



Natural Resources and Renewable Energy Sources



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Renewable vs. non-renewable energy

Renewable vs. non-renewable energy



Renewable energy is energy from renewable natural resources that are replenished on a human timescale. Using renewable energy technologies helps with climate change mitigation, energy security, and also has some economic benefits.

Non-renewable energy resources include coal, natural gas, oil, and nuclear energy. Once these resources are used up, they cannot be replaced, which is a major problem for humanity as we are currently dependent on them to supply most of our energy needs.

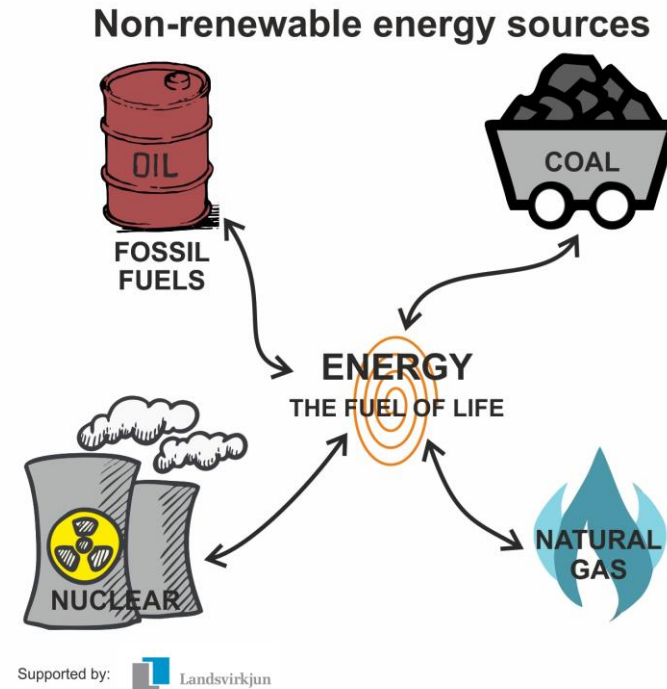


Renewable vs. non-renewable energy



Non-renewable energy sources

- Coal
- Natural gas
- Oil
- Nuclear energy



Renewable vs. non-renewable energy



Non-renewable energy sources

Advantages

- Available in highly concentrated form
- Easy to store and transport
- Reliable supply and they have high energy density

Disadvantages

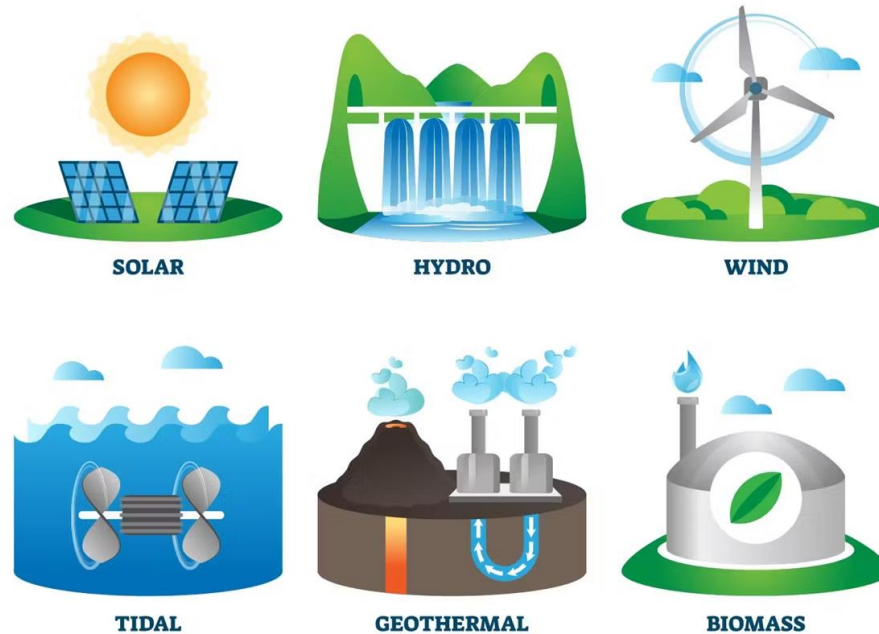
- Highly polluting
- High running cost
- A fossil fuel contribute to global warming
- It's residual products are generally non-biodegradable
- it produces greenhouse gases
- Responsible for acid rain

