

Committee: Environmental Sub-Commission 2

Issue: Considering the environmental impact of the renewable energy industry

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INTRODUCTION

Alternative forms of energy have been a particularly discussed topic, especially in the last decade. Using renewable energy is in itself a goal for many nations. The reasons behind that vary. The most commonly cited ones have to do with the environment. Fossil fuels, currently the most commonly used power source on the planet², have a large CO₂ footprint associated with them, which, as is commonly known, is the largest contributor to the greenhouse effect. It must also be noted that fossil fuels have an expiration date. "Coal reserves are available up to 2112, and will be the only fossil fuel remaining after 2042"²¹. This fact makes eliminating our dependence on fossil fuels an urgent matter that, if not addressed, could have disastrous consequences on our society. Even forgetting environmental motives for using renewable energy sources, there are still incentives for using them. As stated, fossil fuel reserves are declining. This is bound to drive their prices up rapidly as they become harder and harder to come by. Therefore, switching to renewable energy can protect countries as well as corporations from those rising prices and even give them a competitive advantage against others who did not foresee this change. These, along with other benefits, such as creating job opportunities, improving public image and even incentives provided by most countries, have led to an ever increasing adoption of renewable energy sources.

Solar and wind power, nuclear energy (from fission or fusion), tidal energy, geothermal energy and hydropower all have the potential to eventually replace fossil fuel. However, in the rush to find the perfect alternative energy source, most people have not stopped to consider the possible environmental impact of those alternative sources themselves. Even though in the majority of cases renewable energy sources are vastly more environmentally-friendly than their fossil fuel counterparts, they are still far from perfect.

In your resolutions, you will have to propose ways to combat the negative effects of those alternative energy sources, either through improvements to existing ones, or through energy sources, that have not yet been considered enough, and do not carry the disadvantages of the ones currently in use.

DEFINITION KEY TERMS

Renewable Energy

According to Dictionary.com, renewable energy is defined as “Any naturally occurring, theoretically inexhaustible source of energy, such as biomass, solar, wind, tidal, wave, and hydroelectric power that is not derived from fossil or nuclear fuel.” However, the part of the definition regarding nuclear power is largely debated and so, for the purposes of this study guide, renewable energy will also refer to nuclear energy.

Nuclear Energy

“Energy released during a nuclear reaction as a result of fission or fusion.”⁷

Nuclear Fission

“Nuclear fission is a nuclear reaction in which a heavy nucleus (such as uranium) splits into two lighter nuclei (and possible some other radioactive particles as well).”⁸

Nuclear Fusion

Nuclear Fusion is, in layman terms, the opposite of nuclear fission. During nuclear fusion two lighter atomic nuclei fuse to form a heavier one (e.g. two hydrogen atoms fusing into a helium one) releasing large amounts of energy⁹. This is the same process that is constantly taking place in the core of the sun. This form of energy is still in its infancy and as such it cannot be used for commercial power plants, but it is being heavily researched into and many experts consider it the ultimate form of clean energy.

For more information on the difference between fission and fusion, you may have a look at the link provided: http://www.diffen.com/difference/Nuclear_Fission_vs_Nuclear_Fusion

Solar Energy

“Electromagnetic energy transmitted from the sun (solar radiation). The amount that reaches the earth is equal to one billionth of total solar energy generated, or the equivalent of about 420 trillion kilowatt-hours.”¹⁰

Solar or Photovoltaic (PV) module

Refers to the a single unit of solar cells combined with other supplementary parts that allow the production of electricity from sunlight.¹⁰

Hydroelectric power

“The production of electricity by the force of fast moving water.”¹¹ This form of electricity is usually produced through the use of water dams; however alternate methods exist, such as tidal energy or wave power.

BACKGROUND INFORMATION

Hydroelectric Energy

Hydroelectric Energy is the most used renewable energy source in the world, currently accounting 17% of the world’s electricity production.² Hydroelectric energy is mainly produced in dams in which large turbines are placed. In order to power them, water is withheld from a source using the dam and released whenever power is needed so that the turbines may spin and generate electricity.³ The reason behind Hydropower’s popularity is mainly its efficiency with some hydropower generator managing up to 90% efficiency.⁴ That, coupled with the fact that countries such as the US already have a large amount of dams explain hydropower’s wide usage.

Hydropower however is not without downsides. Water dams block river flow which can have a variety of detrimental effects to the aquatic ecosystem. “The **dam wall blocks fish migrations**, which in some cases and with some species completely separate spawning habitats from rearing habitats”⁵. By blocking the flow of the river, **transfer of sediment**, which is a vital resource for the river ecosystem, **is also hindered**. The **reduced flow** can be extremely detrimental to the river’s fish population, which depends on a regular water flow throughout the year.

