



An introduction to Renewable Energy Sources

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What is energy?

Energy is the ability of a body or system to do work or produce a change, expressed usually in joules or kilowatt hours (kWh) *

No activity is possible without energy and its total amount in the universe is fixed. In other words, it cannot be created or destroyed but can only be changed from one type to another.



The two basic types of energy are:

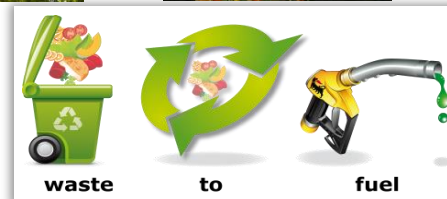
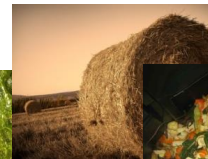
- **Potential:** energy associated with the nature, position, or state (such as chemical energy, electrical energy, nuclear energy)
- **Kinetic:** energy associated with motion (such as a moving car or a spinning wheel)



What are Renewables?



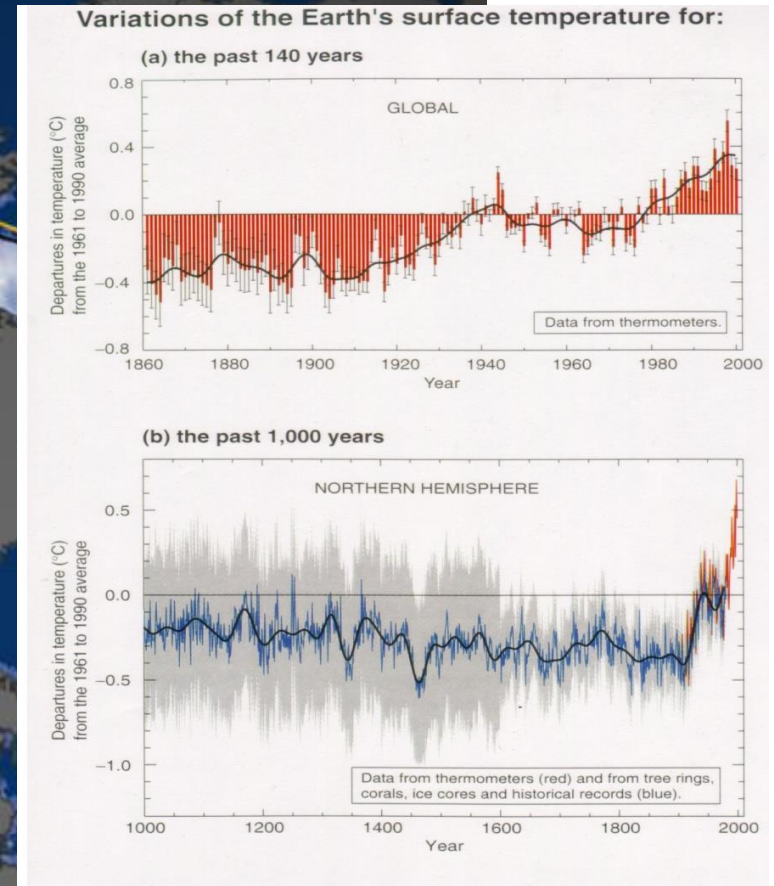
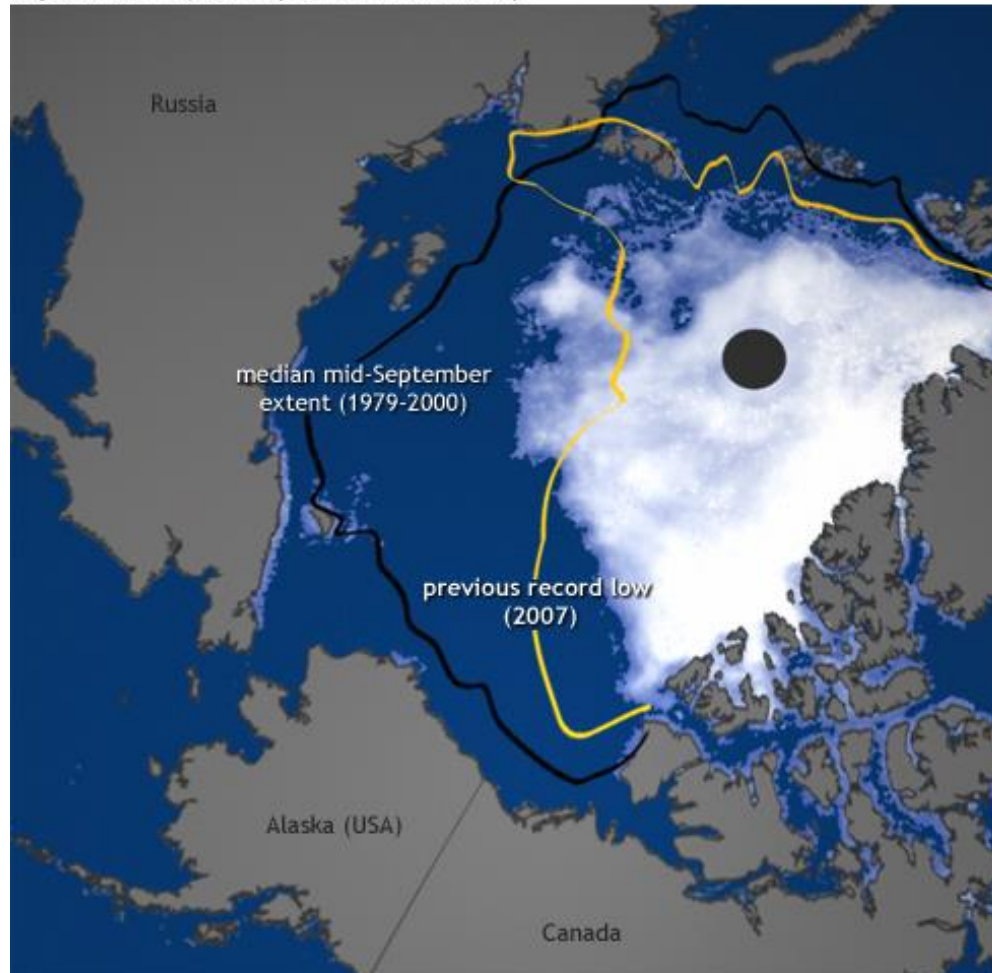
- Solar energy
- Wind energy
- Hydropower (water power)
- Geothermal energy
- Biofuels