Renewable vs. non-renewable energy



Renewable energy sources

- Solar energy
- Wind energy
- Geothermal energy
- Hydropower energy
- Biomass energy



Renewable vs. non-renewable energy



Renewable energy sources

Advantages

- Low pollution
- Free of cost
- Available in nature
- A very large amount of energy could be generated in this way

Disadvantages

- Usually produced in small quantities
- Often very difficult to store
- High cost of harvesting energy

Renewable vs. non-renewable energy



Why to transform our energy mix?

- We have limited fuels available on Earth
- Our demand for energy is increasing day by day
- It is possible that someday most of the fuels will be exhausted and we will have to switch over to alternate energy
- Once it is used, it cannot be formed again. As Petroleum once used cannot be renewed again



Importance of renewable energy

Importance of renewable energy



Environmental Benefits

- Reduces greenhouse gas emissions.
- Decreases air and water pollution.

Economic Benefits

- Creates jobs in the renewable energy sector.
- Reduces dependence on imported fuels.



Importance of renewable energy



Reduce greenhouse gas emissions

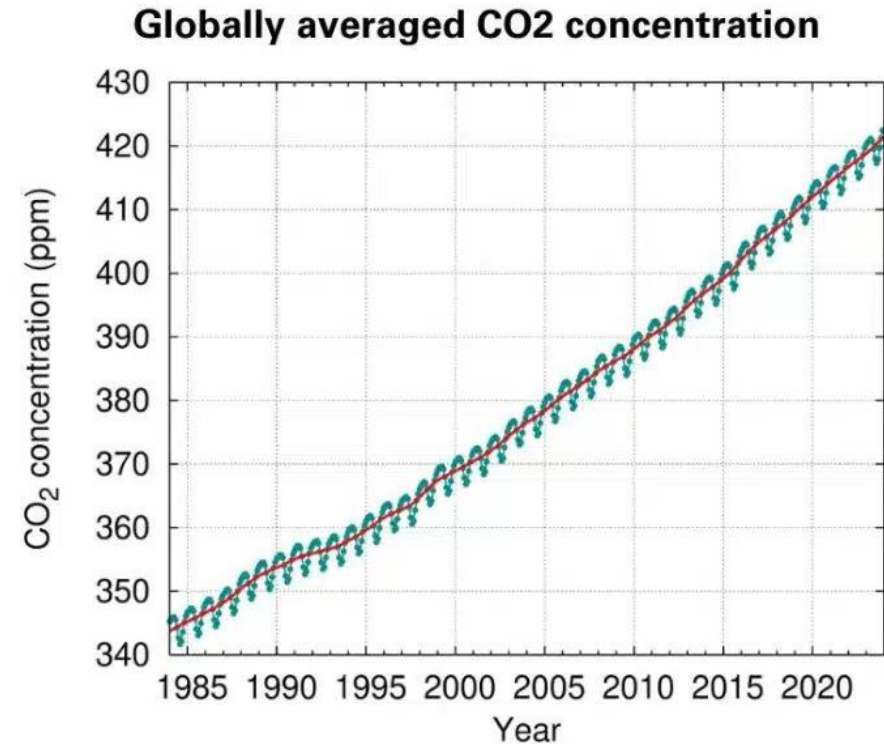
- The **hottest-ever summer**, and the hottest day on record, **2024** was recently confirmed as the hottest year in history, with the global average temperature 0.12°C above 2023, the previous warmest calendar year on record.
- The global average temperatures was 1.60°C above pre-industrial levels, making it also the first calendar year that has reached more than 1.5°C above the pre-industrial level.

Importance of renewable energy



Reduce greenhouse gas emissions

- **Greenhouse gas** concentrations **have never been so high**. Atmospheric concentrations of all three major planet-warming gases – carbon dioxide, methane, and nitrous oxide – reached new highs in 2023
- This is undoubtedly one of **the biggest environmental problems** of our lifetime: as greenhouse gas emissions blanket the Earth, they trap the sun's heat, leading to **global warming**.



Importance of renewable energy



Decreases air and water pollution.

