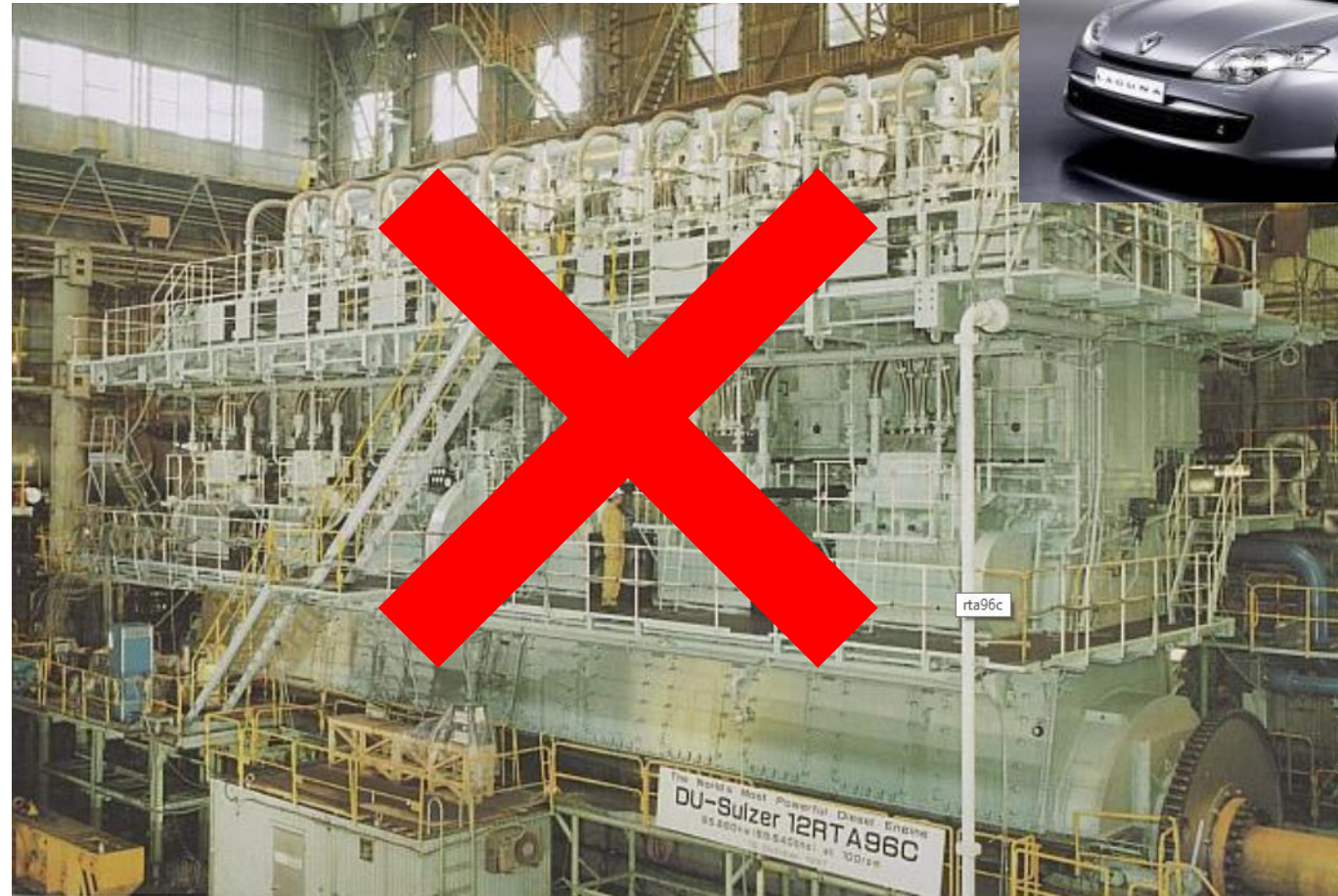
- No residues
- Coal



- No residues
- Coal ✗
- Natural Gas



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear ✗
- Biomass



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear ✗
- Biomass ✓
- Wind



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear ✗
- Biomass ✓
- Wind ✓
- Solar



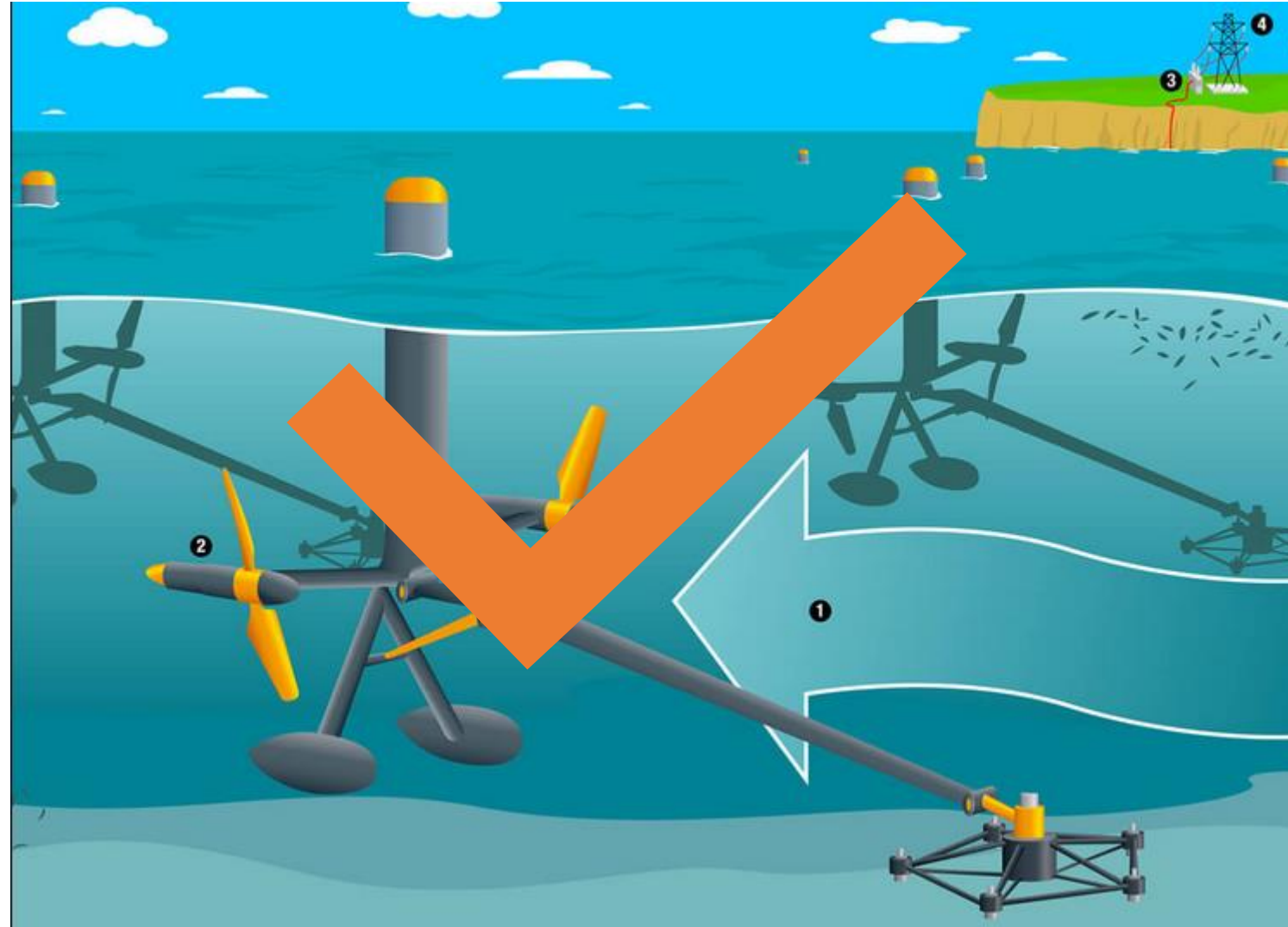
- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear ✗
- Biomass ✓
- Wind ✓
- Solar ✓
- Geothermal



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear ✗
- Biomass ✓
- Wind ✓
- Solar ✓
- Geothermal ✓
- Hydro



- No residues
- Coal ✗
- Natural Gas ✗
- Gasoil ✗
- Nuclear ✗
- Biomass ✓
- Wind ✓
- Solar ✓
- Geothermal ✓
- Hydro ✓
- Oceanic





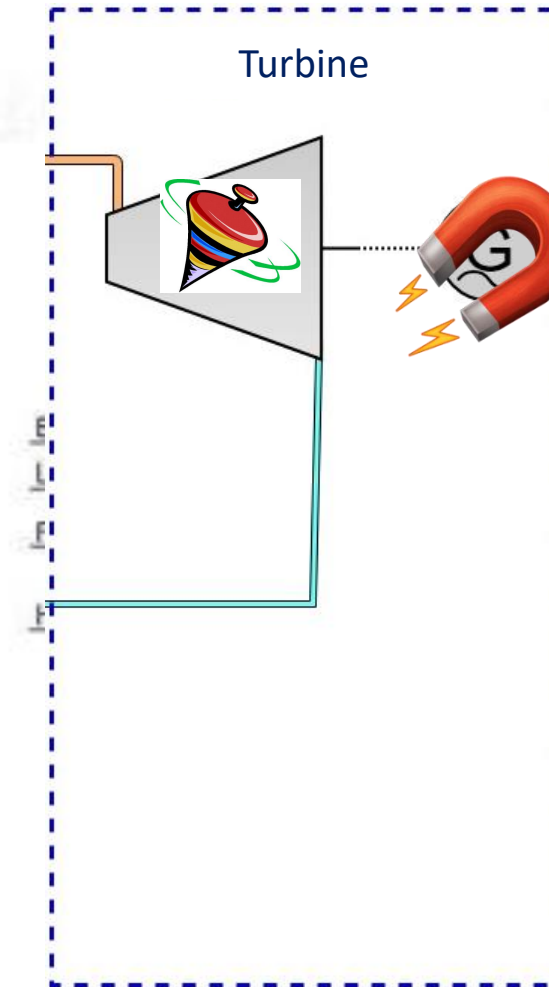
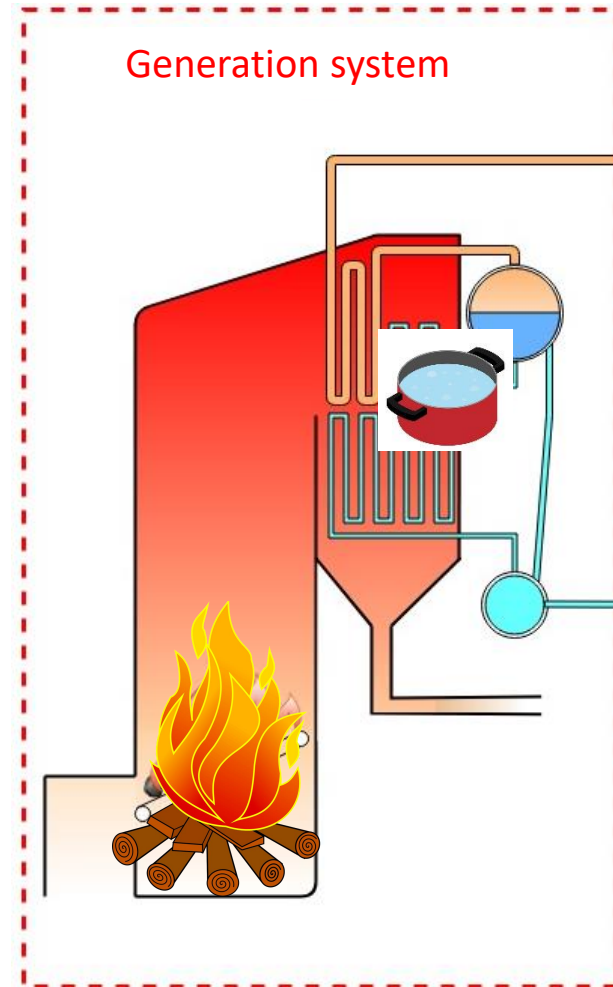
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- Sources:

Agricultural residues

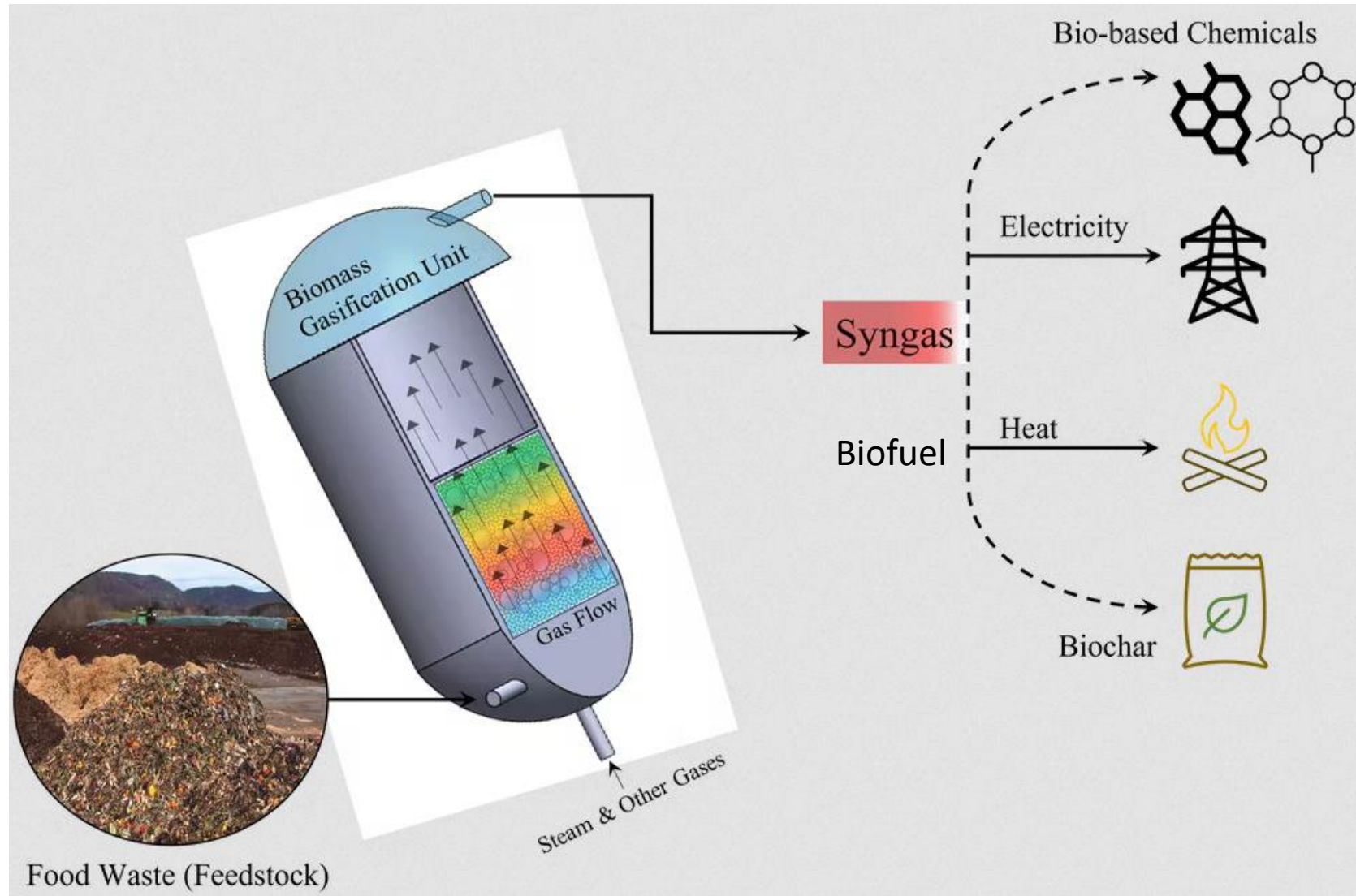
Animal residues

Industrial residues

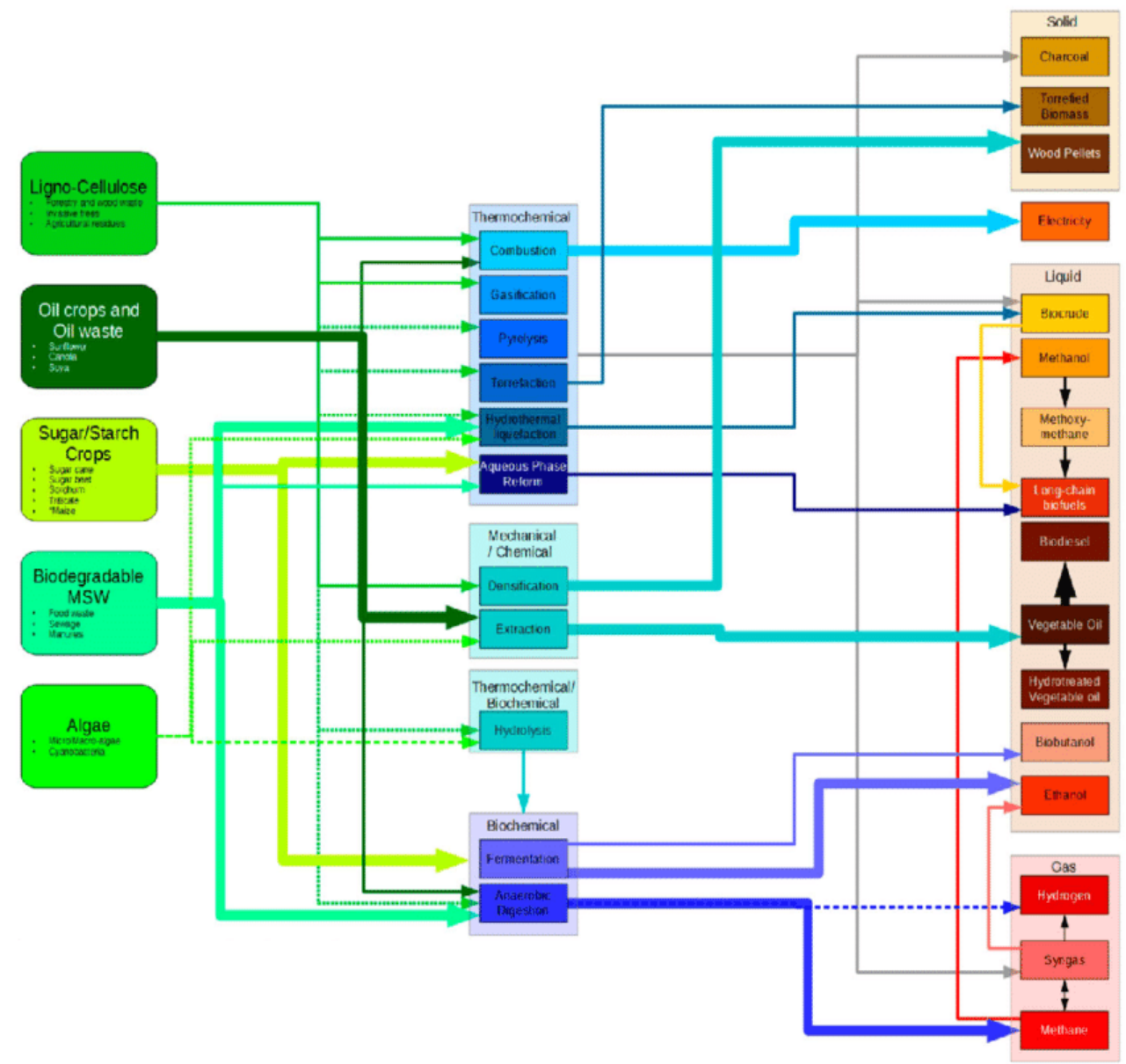


10-40 MW





- Pathways



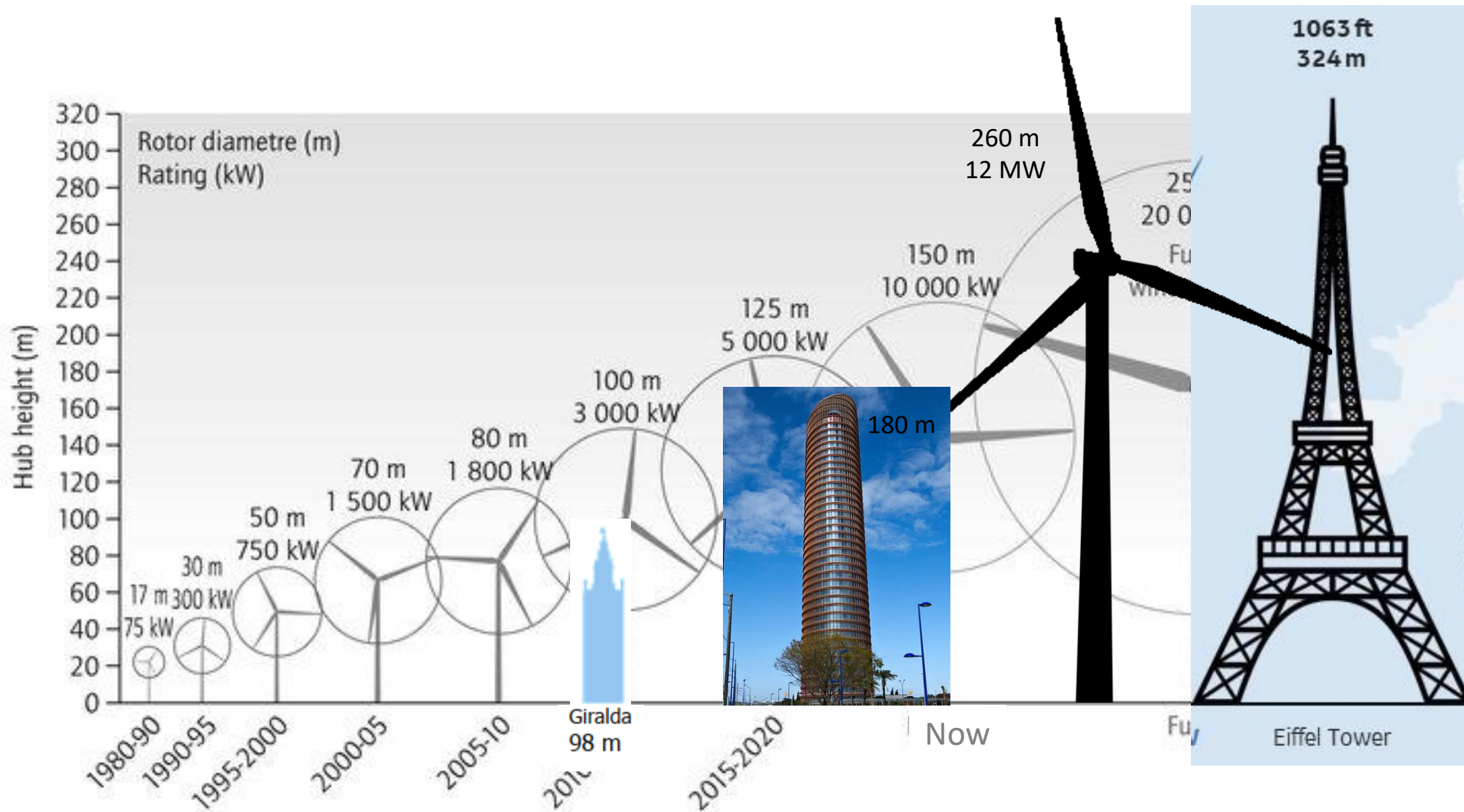
Pros

- Uses waste as a resource
- Available all around the world
- Very abundant
- Can be converted into fuel

Cons

- The escape gases may be harmful
- Can displace food resources
- Not very efficient
- Expensive
- Seasonal supply
- Small scale