Nuclear Fission *(see Definition of Key Terms)*

Following behind Hydropower, Nuclear energy is the second most used renewable energy source, producing 11% of the world’s electricity.² In most cases, nuclear energy refers to energy produced by the process of **nuclear fission**. During this process, atoms of a radioactive element are made to undergo fission, usually through means of being bombarded by neutrons. This process generates heat, which is used to generate steam and

in turn spin generator turbines. The element used in the vast majority of nuclear reactors is Uranium which, when found in nature consists of 0.7% U-235 (The isotope of uranium which is “fissile”, meaning it can be used as nuclear fuel) and 99.3% U-238 (The non-“fissile” isotope of Uranium). In order for the uranium to become usable as nuclear fuel it must be “enriched” meaning that the concentration of U-235 must be increased. After the enrichment process Uranium is ready to be used in a nuclear reactor⁶.

The dangers of nuclear power are several and because of them there is a lot of opposition to the wider adoption of nuclear power. The first argument against nuclear power that comes to mind for most people is the **risk of accidents**. The accidents at Chernobyl, Three Mile Island, and more recently Fukushima, have made the public fear nuclear power. At the same time the issue of managing **nuclear waste** is one which has plagued the global community ever since nuclear power plants started being widely used, and ways of managing it are still being debated.

Solar Power

Solar power is currently one of the least used energy sources sitting at about 1% of the global energy production. However it is considered one of the cleanest energy sources currently available, with little to no attention to its negative effects. In reality though, production of Photovoltaic (PV) cells produces large amounts of **dangerous substances**. These substances include silicon dust -also known as kerf- (from the sawing of silicon), silicon tetrachloride and more¹², all of which are either toxic or need to be handled with extreme care. At the same time, solar modules contain **precious metals** which are usually thrown away when the solar panels reach their end of life. Finally, solar panels require **large amounts of silicon** in their construction. Silicon, while abundant, requires lots of energy to be made into a usable form and this energy usually comes from fossil fuel power plants, making the environmental impact of this process quite significant.

Wind Power

Wind power is, in many ways, the cleanest form of renewable energy currently available. The largest environmental impact associated with wind turbines is their **land usage**, which, in some cases, has been covered by cutting down forests. This problem however, can be solved, as shown by Denmark, a country which depends on wind power for 34% of its energy requirements, which places most of its wind turbines in shallow water, close to the shore line. The most common issue attributed to wind power is that birds and bats are killed by the turbines’ fins. The amount of bird and bat deaths due to wind turbines,

though, has been proven negligible as evidenced by a study conducted by the National Wind Coordinating Committee (NWCC)²⁴.

MAJOR COUNTRIES AND ORGANIZATIONS INVOLVED

European Union (EU)

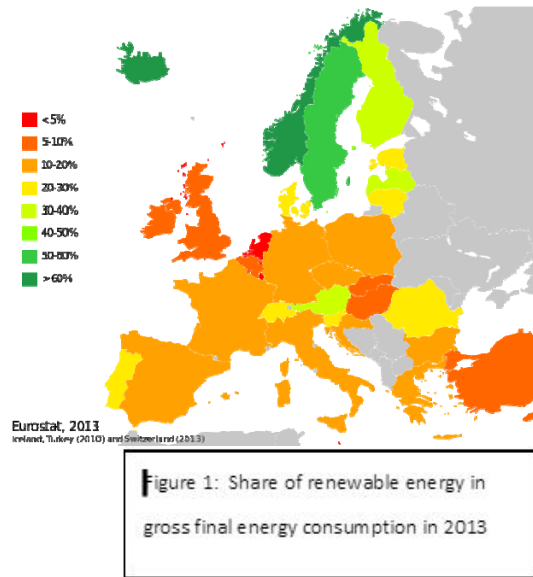
According to the European Commission's renewable energy directive, the EU must cover at least 20% of its energy requirements through renewable sources, with specific targets having been set for each EU member state ranging from 10% for Malta to 49% for Sweden.¹⁹

Regarding nuclear energy, the Euratom treaty established the European Atomic Energy Community, which is governed by the EU's laws and regulations, even though it is a separate legal entity. The community's duties include, among others, fostering atomic energy research and cooperation, establishing and ensuring the enforcement of nuclear safety standards and cooperating with other countries and organizations to further the peaceful usage of nuclear power²⁰.

It is also worth noting that France, one of the founding members of the EU, is one of the most prominent users of nuclear power, currently generating 76% of its electricity through nuclear power plants, and Denmark, another member of the EU uses wind power to cover 34% of its energy needs.

Silicon Valley Toxics Coalition (SVTC)

"Silicon Valley Toxics Coalition is a diverse non-profit organization engaged in research, advocacy and grassroots organizing to promote human health and environmental justice in response to the rapid growth of the high-tech industry."¹⁷ The SVTC releases an annual scorecard, which rates how environmentally friendly solar power companies are, according to the SVTC's standards (The scorecard is analyzed again in *Previous Attempts to Solve the Issue*).