- According to the World Health Organization, an estimated **4.2 to 7 million people die** from air pollution worldwide every year and nine out of ten people breathe air that contains high levels of pollutants.





Types of renewable energy

Types of renewable energy



- The wind, the sun, and Earth are sources of renewable energy. These energy sources **naturally renew**, or replenish themselves.
- Wind, sunlight, and the planet have energy that transforms in ways we can see and feel. We can see and feel evidence of the transfer of energy from the sun to Earth in the sunlight shining on the ground and the warmth we feel when sunlight shines on our skin. We can see and feel evidence of the transfer of energy in wind's ability to pull kites higher into the sky and shake the leaves on trees. We can see and feel evidence of the transfer of energy in the geothermal energy of steam vents and geysers.
- People have created different ways to capture the energy from these renewable sources.

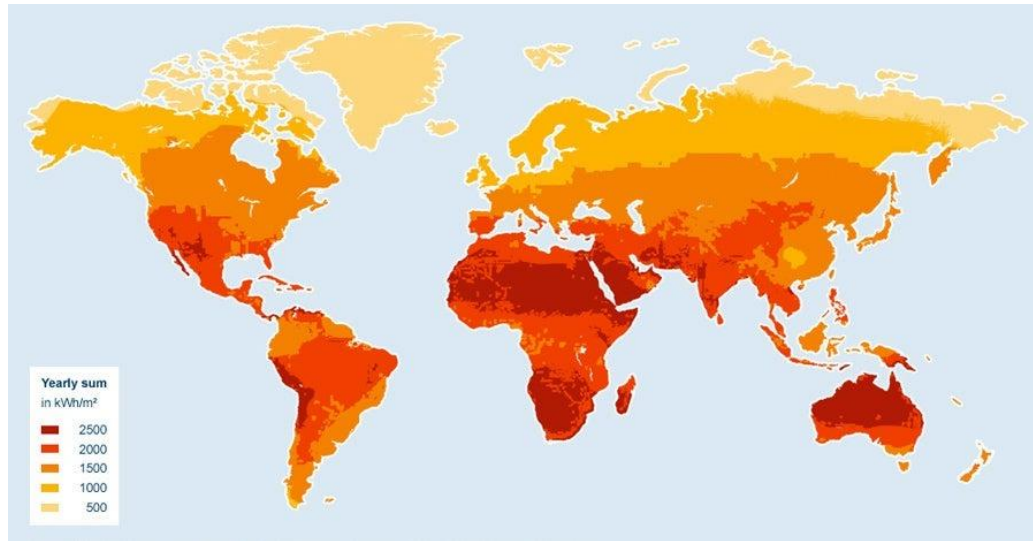
Types of renewable energy - Solar energy



Solar energy uses special technology to capture the sun's rays. The two main types of equipment are **photovoltaic cells** and **mirrors** that focus sunlight in a **specific spot**. These active solar technologies use sunlight to generate electricity.



Types of renewable energy - Solar energy



Solar radiation produced from the sun's energy is abundant in most places on Earth, but some locations are more suitable for solar power generation than others. Solar installations have higher electricity production in places where the sun shines all year long.

Some of the countries with the most sunlight are on the top 10 solar capacity list, such as Australia and India, but there is **huge potential in Africa and South America** to grow solar generation.

Types of renewable energy - wind energy



We capture the wind's energy with wind turbines. A turbine is similar to a windmill; it has a very tall tower with two or three propeller-like blades at the top. These blades are turned by the wind. The blades turn a generator (located inside the tower), which creates electricity.

Groups of wind turbines are known as **wind farms**. Wind farms can be found near farmland, in narrow mountain passes, and even in the ocean, where there are steadier and stronger winds. Wind turbines anchored in the ocean are called “**offshore** wind farms.”



Types of renewable energy - wind energy



Advantages and Disadvantages

- **Wind** energy can be **very efficient**. In places like the Midwest in the United States and along coasts, steady winds can provide cheap, reliable electricity.
- Another great advantage of wind power is that it is a “clean” form of energy. Wind turbines do not burn fuel or emit any pollutants into the air.
- Wind is **not** always a **steady** source of energy, however. Wind speed changes constantly, depending on the time of day, weather, and geographic location. Currently, it cannot be used to provide electricity for all our power needs.