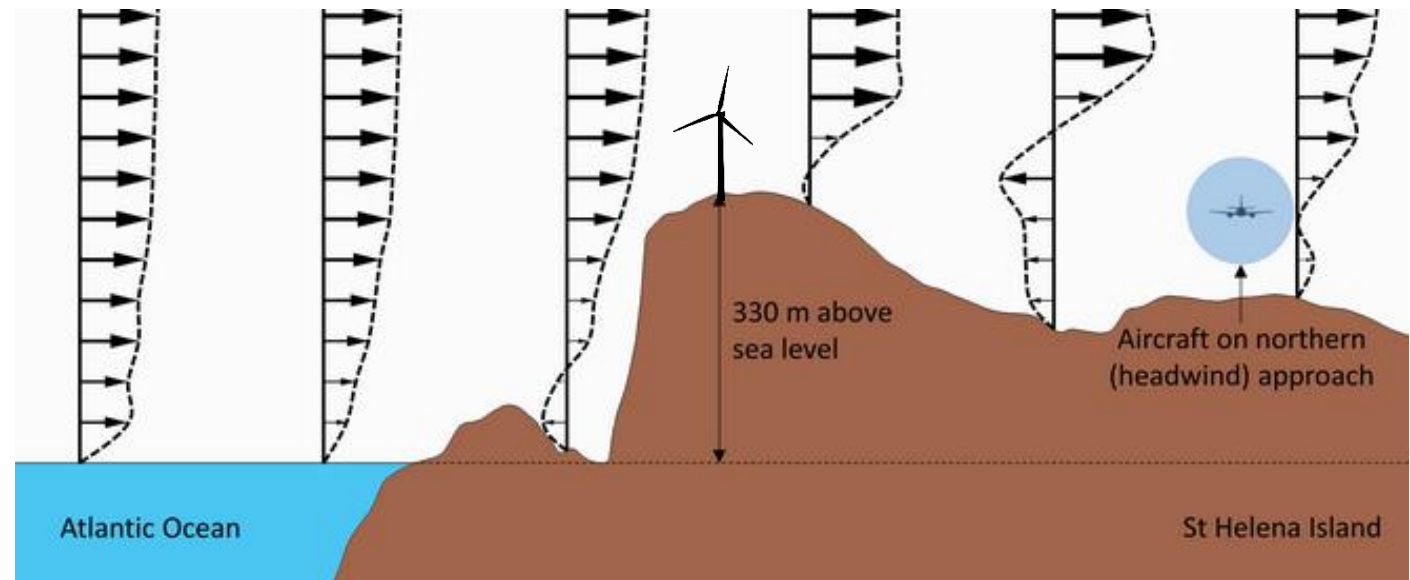


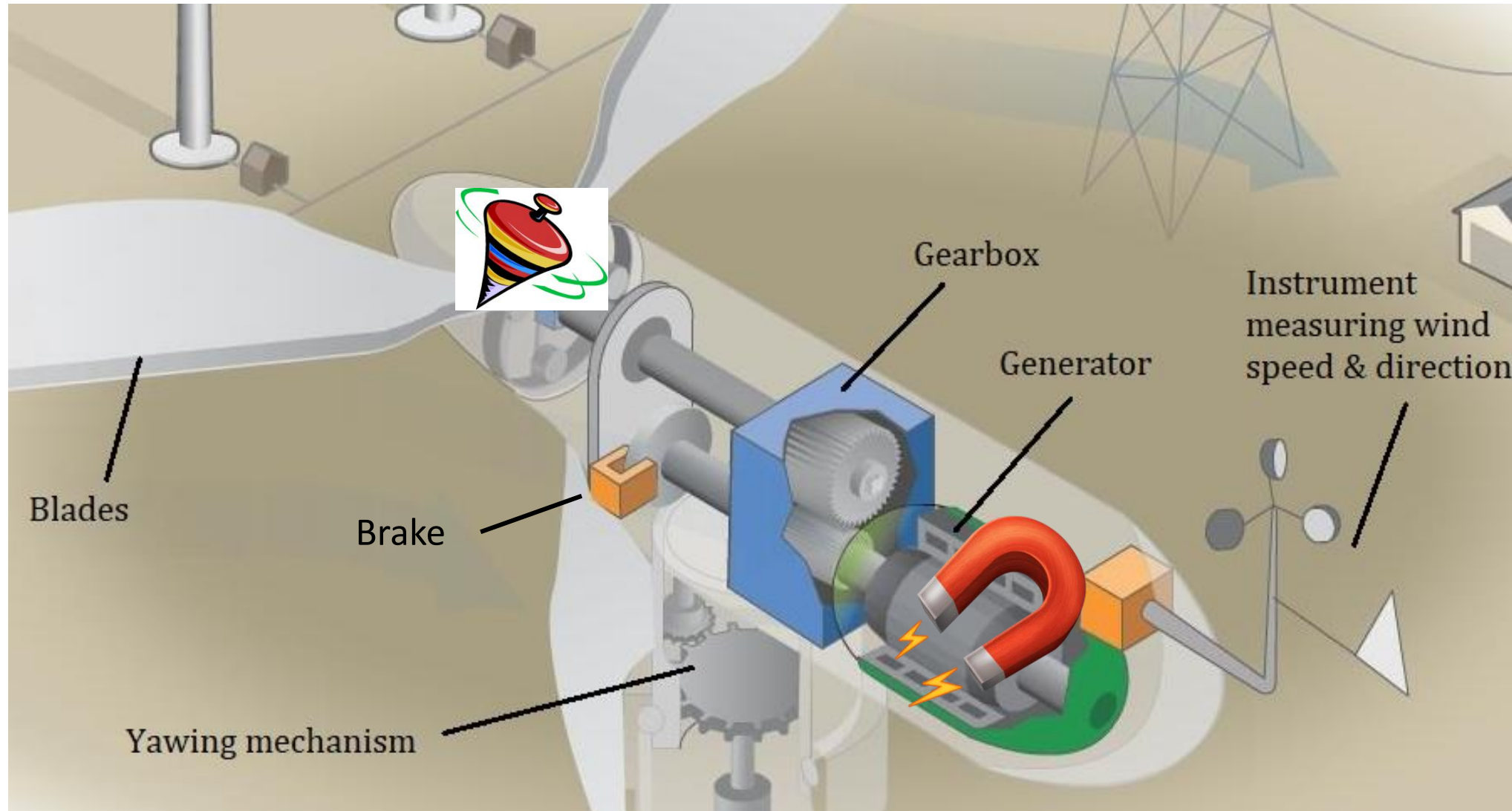


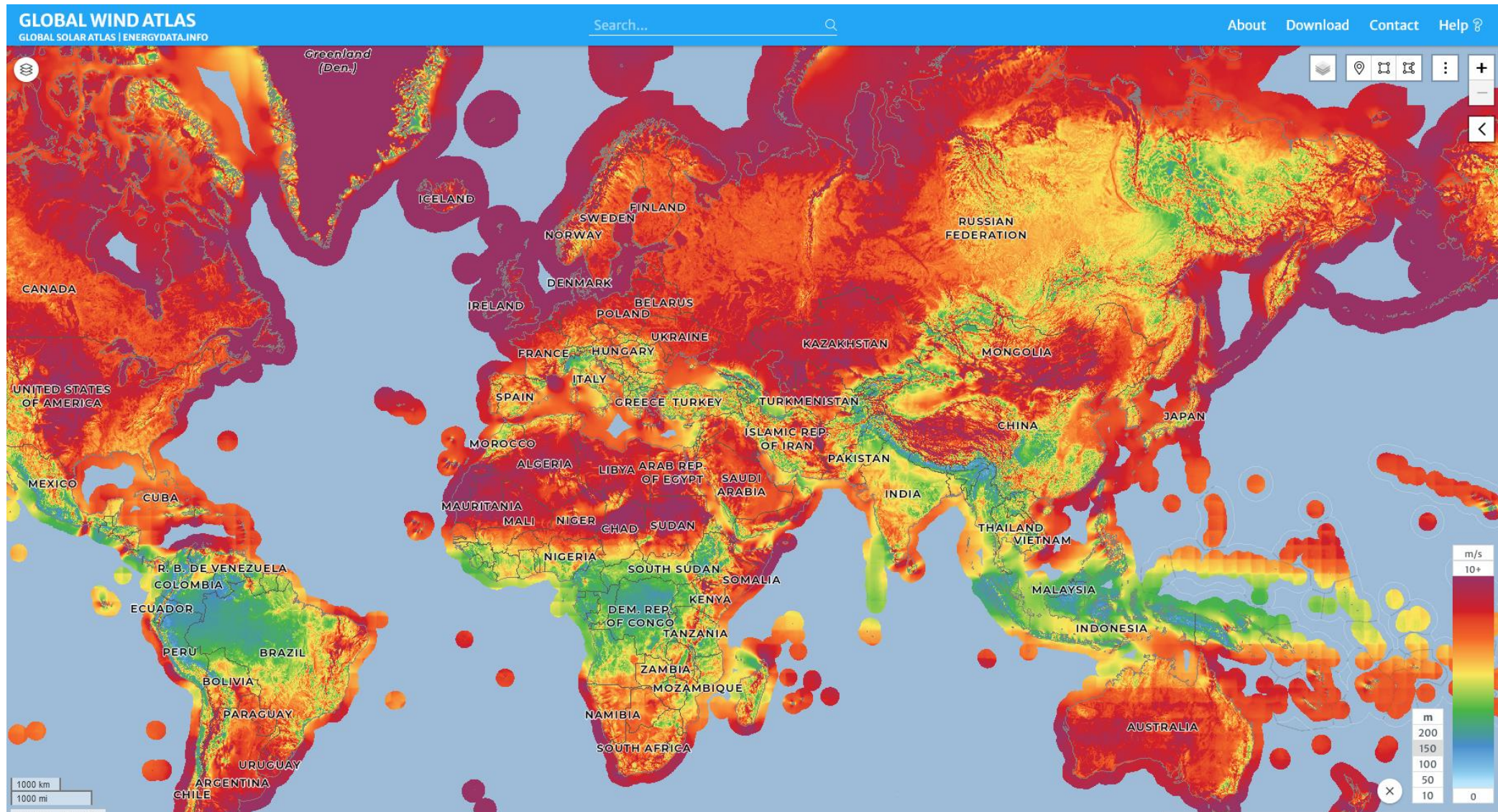
- Why that big?

Cost

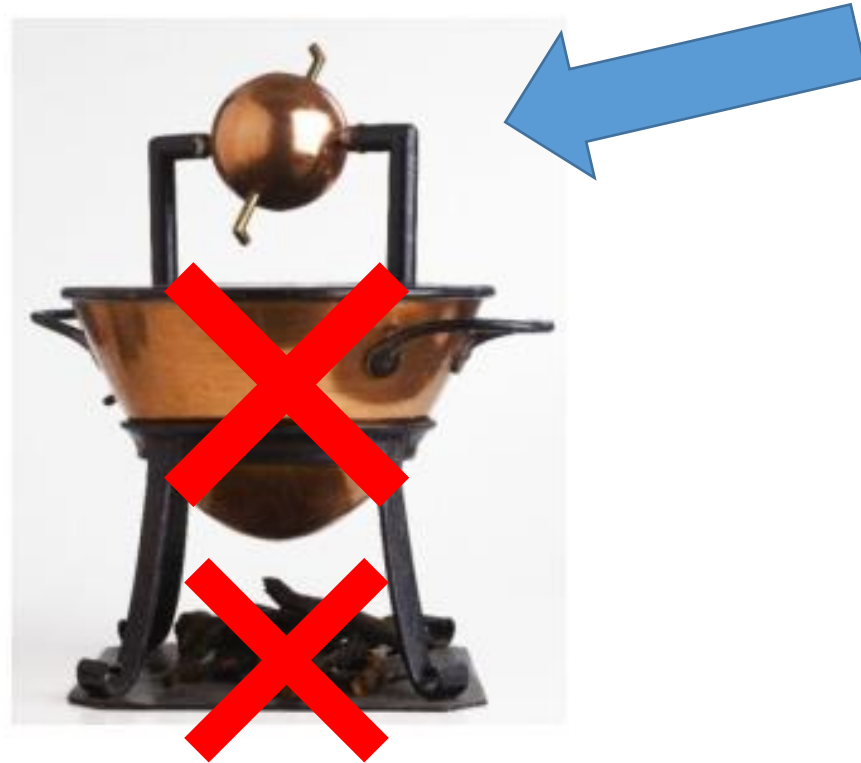
Efficiency









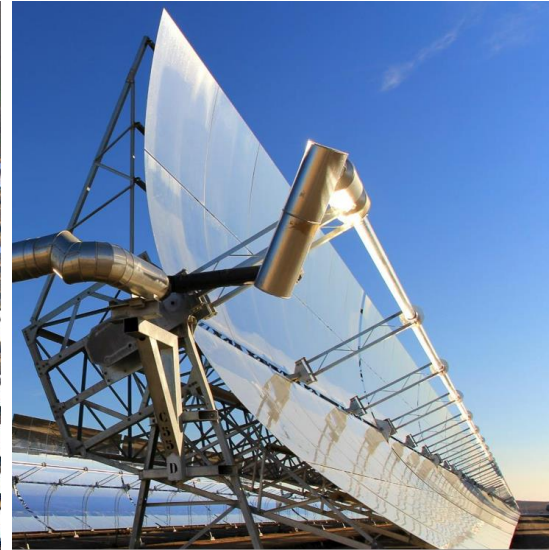


Pros

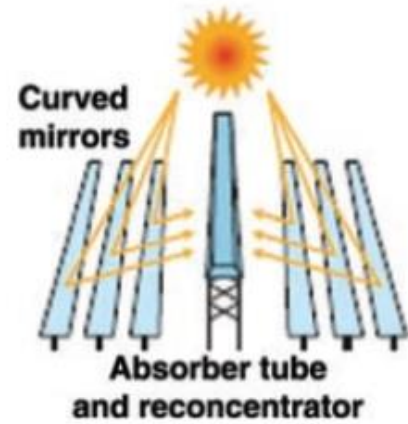
- Low operating cost and highly autonomous
- Land available for other uses
- Cheap

Cons

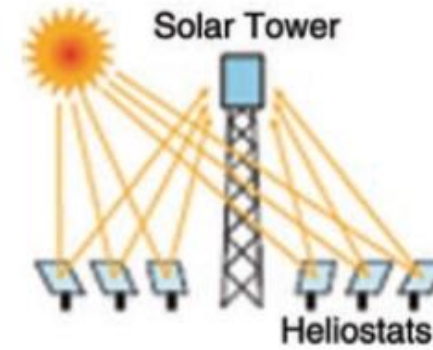
- Unpredictable
- Visual pollution
- Affects birdlife
- Specific locations



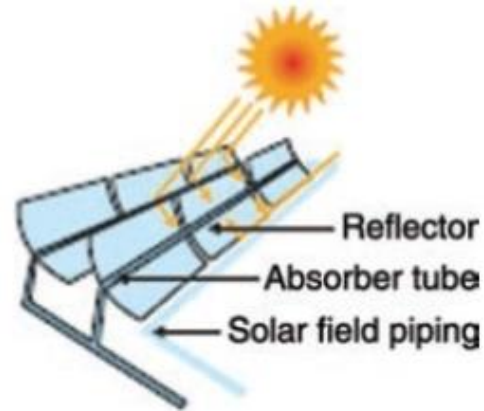
Linear Fresnel



Tower
(central receiver systems)