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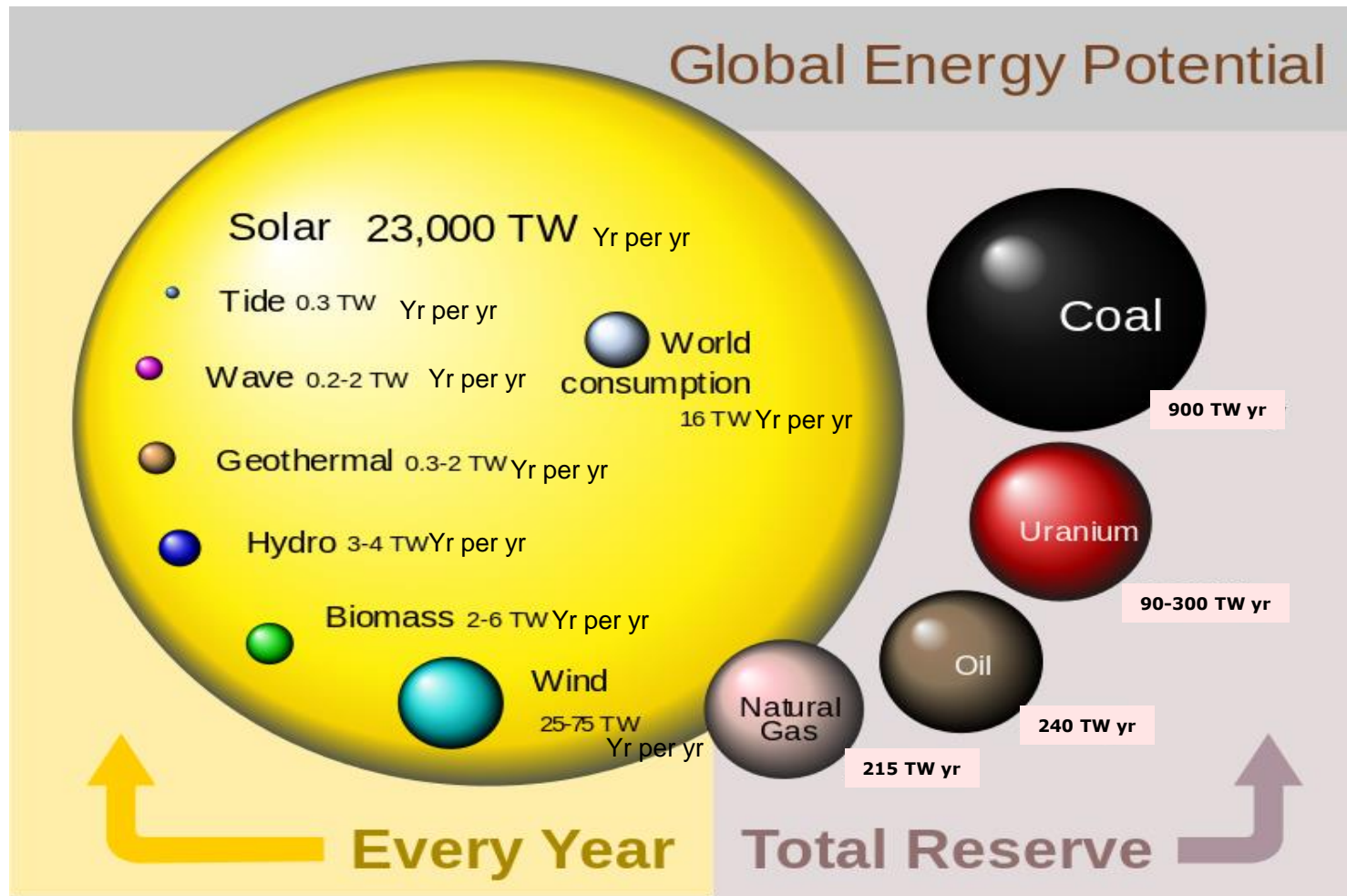
Why are Renewables important? - Climate change