Types of renewable energy - Geothermal energy

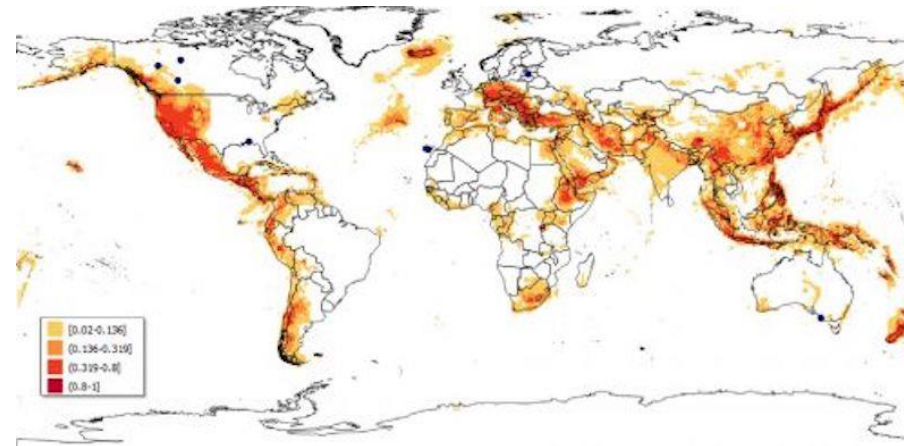
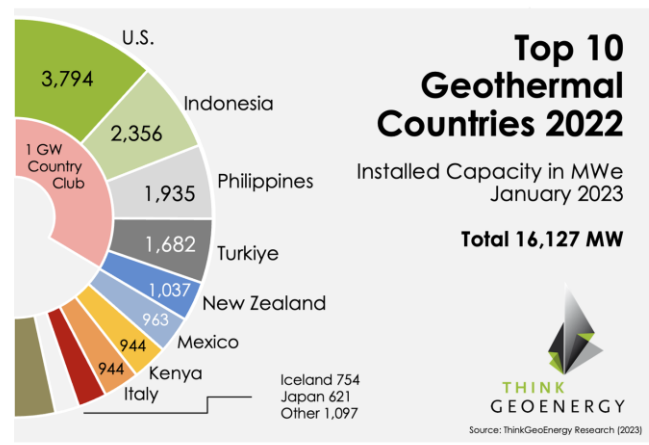


- We can access underground geothermal heat in different ways. One way of using geothermal energy is with “geothermal heat pumps.” A pipe of water loops between a building and holes dug deep underground. The water is warmed by the geothermal energy underground and brings the warmth aboveground to the building. Geothermal heat pumps can be used to heat houses, sidewalks, and even parking lots.
- Another way to use geothermal energy is with steam. In some areas of the world, there is underground steam that naturally rises to the surface. The steam can be piped straight to a power plant.

Types of renewable energy - Geothermal energy



Geothermal energy is only available in certain parts of the world. Another disadvantage of using geothermal energy is that in areas of the world where there is only dry heat underground, large quantities of freshwater are used to make steam. There may not be a lot of freshwater. People need water for drinking, cooking, and bathing.



Types of renewable energy - Biomass energy



Biomass is any material that comes from plants or microorganisms that were recently living. Plants create energy from the sun through photosynthesis. This energy is stored in the plants even after they die.

Trees, branches, scraps of bark, and recycled paper are common sources of biomass energy. Manure, garbage, and crops, such as corn, soy, and sugar cane, can also be used as biomass feedstocks.

We get energy from biomass by burning it. Wood chips, manure, and garbage are dried out and compressed into squares called “briquettes.” These briquettes are so dry that they do not absorb water. They can be stored and burned to create heat or generate electricity.

Types of renewable energy - Biomass energy



Advantages and Disadvantages

- A major advantage of biomass is that it can be stored and then used when it is needed.
- Growing crops for biofuels, however, requires large amounts of land and pesticides. Land could be used for food instead of biofuels. Some pesticides could pollute the air and water.
- Biomass energy can also be a nonrenewable energy source. Biomass energy relies on biomass feedstocks—plants that are processed and burned to create electricity. Biomass feedstocks can include crops, such as corn or soy, as well as wood. If people do not replant biomass feedstocks as fast as they use them, biomass energy becomes a non-renewable energy source.