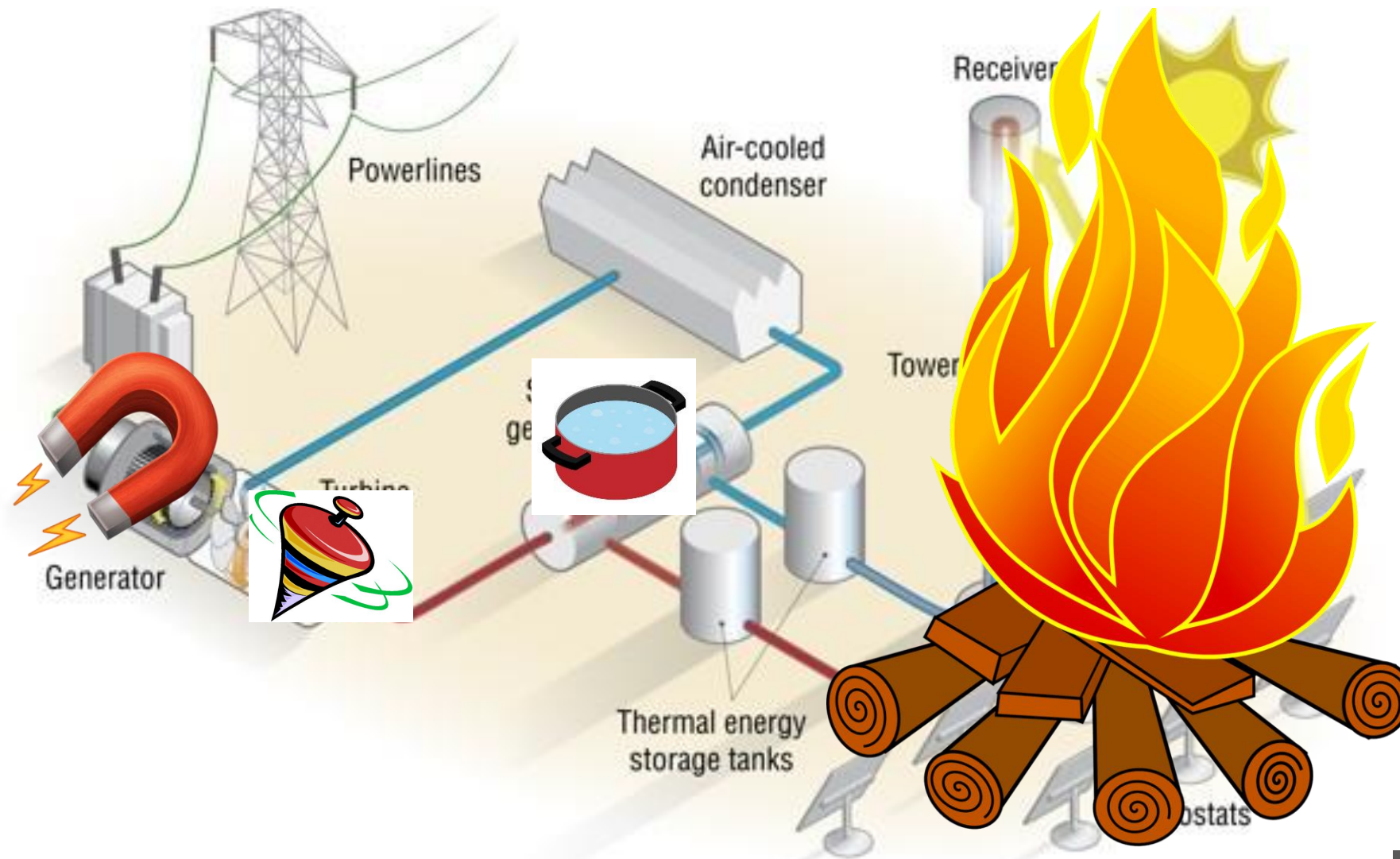


Parabolic Trough

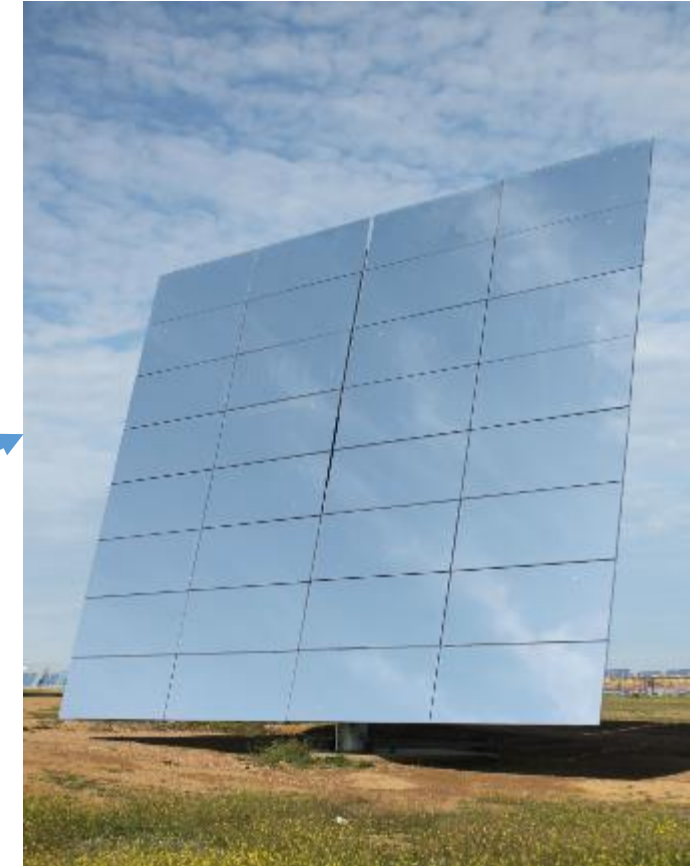
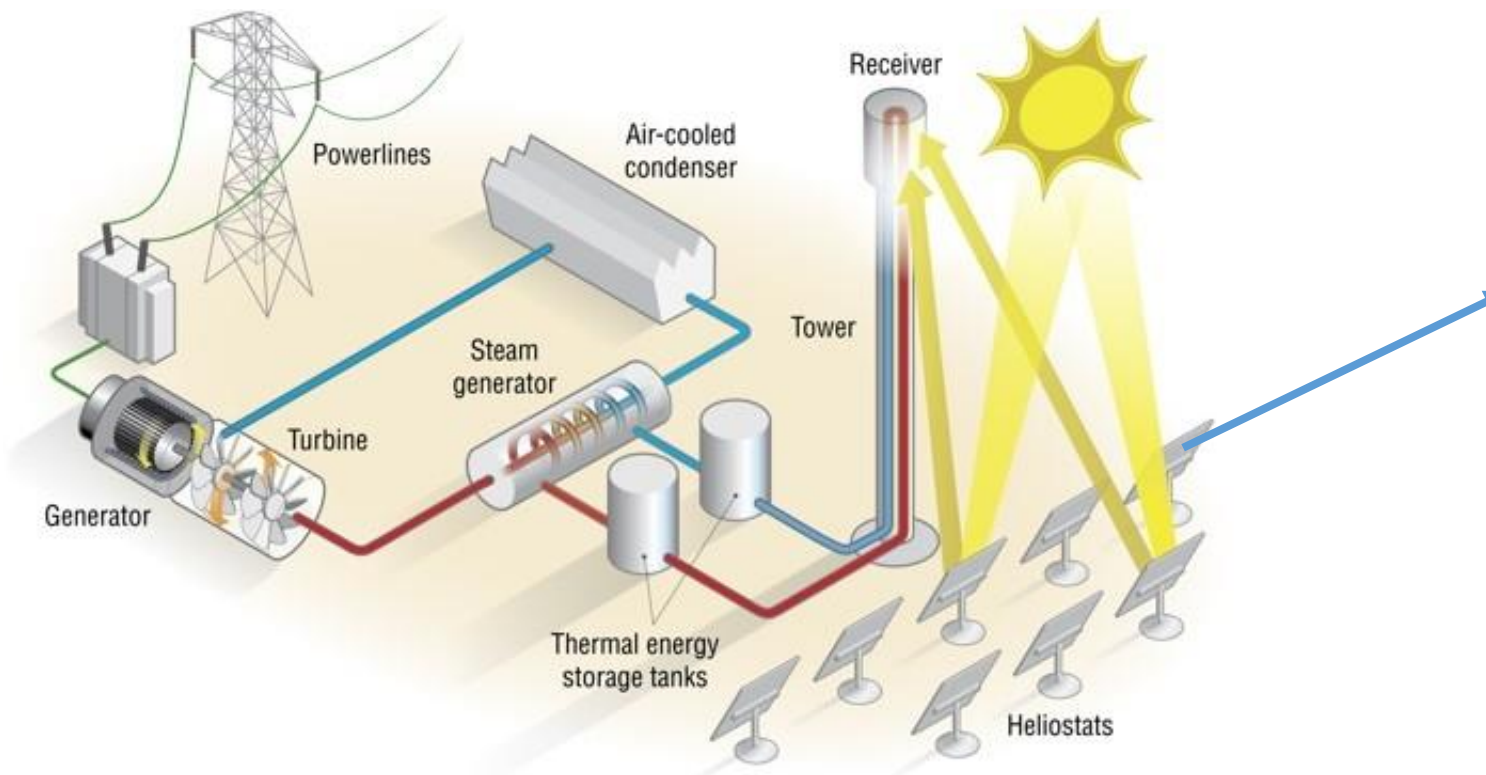


Parabolic Dish



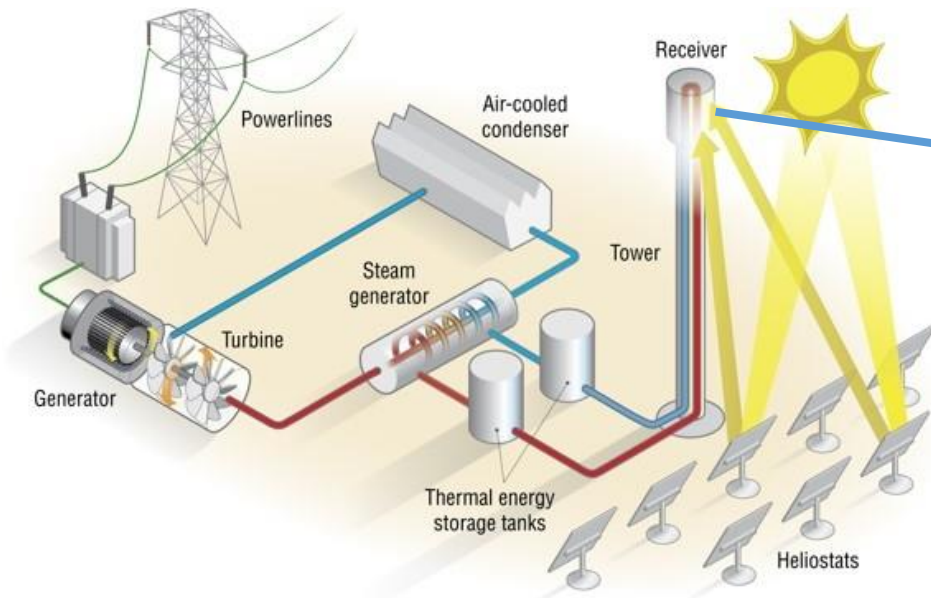


- Central receiver



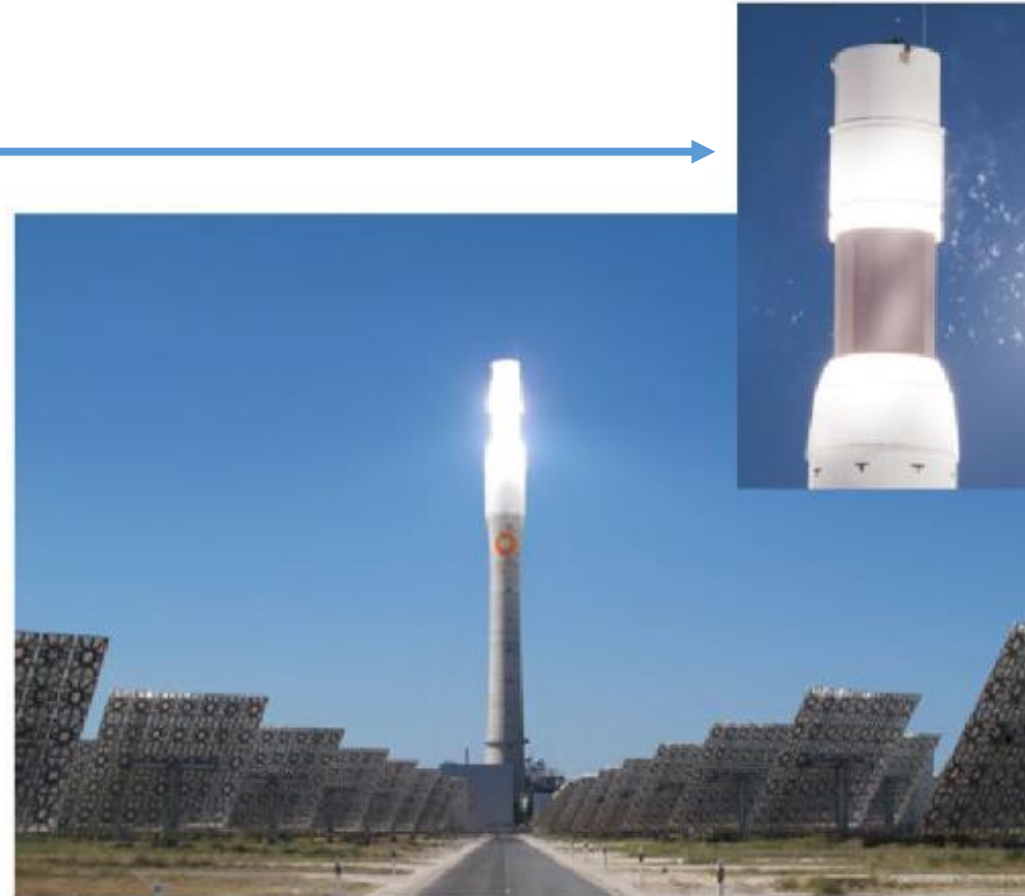
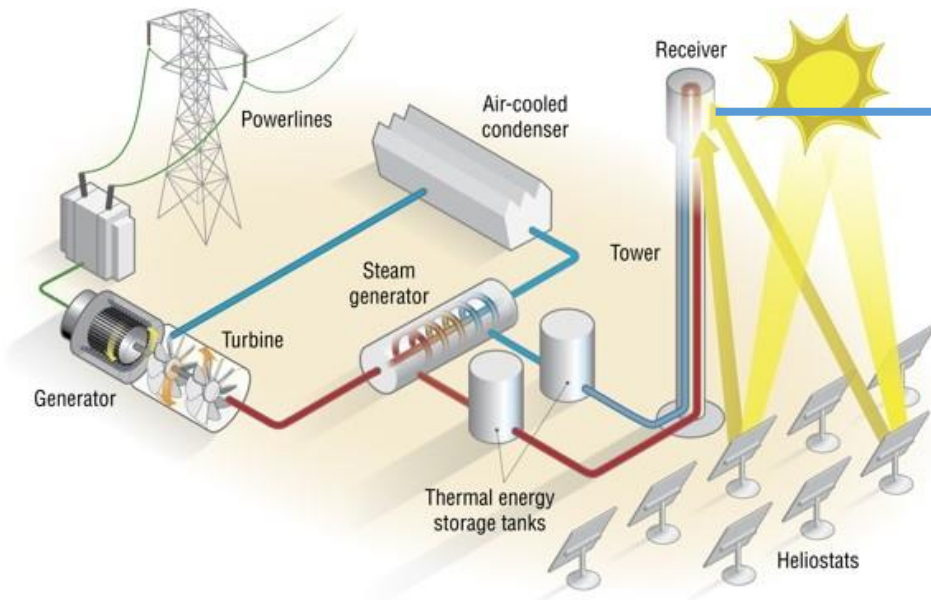
100 MW