September 16, 2012 (summer minimum)



Why are Renewables important? - Availability of resources

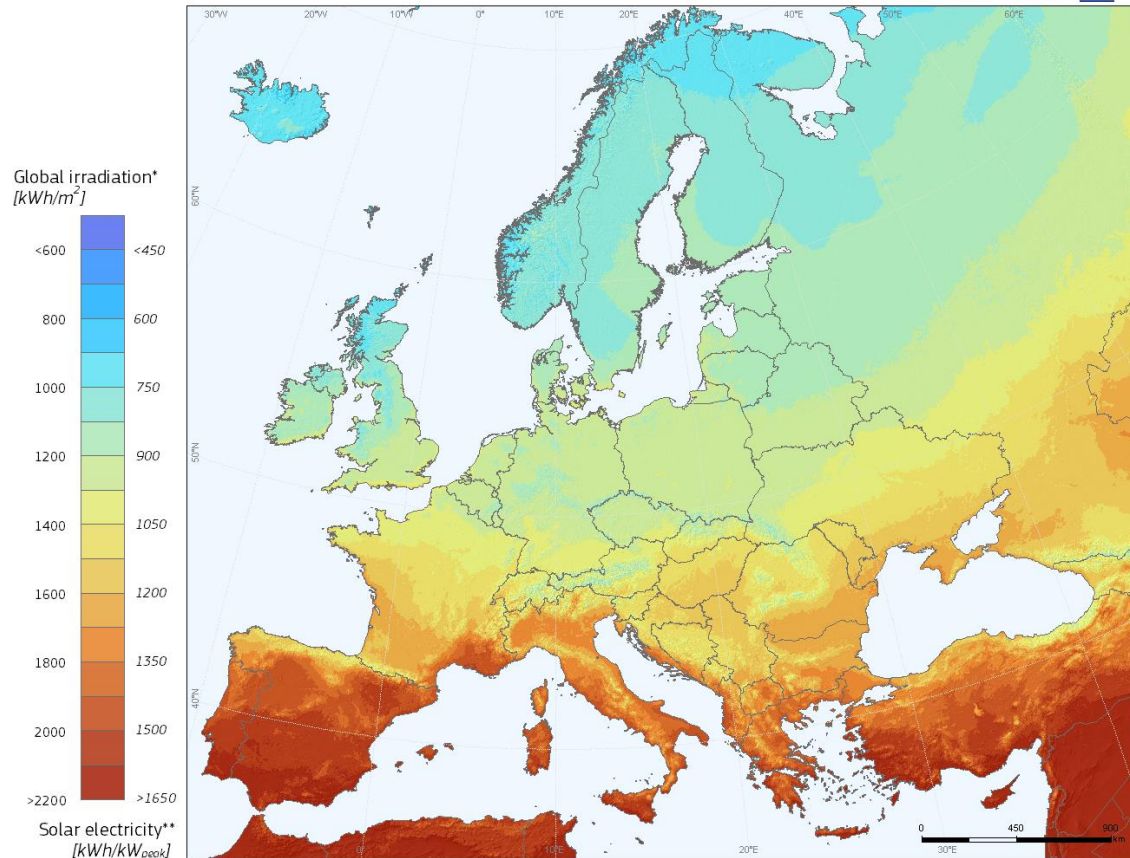
Energy potential of **renewable energy sources per year**, compared to the **finite total estimated energy potential of fossil fuels** (including nuclear)



