**Energy Forms**

Some energy sources are cleaner than others. However, all of them have an impact on the environment. You will be surprised to see that, during the manufacturing of parts, some green technologies may pollute and increase the greenhouse effect more than traditional energy sources.

This means that we need to invest in the least polluting technologies, both during the manufacturing of parts and operation, and combine them with technologies that, for example, capture CO2 from the environment and the emission source.Technologies that are clean as they operate but have a great impact on the environment when they are manufactured (especially regarding emission of potent greenhouse gases) need more research before being widely adopted.

Below is a description of some different types of energy.

1. Βiofuel Energy

It is made from different sources (ethanol, biodiesel, biomass, wood chips, municipal waste, among others) and pollutes less than fossil fuels during burning. It is a renewable energy source, cheaper to produce than fossil fuels and it can be produced by any country.

However the emissions of this energy include CO2, CO, and sulfur, biodiesel creates a lot of nitrogen oxide and ashes from biofuels may contain harmful metals, such as cadmium and lead. Also a great amount of energy and water is necessary to grow the crops, produce fertilizers and pesticides and finally transform plants into biofuel. A great amount of the energy used to produce biofuels comes from fossil fuels and they increase the carbon footprint through cultivation and harvest of crops in addition to the destruction of forests for crop plantation. Finally, this form of energy is less efficient than fossil fuels but has higher production costs.

2. Coal Energy (lignite,etc)

Coal contains the energy stored by plants that lived hundreds of millions of years ago and were covered by layers of dirt and rock over millions of years.

It is abundant and inexpensive and “clean coal” technology can remove harmful material before it reaches the environment

However, there is an impact on the environment as it can potentially pollute the air, soil and water and the burning of coal emits CO2, SO2, toxic heavy metals, cadmium, arsenic, and mercury.

“Clean Coal” involves high costs and the coal source is finite. Finally byproducts of coal mining include arsenic, SO2, selenium, and mercury

3. Geothermal Energy

This is the heat energy from the earth. Geothermal resources are reservoirs of hot water that exist below the earth’s surface

It is a renewable resource that is also reliable and predictable. It creates smaller amounts of CO2 and sulfur components than fossil fuels and it is great for heating. Its use does not burn fuels and it has small footprint on the land.

On the other hand, it involves heavy upfront costs and it is sustainable only if reservoirs are properly managed.

4. Hydropower

It is the power generated by a dam or diversion structure to change the natural flow of a river.

It does not pollute the water or air and it is a renewable, reliable and flexible source of energy.

Nevertheless, it forces relocation of people and animals, it may change the temperature and flow of water and may cause low level of dissolved oxygen in water. It also disturbs the river habitats and fish populations and the dams are quite expensive. Finally this energy can be affected by droughts.

5. Petroleum Energy

This is still a widely used form of energy, which is reliable as we have developed the proper technology for its use.

However, the drilling operation disrupts wildlife habitat and it impacts the landscape through the removal of vegetation and increase of erosion, which leads to landslides and floods. Petroleum emits CO2, CO,and other air pollutants and methane is also produced during its extraction. There can be oil spills and urban runoffs that pollute the water and have an impact on animals. Finally, it is a non-renewable source of energy.

6. Solar Energy

The energy from the sun is abundant, renewable, and sustainable, which is available worldwide. It does not pollute the air or water, it is silent and needs low maintenance.

However, it is a high upfront investment and the solar panel production emits hexafluoroethane (C2F6), nitrogen trifluoride(NF3) and sulfur hexafluoride (SF6), which are very potent greenhouse gases.

Certain solar cells require expensive and rare materials, such as copper and the solar panels require large space. Finally the energy from the sun is intermittent.

7. Nuclear Energy

This is a form of energy released from the nucleus of atoms and it can be produced by fission – when the nuclei of atoms are split into several parts or fusion – when the nuclei fuse together.

Nuclear energy has insignificant carbon emissions and low operating costs and it is more efficient and reliable than fossil fuel.

Nevertheless, it generates radioactive waste, it has high start up costs and nuclear accidents can pose serious health effects. Uranium, which is a radioactive material, is finite and non-renewable and high amounts of water are needed for production of steam and system cooling. Finally, the wastewater from the power plants may contain pollutants.

8. Wind Energy

This is a clean, renewable and sustainable energy source since the wind is free and available everywhere. It does not pollute the air or water and it has low operating costs.

However, it is intermittent and unpredictable, it may result in death of bats and birds and in disturbance of the natural environment, it has high upfront costs and it creates noise and visual pollution. Turbine manufacturing and installation emit greenhouse gases and produces waste that cannot be recycled.

9. Tidal Energy

This is a form of renewable energy powered by the ocean tides. Tides are the rise and fall of ocean waters. This energy is renewable and predictable and effective at low speeds, with a long life span and it does not emit greenhouse gases.

On the other hand, its environmental effects are potentially similar to those of hydroelectric dams, it is an intermittent source of energy and it may disturb the natural movement/migration of fish. It is expensive and not cost-effective, it needs to be close to the shore and it is a new technology that requires more research and a large amount of funding.

10. Hydrogen Energy from Electrolysis

Hydrogen is an energy carrier that can be used to store, move and deliver energy produced from other sources. Hydrogen fuel can be produced through natural gas reforming and through electrolysis. Hydrogen energy from electrolysis is a low carbon technology if the electricity for electrolysis comes from renewable sources with low CO2 emission, but a high carbon technology if the electricity for electrolysis comes from fossil fuels. It is less efficient than batteries and the fuel cells efficiency is only 40%-60%.

<https://www.aje.com/arc/energy-types-pros-cons/>

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| --- | --- | --- | --- | --- | --- |
|  | Biofuel energy | Coal energy | Geothermal enegy | Hydro  power | Petroleum  energy |
| Advantages |  |  |  |  |  |
| Disadvantages |  |  |  |  |  |
|  | Solar energy | Nuclear power | Wind power | Tidal energy | Hydrogen |
| Advantages |  |  |  |  |  |
| Disadvantages |  |  |  |  |  |