- Central receiver



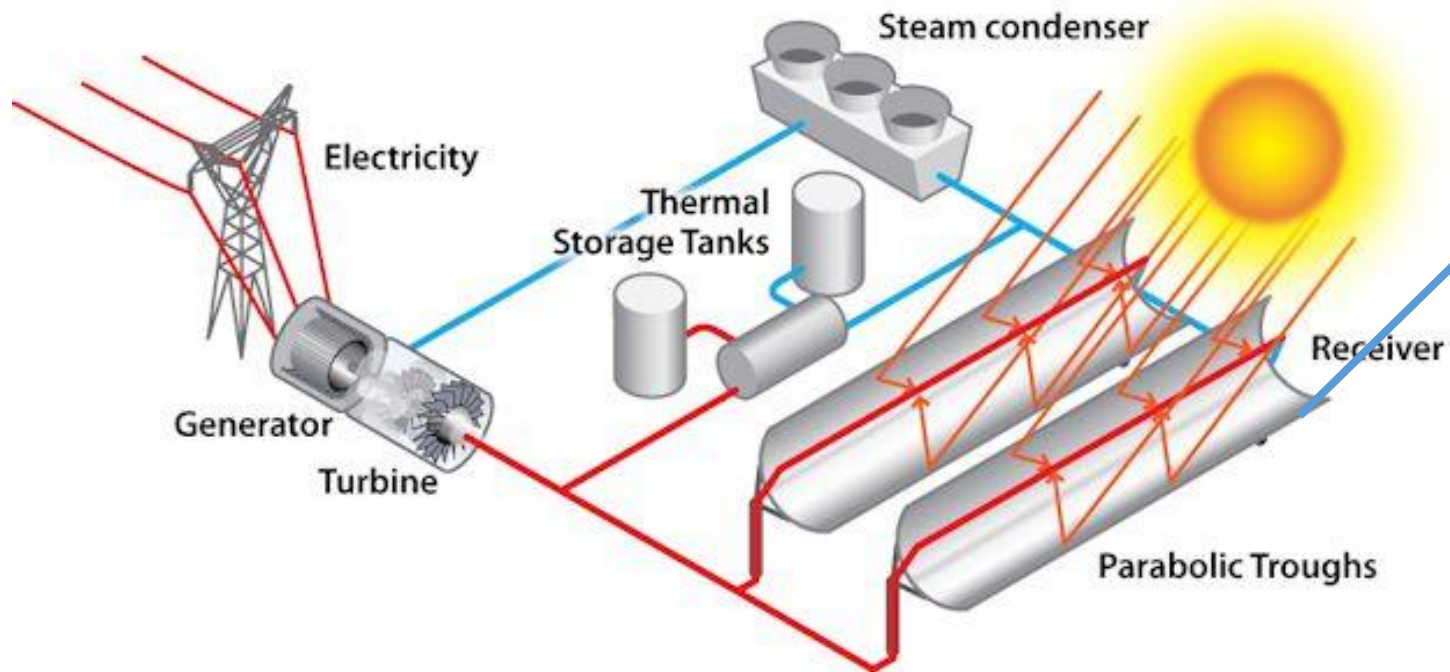
100 MW

- Central receiver

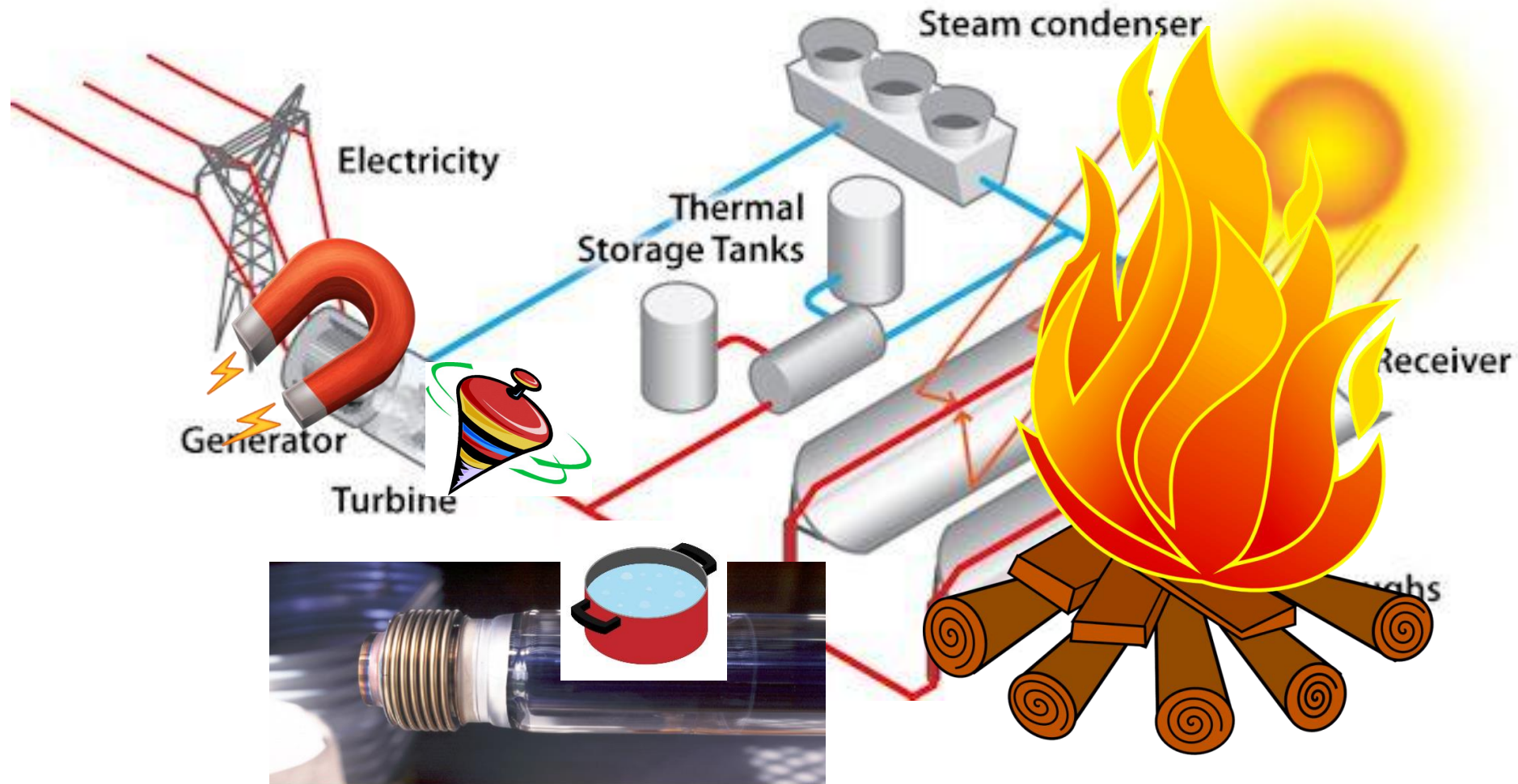


100 MW

- Parabolic Trough collector



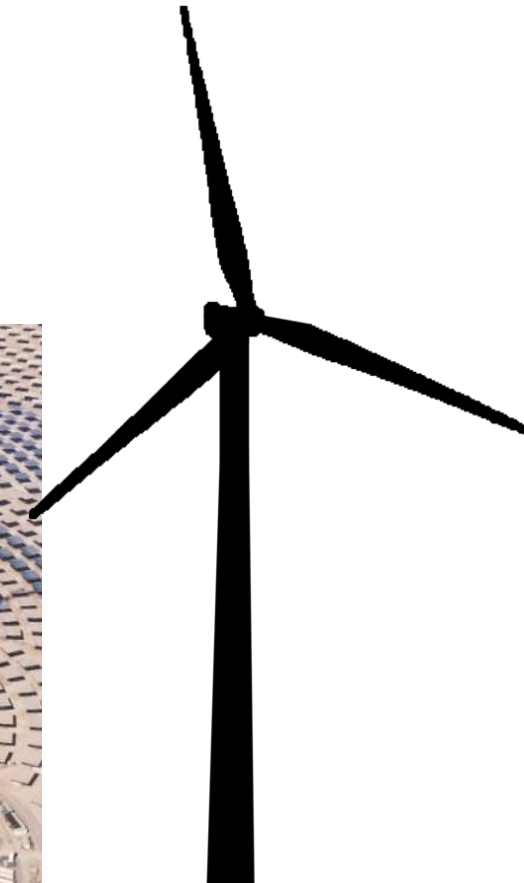
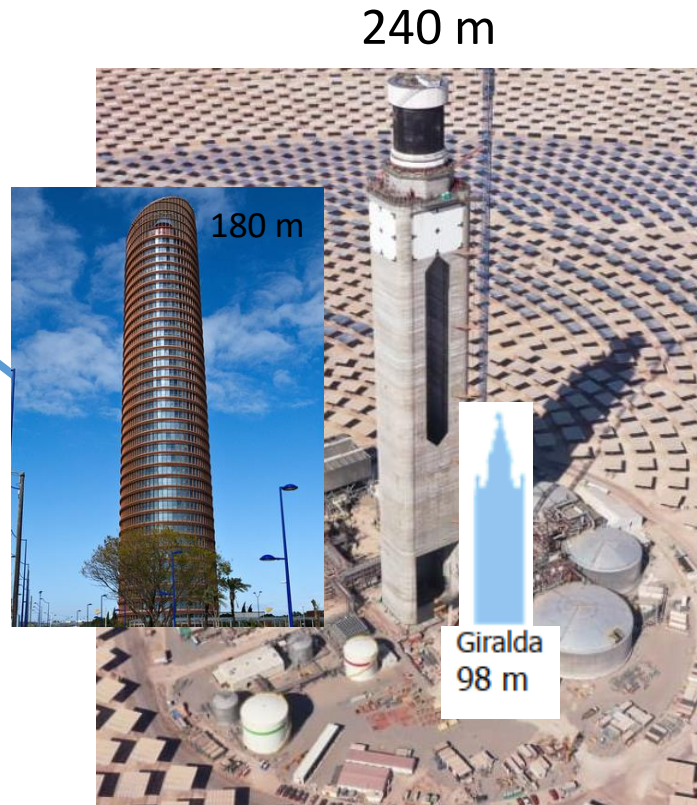
50 - 100 MW



- How big is it?

110 MW





260 m
12 MW

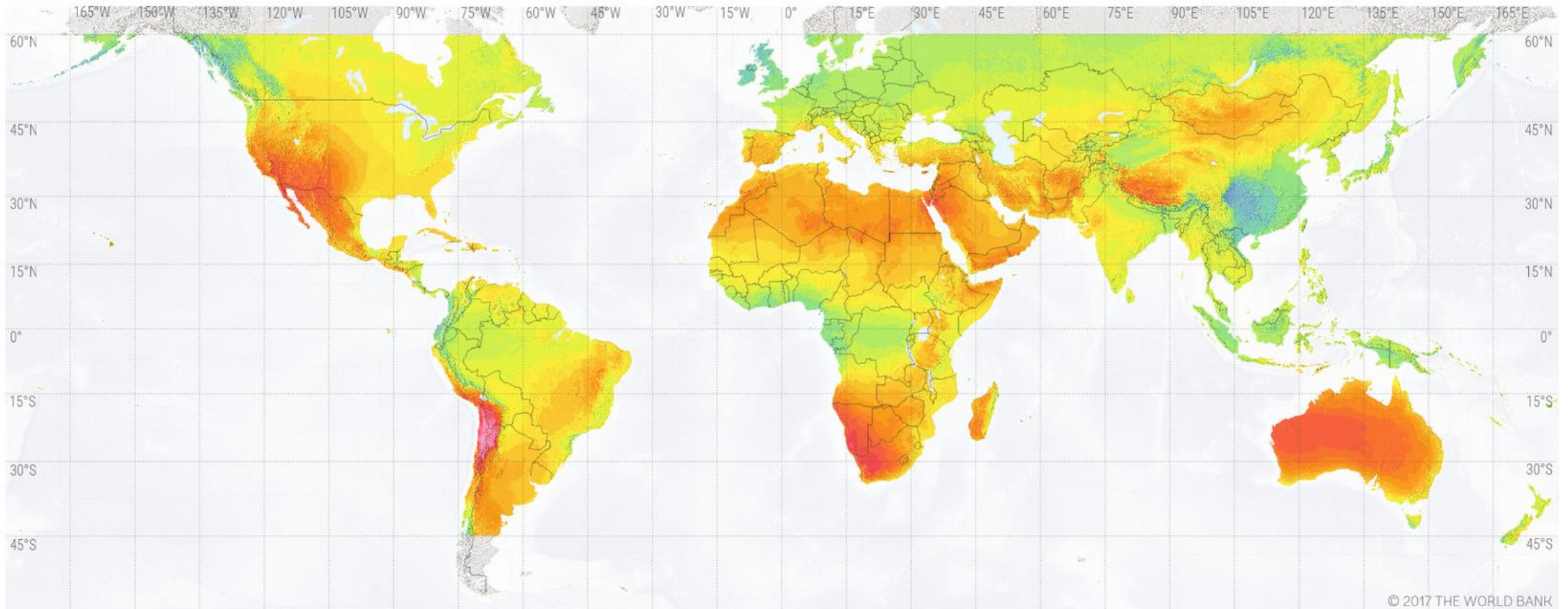




Renewable Energy: Solar Thermal

SOLAR RESOURCE MAP

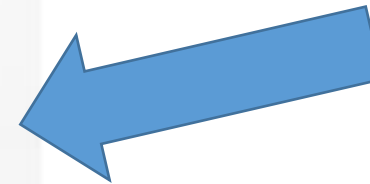
DIRECT NORMAL IRRADIATION



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Long-term average of daily/yearly sum