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Resources are not evenly distributed

Photovoltaic Solar Electricity Potential in European Countries



* Yearly sum of global irradiation incident on optimally-inclined south-oriented photovoltaic modules

** Yearly sum of solar electricity generated by optimally-inclined 1kW_p system with a performance ratio of 0.75

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PVGIS <http://re.jrc.ec.europa.eu/pvgis/>

Authors: Thomas Huld, Irene Pinedo-Pascua
EC - Joint Research Centre
In collaboration with: CM SAF, www.cmsaf.eu

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Why are Renewables important? Sustainable access to energy



Silicon photovoltaics

Direct transformation of light to electricity

350-400 kTon 2014
10 producers



How Photovoltaics is used

Roof mounted on grid
100 kW



Utility scale
1 MW



Captive market
20 kW



Captive market
1 kW



Special projects BIPV
100 kW



Rural electrification,
Small systems



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Concentrating Solar Power - CSP



Parabolic trough



Parabolic dish



Fresnel



Solar tower



Mirrors and lenses are used to concentrate solar heat and transform it to vapour or to electricity

Coupling fossil/solar systems

Diesel Generator



Power 200 kW

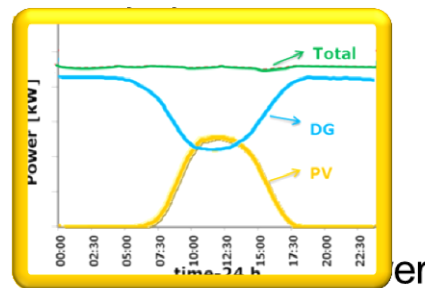
Photovoltaic Plant




Power 110 kW




- supervision
- measurement
- protection
- control




Sucker Rod Pump (SRP) 1

	Power	40 kW
	Production	401 bpd
	Oil	13°API

Sucker Rod Pump (SRP) 2

	Power	40 kW
	Production	42 Bpd
	Oil	15°API

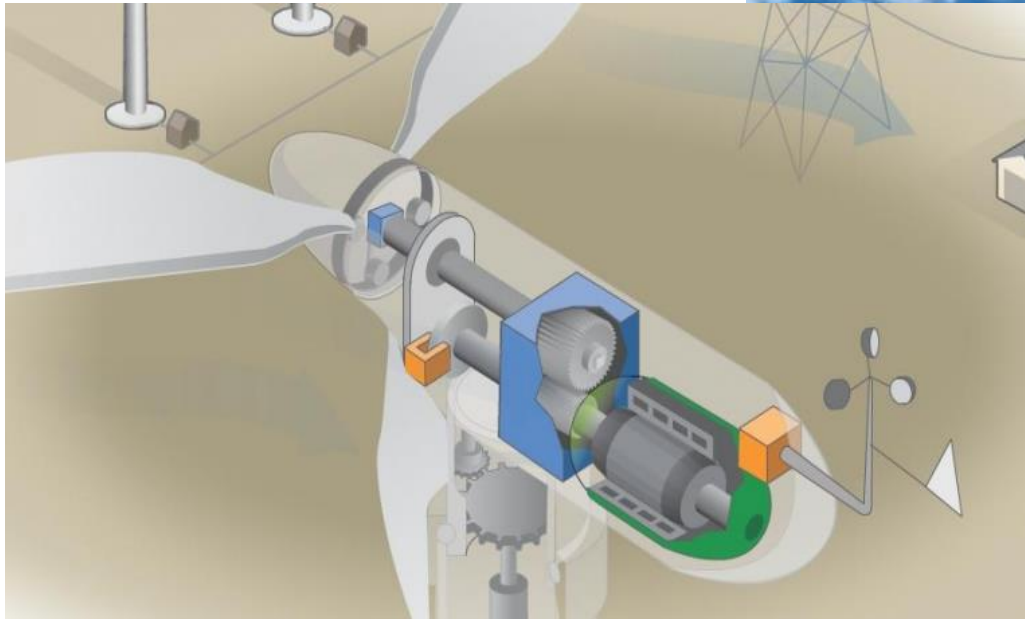
Sucker Rod Pump (SRP) 3

	Power	33 Kw
	Production	71 bpd
	Oil	10°API



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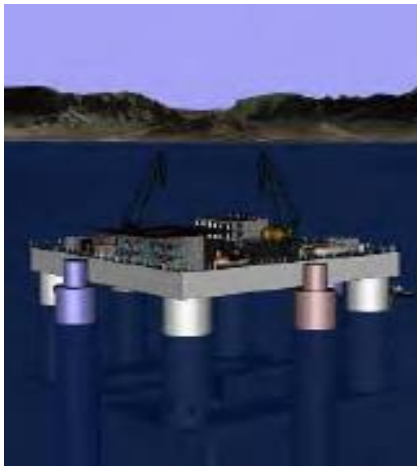
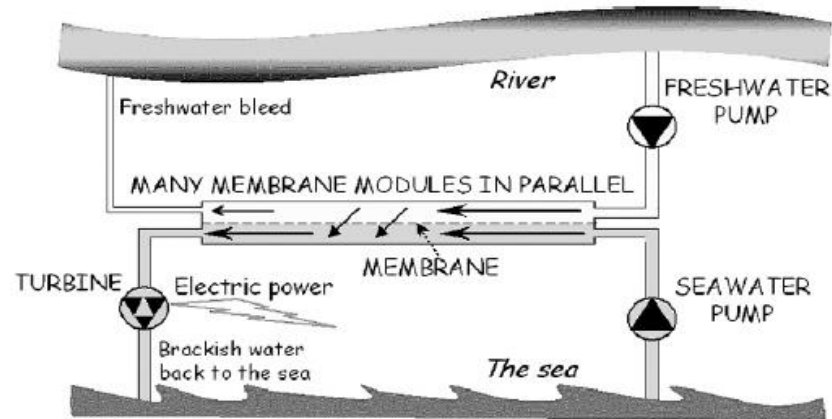
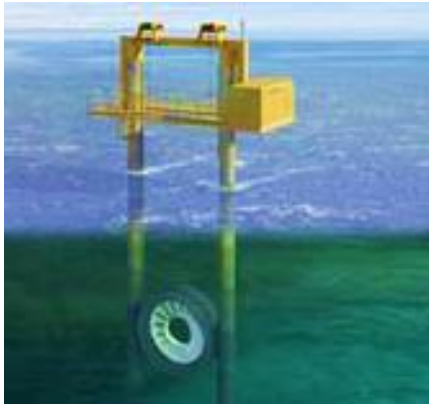
Wind energy



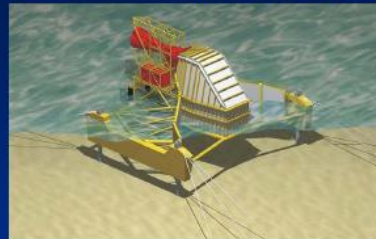
Hydropower



Waves, tides and all that - ocean energy



Fixed Oscillating Water Column Terminator (Oceanlinx)