Types of renewable energy - Hydropower energy



Dams block the river and create an artificial lake, or reservoir. A controlled amount of water is forced through tunnels in the dam. As water flows through the tunnels, it turns huge turbines and generates electricity.



Types of renewable energy - Hydropower energy



Advantages and Disadvantages

- Hydroelectric energy is fairly inexpensive to harness. Dams do not need to be complex, and the resources to build them are not difficult to obtain. Rivers flow all over the world, so the energy source is available to millions of people.
- Hydroelectric energy is also fairly reliable. Engineers control the flow of water through the dam, so the flow does not depend on the weather (the way solar and wind energies do).
- However, hydroelectric power plants are damaging to the environment. When a river is dammed, it creates a large lake behind the dam. This lake (sometimes called a reservoir) drowns the original river habitat deep underwater



Renewable energy and The European Green Deal

Renewable energy and The European Green Deal



Climate change and environmental degradation are an existential threat to Europe and the world. To overcome these challenges, the European Green Deal will transform the EU into a modern, resource-efficient and competitive economy, ensuring:

- **no net emissions** of greenhouse gases by **2050**

One third of the **€1.8 trillion investments** from the NextGenerationEU Recovery Plan, and the EU's seven-year budget will finance the European Green Deal.

The European Commission has adopted a set of proposals to make the EU's climate, energy, transport and taxation policies fit for **reducing** net greenhouse gas emissions by at **least 55% by 2030**, compared **to 1990 levels**.

Renewable energy and The European Green Deal



The production and use of energy account for more than 75% of the EU's greenhouse gas emissions.

The Commission's main objectives to achieve this are:

- build interconnected energy systems and better integrated grids to support renewable energy sources
- promote innovative technologies and modern infrastructure
- boost energy efficiency and eco-design of products
- decarbonise the gas sector and promote smart integration across sectors
- empower consumers and help EU countries to tackle energy poverty
- promote EU energy standards and technologies at global level
- develop the full potential of Europe's offshore wind energy



Student activity

Student activity



- The task of the students is to record the consumption of individual devices (computer, fridge,...) in the school during a specified period of time.
- Calculate how much energy a computer (which will be on all day at school) and a fridge (which will be on all day) consume per day
- You need to find out how much electricity your fridge and computer uses
- How much electricity do I use by using my PC/fridge in a month/year/my whole life?

Student activity - example of a possible solution



The following data are used in the calculations:

PC use - 5 hours/day (0,03 kWh/hour)

Fridge - 24 hours/day (0,02 kWh/hour)

The power consumption of the PC and fridge is as follows:

Daily consumption: $5 \times 0.03 + 24 \times 0.02 = 0.63$ kWh

Monthly consumption: $30 \times 0.63 = 18,9$ kWh

Year consumption: $12 \times 18,9 = 226,8$ kWh

Lifetime consumption: $77 \times 226,8 = 17,463$ kWh = 17,463 MWh

Student activity



- Solar energy (one solar panel produce 0,82 kWh/day in Czechia)
 - In how many days the solar panel makes energy for PC and fridge for the whole year?
- Wind energy (the turbine has an output of 250 kW per hour)
 - how many hours a wind turbine would have to spin to cover energy for the year?
- Hydroelectric power plant Spálov (generates 1,37 mWh/hour)
 - how many hours does the power plant need to be running to cover my lifetime energy?

Student activity



Coal power plant Chvaletice

- The plant consumes 3.7 million tonnes of coal annually.
- $3\,171\text{ GWh/year} = 3\,171\,000\text{ MWh}$
- $17,463\text{ MWh (Lifetime consumption of PC and fridge) of } 3\,171\,000\text{ MWh} = 0,00055\%$

How many kilogram of coal is need for Lifetime consumption of PC and fridge?

Quiz



Go Green Against Climate Change -
2023-1-RO01-KA220-SCH-000161283



<https://earth.org/the-biggest-environmental-problems-of-our-lifetime/>

<https://education.nationalgeographic.org/resource/renewable-energy/>

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en