Pros

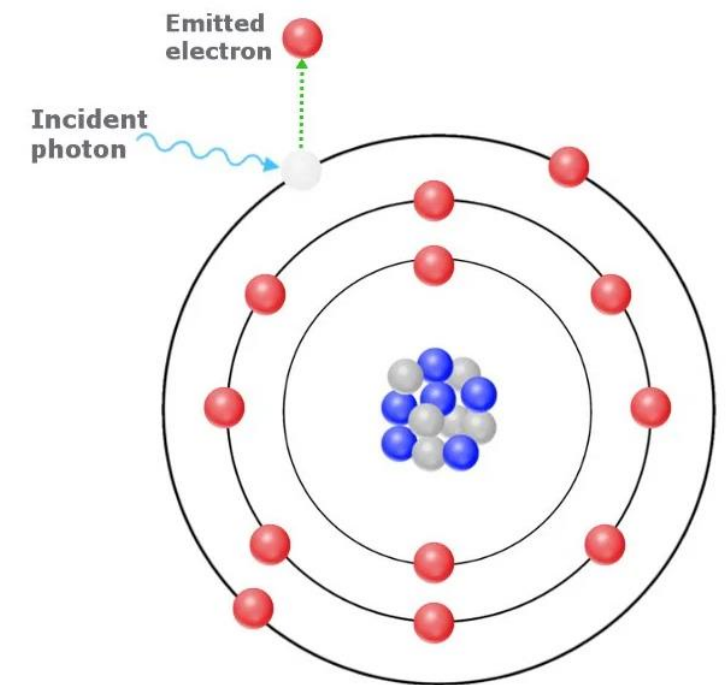
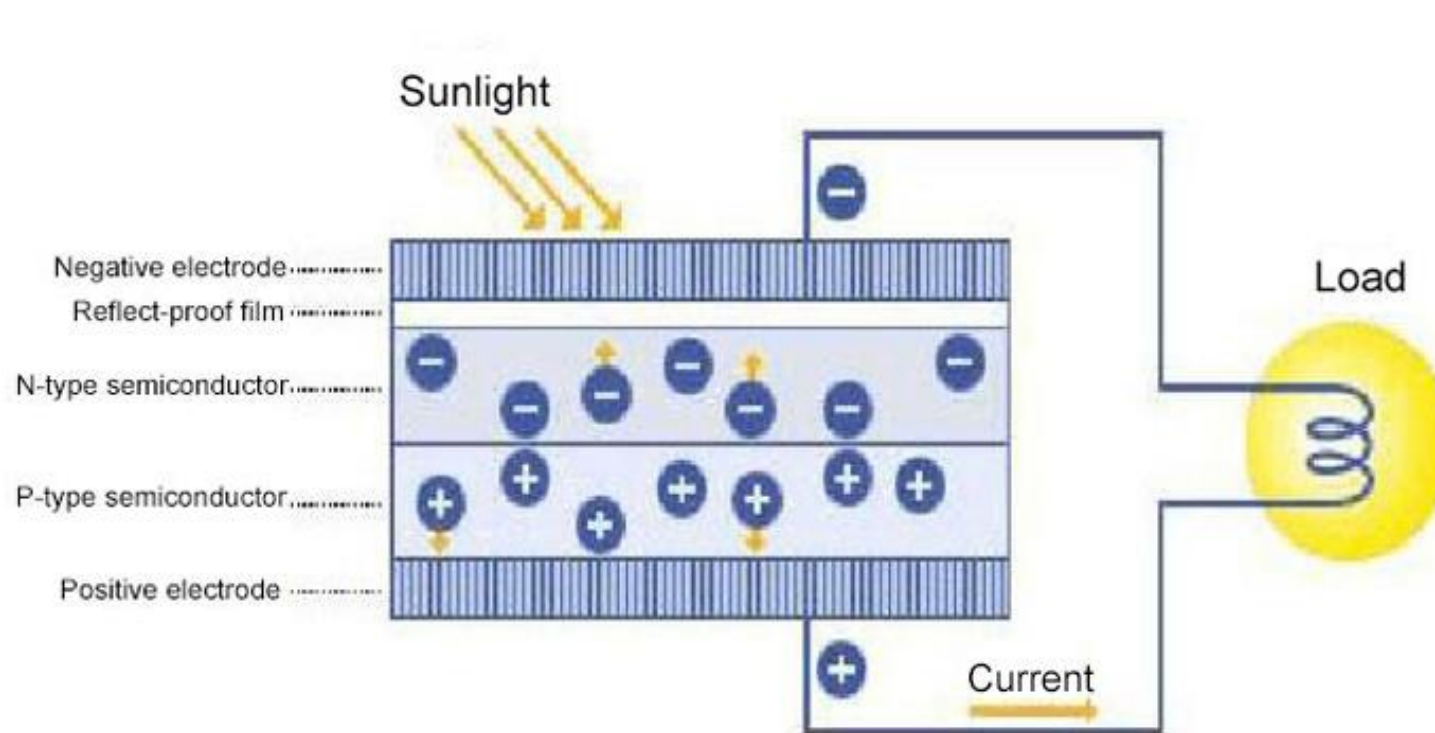
- Clean
- Can store energy
- Dispatchable (can produce energy when needed)
- Medium-low cost of energy

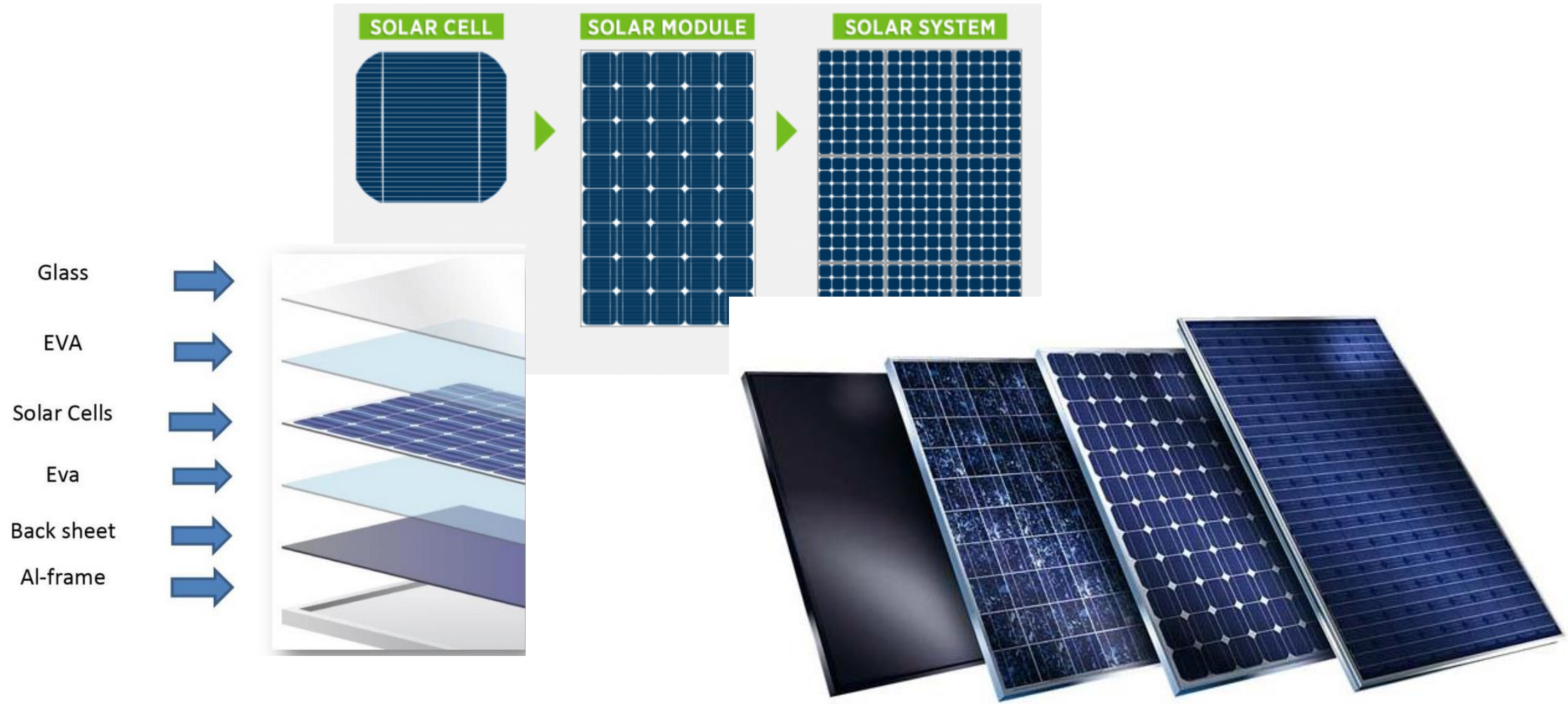
Cons

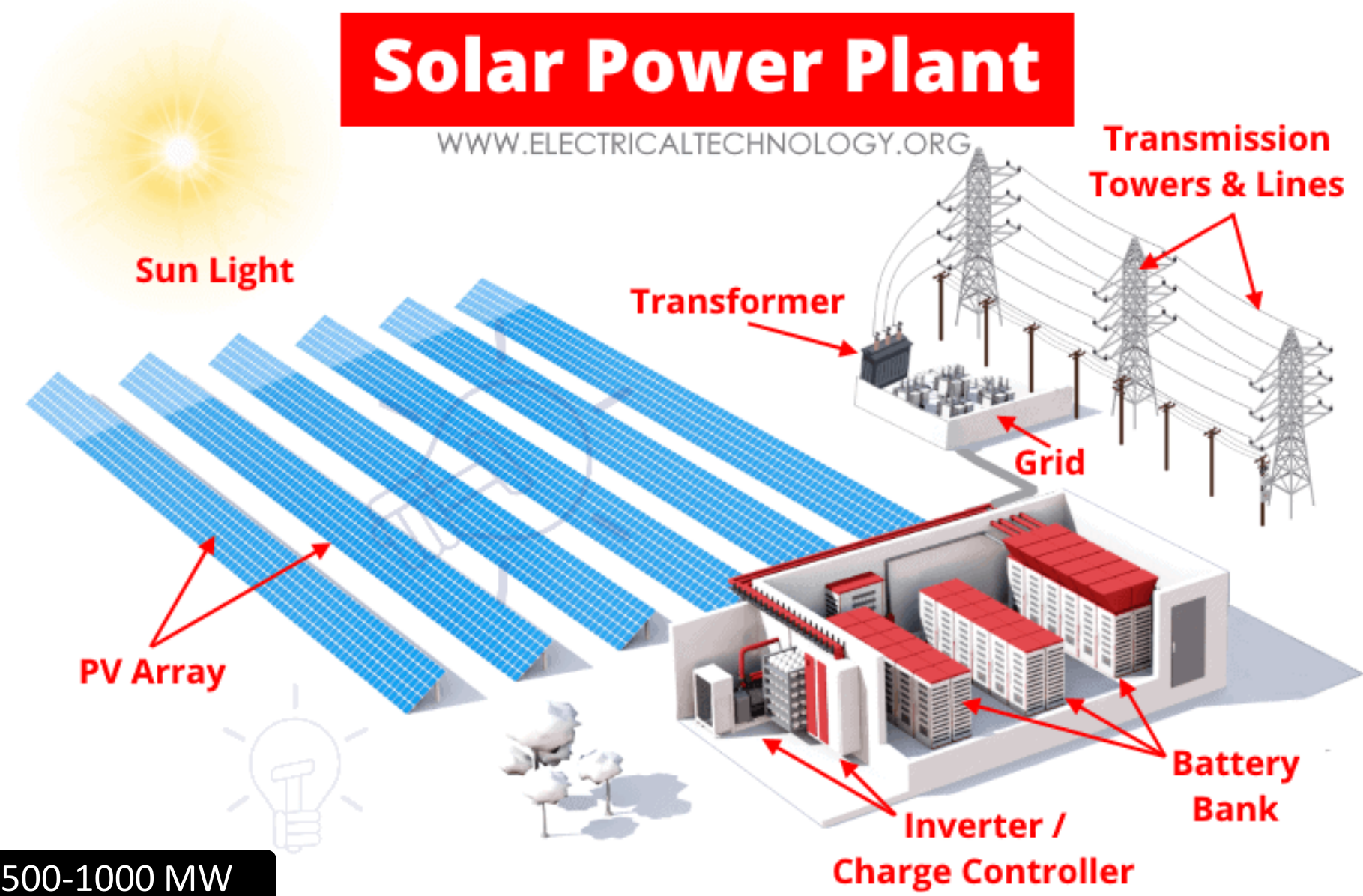
- Specific locations
- Very high cost of installation
- Requires use of water for cleaning
- Land requirements



- How does it works?





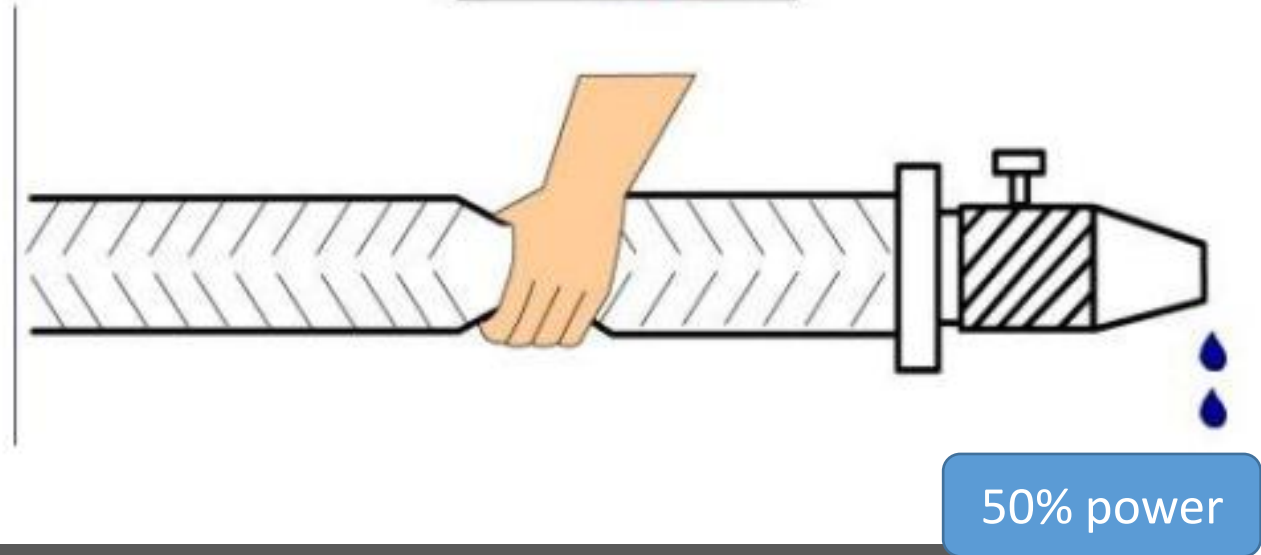
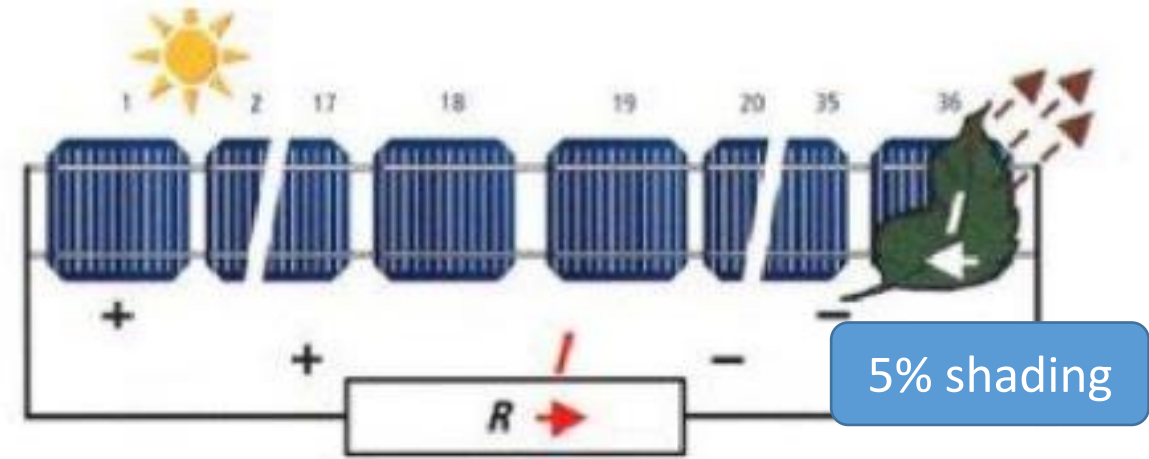


