

Environmental Impacts of Coal, Natural Gas, Nuclear, and Solar Power

Humans have continually had breakthroughs in ways to generate power for the new technologies they create. However, until very recently, they haven't realized the major impacts of these non-renewable and renewable resources and the carbon footprint they leave behind. Coal, natural gas, nuclear, and solar power are some of the most prominent ways countries generate electricity, but each of them has its own list of environmental impacts that people have to conclude which is the most effective and environmentally friendly.

Coal is a non-renewable fossil fuel that is burned to generate around half of the electricity used in the U.S (U.S. Energy Information Administration). It is inexpensive to extract, and it can be found all over the world. Besides, its extraction doesn't require advanced technologies, so most countries can use it for energy easily (National Geographic Society, Coal). However, when coal is burned, it releases sulfur dioxide (SO₂), nitrogen oxides (NO_x), particulates, and carbon dioxide (CO₂) into the air (U.S. Energy Information Administration). All of these products released by coal pollutes not just the air, but the ground and water. Sulfur dioxide contributes to acid rain, which can deplete the soil of necessary nutrients for plants and lower the pH of water, damaging water-life. Nitrogen oxides and particulates contribute to smog, air pollution that can damage wildlife and plants. (U.S. Energy Information Administration). Also, it releases carbon dioxide, which is the main greenhouse gas released from fossil fuels and leads to global warming. When coal is burned, it releases carbon into the atmosphere, which builds up greenhouse gases (National Geographic Society, Coal). Coal's environmental impacts aren't only to do with the emissions, but also with the extraction process. There are many ways coal is extracted from the earth, including surface mining, mountaintop removal, and underground mining. Surface mining and mountaintop removal tear apart ecosystems and habitats and let

toxic byproducts pollute the air and waterways. Underground mining leaves significant tailings that can pollute water and can cause underground explosions (National Geographic Society, Coal). Because of these extraction methods, coal fires can ignite and emit tons of greenhouse gases into the atmosphere. It can even reignite years later and start another wildfire. Though coal is easy to gather and use for countries, it releases a colossal amount of greenhouse gases into the air which leads to global warming and rips apart ecosystems that could be vital to this planet.

Natural Gas is also a non-renewable fossil fuel, but it seems to be cleaner than coal. It is an alternative fuel for many types of vehicles, which only emits propane and butane and releases 70% less carbon dioxide into the atmosphere than coal (National Geographic Society, Natural Gas). Also, when burned it only emits carbon dioxide, which in comparison to coal, is a lot better. Nevertheless, natural gas still causes a great amount of harm to the environment due to the process that extracts natural gas, hydraulic fracking. Hydraulic fracking produces highly toxic and radioactive wastewater that could leak if not carefully contained (National Geographic Society, Natural Gas). This could negatively impact the surrounding area, including the ground, aquatic habitats, and underground water sources. Also, if it were to leak, it could release methane into the air, a greenhouse gas that incredibly impacts global warming. This methane along with the carbon dioxide that is released, and the consequences of hydraulic fracking makes natural gas have a high carbon footprint and damage to the environment.

Nuclear power produces renewable, clean energy and as of 2011, around 15% of the world's electricity is generated using nuclear energy (National Geographic Society, Nuclear Energy). It doesn't pollute the air with any greenhouse gases, unlike the former two sources of energy. Carbon dioxide isn't even a byproduct of this method, which means nuclear power's carbon footprint is extremely low in comparison. Also, nuclear plants can be built anywhere, in

rural or urban areas, and the environment around them usually does not get torn apart, like it does when coal mining. Also, the steam that powers the generators and turbines in the plant is recycled to produce more electricity and the excess steam is released into the atmosphere, but it doesn't cause any harm (National Geographic Society, Nuclear Energy). Since it is a newer source of energy, there is still research happening to find out ways to utilize nuclear fusion to generate electricity, which would be safer and more cost-effective. Though it doesn't have any significant global warming impacts, many people think it is too dangerous. Byproducts of nuclear energy are radioactive, and these can be radioactive for thousands of years, which means it has to be stored in special containers (National Geographic Society, Nuclear Energy). These containers could leak and contaminate the area around the nuclear plant. In addition, incidents like 3-Mile Island and Chernobyl, where the nuclear plant had a devastating accident, could happen and damage the people, wildlife, and environment around the facilities. However, those incidents happened many years ago and nuclear engineers are researching safer ways for containment. For an example of its safety, France has been deriving around 70% of its electricity for years and hasn't had any major nuclear accidents (Nuclear Energy in France). They have very specific regulations and rules to contain radioactive waste. They also use descriptive and strict protocols to ensure the safety of individuals and the environment. If other countries were to take similar strict precautions around nuclear energy, it could be considered safer and a better way to produce electricity, and the public would trust it more.

Solar power is a renewable resource that creates clean energy as nuclear energy does. The most common solar energy technologies utilize photovoltaic (PV) cells and panels to convert the wavelengths from the sun into electricity. According to National Geographic, "In one hour, the Earth's atmosphere receives enough sunlight to power the electricity needs of every human being

on Earth for a year” (National Geographic Society, Solar Energy). Though it creates clean energy, the manufacturing of the PV cells generates global warming emissions, with it utilizing hazardous materials, like hydrochloric acid, sulfuric acid, hydrogen fluoride, acetone, nitric acid, and more. Also, manufacturing PV cells use a lot of water, around “600-650 gallons of water per megawatt-hour of electricity produced” (National Geographic Society, Solar Energy). Solar energy, from a glance, seems to be a clean, environmentally friendly way to generate electricity, the process of creating the materials for solar panels requires dangerous chemicals that are terrible for the environment.

Though all of these methods have their issues attached to them, nuclear seems to have the smallest carbon footprint out of all of these electricity generation methods. It does not release any carbon dioxide into the air, along with any other greenhouse gases, and it is a clean and renewable energy. Though solar power also is a clean and renewable energy, the process of manufacturing the photovoltaic cells uses a major amount of water and uses dangerous chemicals that could leak into the environment. Especially since nuclear engineers and others are researching methods to make nuclear plants and the nuclear energy process safer and more effective, through the data, it makes sense that people should begin to use nuclear power as the main source of energy.

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