Floating Attenuator (Pelamis)



Floating Overtopping Terminator (Wave Dragon)



Floating Point Absorber (AquaBuOY)



Biomass and biofuel



waste



to



fuel

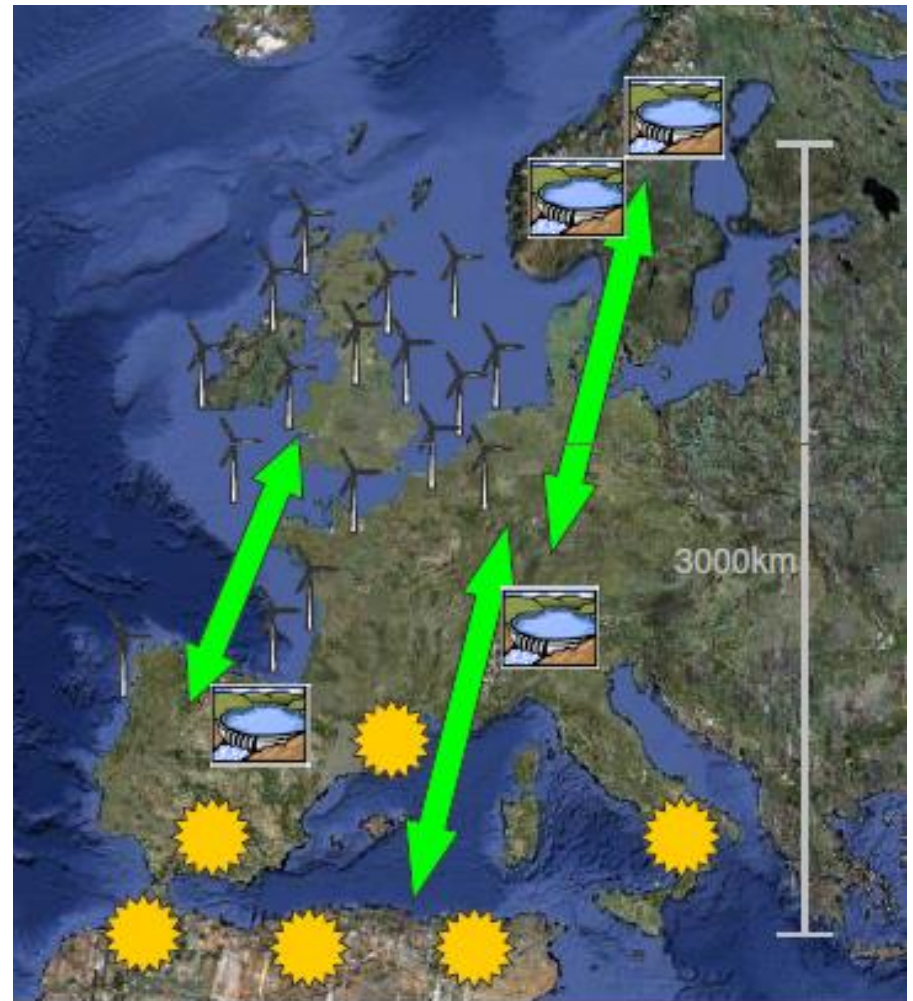


Geothermal energy



And what about grids?

- Interconnection of remote renewable energy sources
- Overcoming «bottlenecks» in the existing AC grids
- Low loss (HVDC) transmission systems
- Controllable power flows over a wide area
- Avoidance of synchronisation over a wide area
- Less environmental impact than AC reinforcement



Pros and Cons

Most of them provide unlimited supply

Energy independence

Costs are reducing

Renewables are generally not hazardous to the environment

Biomass and geothermal energy need wise management to avoid their depletion

If clean energy becomes prevalent, the electricity transmission and distribution systems must be transformed

Renewable energy is still expensive

Some green energy installations take up large pieces of land that can be used to grow crops or ruin the landscape



Some myths about Renewable Energy



- Solar panels will never pay-back the energy used to produce them
 - False! Current solar system pay their energy debt in about 1 year
- Wind farms are noisy
 - what about a coal power plant?
- Wind turbines harm birds
 - it happens, but heavy industry has a much greater impact!



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Thank you for your kind attention!