Solar Power Plant

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500-1000 MW

- Shading



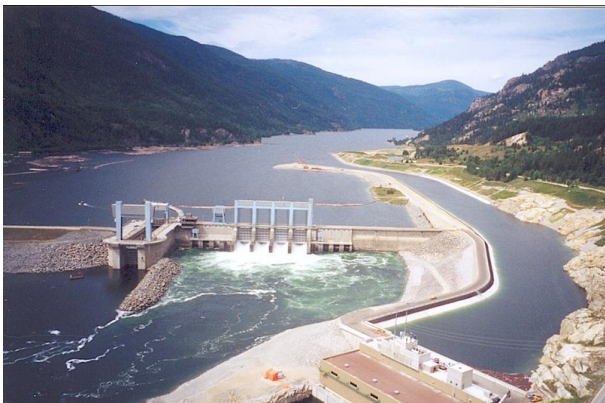


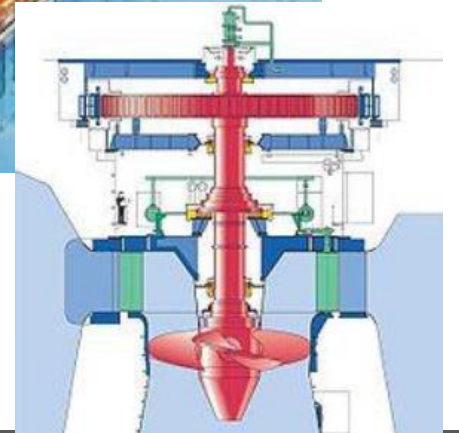
Pros

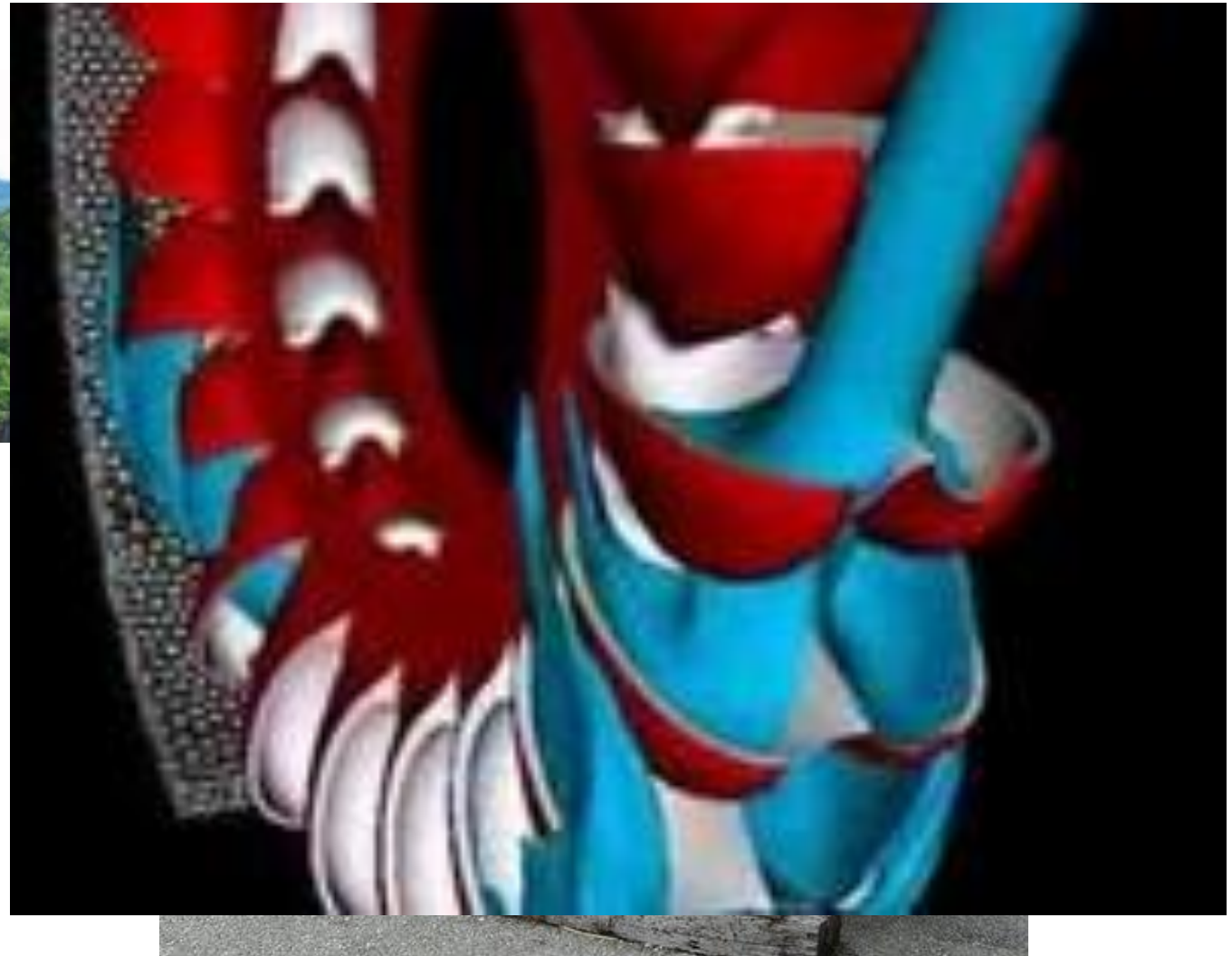
- Easy installation
- Highly autonomous
- Land available for other uses
- Can have small storage
- Very cheap
- Simple

Cons

- Unpredictable
(Partially mitigated with batteries)
- Visual pollution
- Batteries are contaminant
- Specific locations

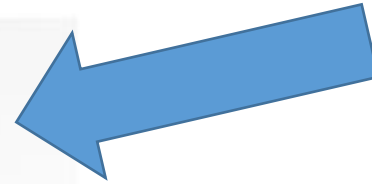










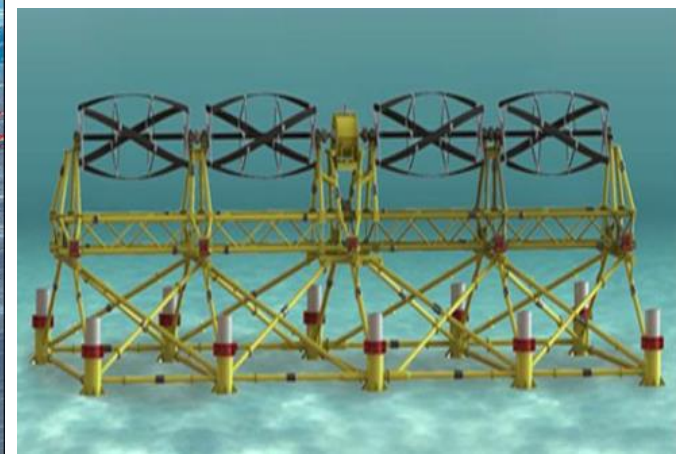
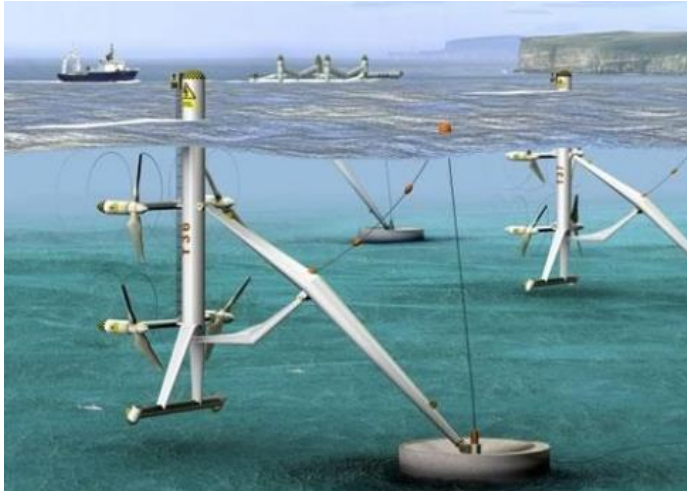


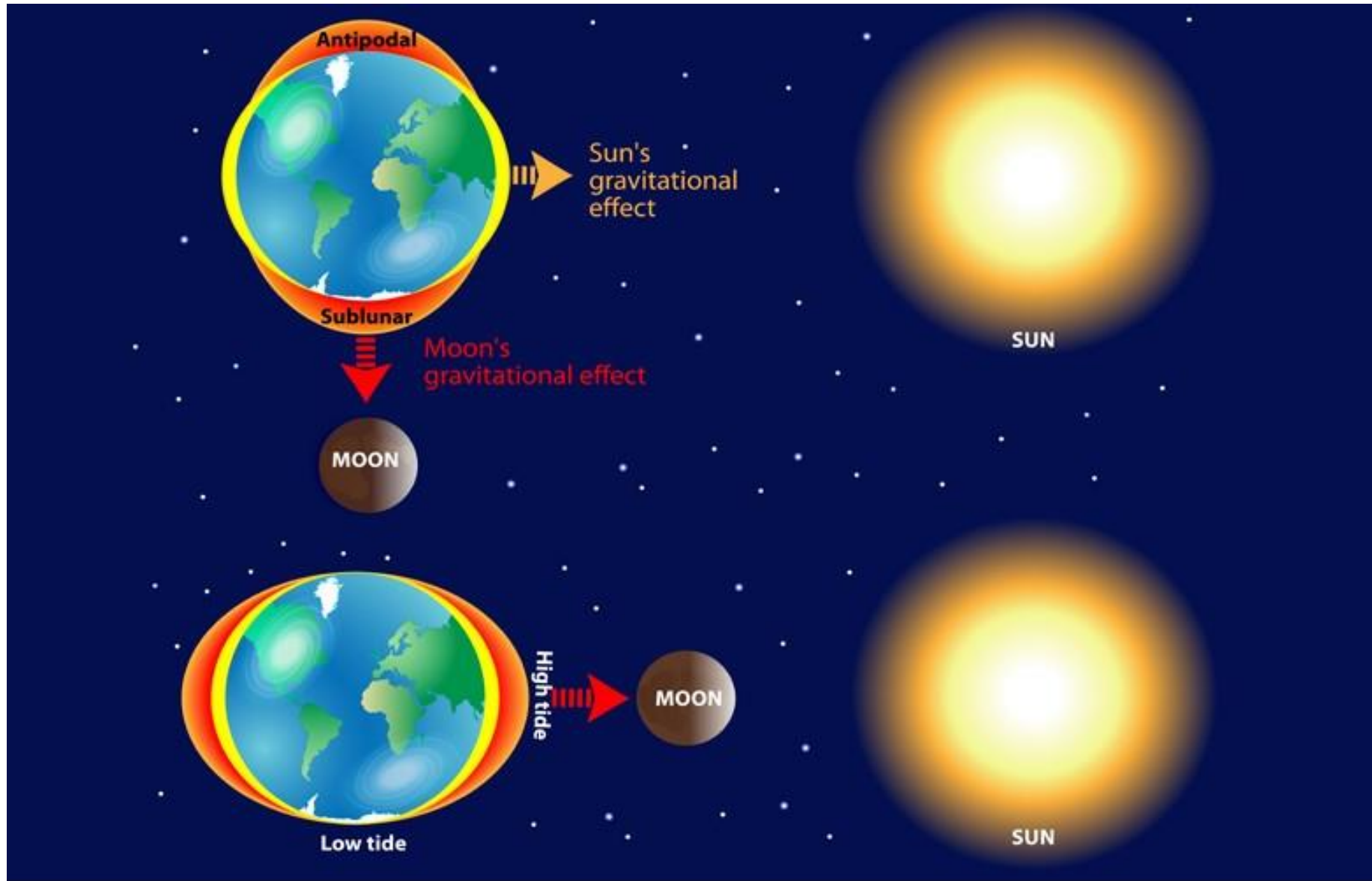
Pros

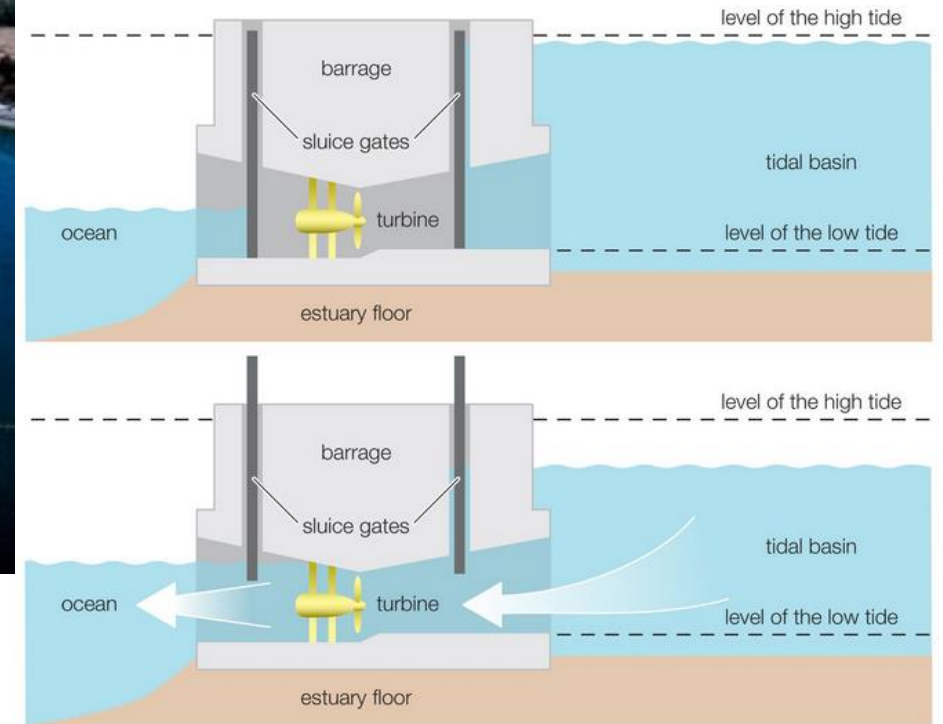
- Clean
- Low operating cost
- Cheap
- Dispatchable