International Atomic Energy Agency (IAEA)

The IAEA is a UN organization, which is responsible for encouraging nuclear cooperation, research and safety. The organization is very concerned with managing nuclear waste and improving the viability of nuclear power. The IAEA has released multiple safety standards regarding nuclear power plants, nuclear waste management and more facets of nuclear power. It is also concerned with advancing nuclear fusion as a viable means of energy production, having founded a journal named “nuclear fusion” which publishes multiple articles and papers on scientific and practical advancements in the field of nuclear fusion, allowing for a central repository of research made on nuclear fusion.

PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

SVTC solar scorecard

The SVTC solar scorecard is a document released annually by the SVTC to rate the “environmental friendliness” of solar panel manufacturers. It awards points for things such as emission transparency (openly disclosing a yearly CO₂ emissions), worker rights, and limited use of heavy metals. Using this scorecard, solar panel users are able to make informed decisions when choosing a solar panel brand, so that environmentally-minded organizations and individuals can reward solar panel companies which take the environment into account.

POSSIBLE SOLUTIONS

Nuclear fusion

Nuclear fusion is an experimental energy source which is currently under heavy research and has no known environmental impact. The process is basically the opposite of nuclear fission (what most people refer to when they mention “nuclear power”). During nuclear fusion, light nuclei, such as those of hydrogen, are forced to combine into

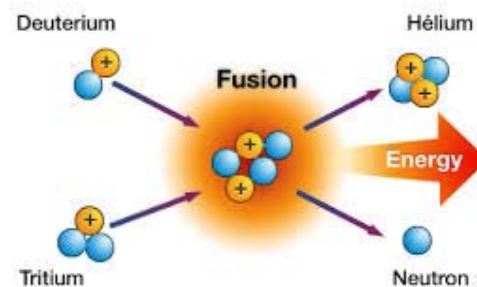


Figure 2: The process of nuclear fusion

one heavier nucleus, releasing large amounts of energy in the process. Contrary to nuclear fission, fusion produces little to no nuclear waste, and “fusion doesn't produce runaway chain reactions the way fission can, so there's no need to worry about meltdowns”¹⁴.

At this point, nuclear fusion is not yet used as a means of energy production, since the energy input required to make the nuclear reaction take place is greater than the energy produced by the reactor. Added to this, the cost of such a reactor makes nuclear fusion non-viable as an energy source. However, there are running projects such as the national ignition facility in the US, and ITER, which is currently being built in France. These projects are building or have built working fusion reactors and are actively working to make such reactors viable for commercial energy production.

Solar panel recycling

Since solar panel manufacturing has large energy requirements and taking into account the fact that there are small but considerable amounts of precious metals in those panels, recycling them has been considered an effective solution. Unfortunately, “Right now, solar panel recycling suffers from a chicken-or-egg problem: There are not enough places to recycle old solar panels, and there are not enough defunct solar panels to make recycling them economically attractive.”¹⁵ By making the recycling of solar panels more viable, perhaps by providing incentives, more and more of their users will recycle them instead of throwing them away, which is in benefit of the environment.

Measures to reduce the environmental impact of dams

Hydroelectric dams have a variety of negative effects on the environment, according to a paper named “Managing the environmental impact of dams”²³. Scientists and environmental experts have proposed a variety of actions that could be taken in order for the environmental impact associated with dams to be minimized. These actions can be classified into three broad categories:

- **Avoidance Measures:** Alternatives to dam construction which would completely eliminate their impact on the aquatic ecosystem. Examples: water recycling, rainfall harvesting and even not using hydropower in the first place, replacing it with other renewables such as wind and solar.
- **Mitigation Measures:** These are currently the most widely used measures. They involve changes to the operation of a dam or actions taken on the river where the dam is located to reduce its effects. Examples: Man-made fish spawning areas (to

counteract the fact that fish cannot travel to their upstream spawning locations after the construction of a dam) and manual addition of sediment to the river.

- **Compensation Measures:** These are measures taken against effects which cannot be dealt with through either of the previous measure types. Examples: establishing affected areas as national parks so that they can be officially protected and rehabilitation of affected areas after the damage has been done.

Improving current renewable energy sources

While new energy sources are a way of accomplishing the aim of reducing the environmental impact of the renewable energy industry, research is always a way to eliminate or reduce its downsides. For example, funding research projects to find alternative ways of Photovoltaic cell manufacturing so that the dangerous waste products currently produced by it can be reduced could prove extremely beneficial in the long term. Similarly, most disadvantages of renewable energy sources could be rendered insignificant, with sufficient research.

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Pictures and graphs

- Figure 1: <<https://commons.wikimedia.org/wiki/File:European-union-renewables-new.svg>>
- Figure 2:
<http://fusionforenergy.europa.eu/understandingfusion/whatisfusion/Whatisfusion_2.jpg>