Cons

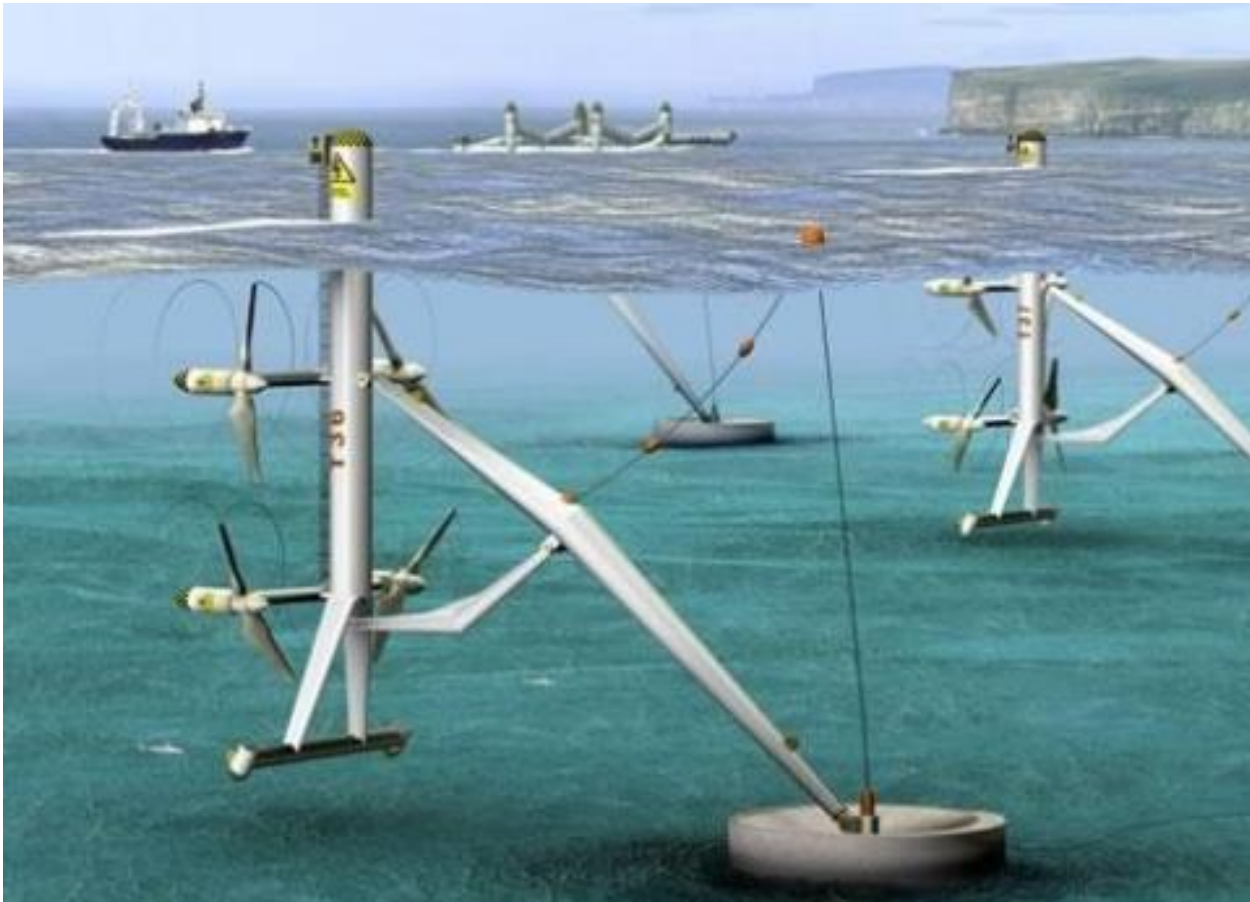
- Visual pollution
- Affects wildlife
- Specific locations
- Very high cost of installation
- Affects population when installed
- Risk of damn failure



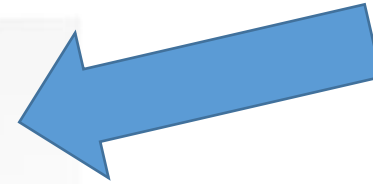




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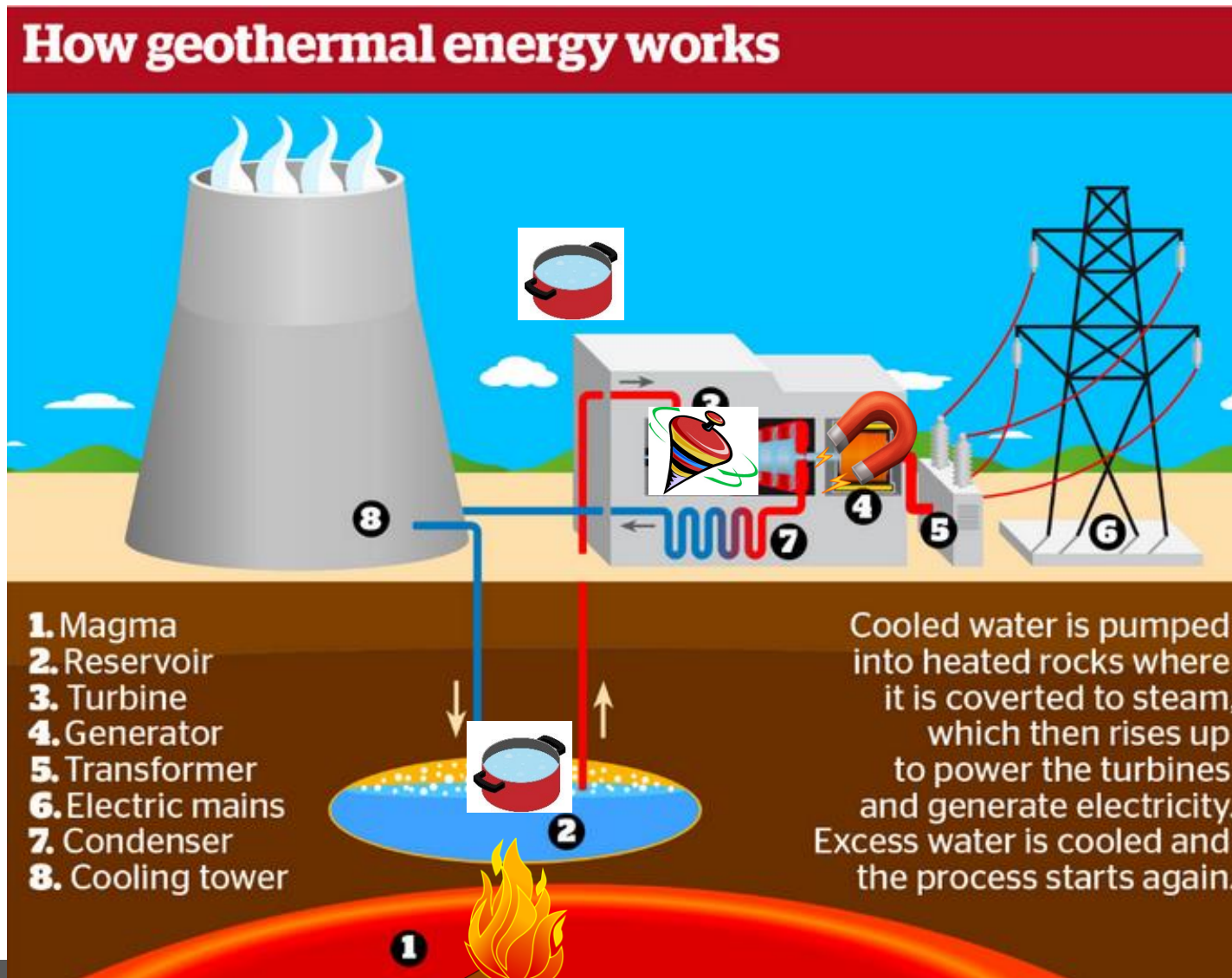
Pros

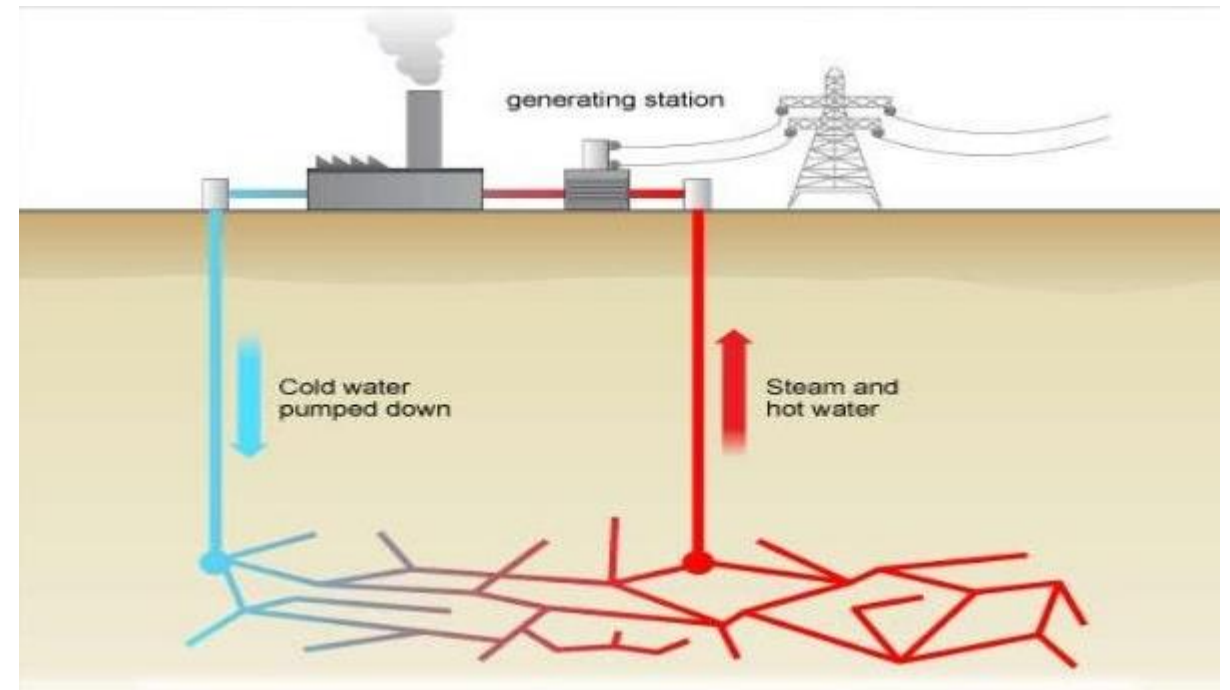
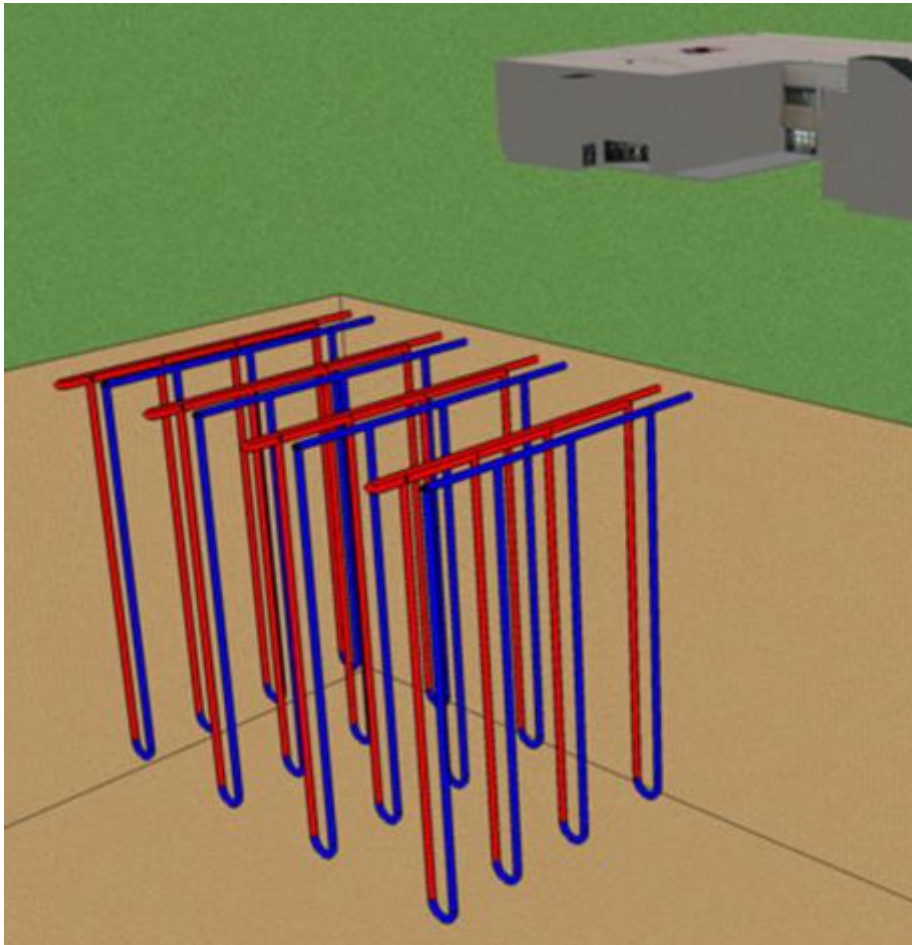
- High availability
- Could be cheap (in the future)

Cons

- Visual pollution
- Affects wildlife
- Distance to the user
- Traffic problems
- Not very efficient
- Still under R&D
- Maintenance











Pros

- Dispatchable
- Can be used to provide heat to houses / industry

Cons

- Only available in specific locations
- Not that cheap
- Water quality (open loop)
- Requires water
- Low efficiency

- What is your ideal energy mix?

Thank you for your attention

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“I have not failed. I’ve just found 10,000 ways that won’t work”
Thomas Edison





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Coordinadora: Cristina Prieto Ríos / Presupuesto: 2.500€ / Curso: 2021-2022

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**3^{er} Plan Propio
de Docencia**