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Politics and economics of fossil fuels and renewables

Science literature has debated the advantages and disadvantages of fossil fuels for a long time. While no one disagrees with the negative environmental consequences, we have not been able to stop using fossil fuels. Whether the environmental cost of using fossil fuels exceeds the costs of developing and building new facilities for other sources of energy is something that needs to be observed over time, and with most people and facilities being built based on the use of fossil fuels, they are resilient to a radical change.

Some alternatives to fossil fuels include renewables like solar, water, wind, and also nuclear fission which is technically nonrenewable, but has much room to improve and does not emit carbon dioxide. Most of these sources have much less carbon dioxide emissions in comparison to fossil fuels, but all require a high cost for research, development, and implementation. These sources can both be forms of mitigation and adaptation to climate change.

Solar, despite its high efficiency, must pass the breakeven as building solar panels is quite expensive and requires a lot of land and cooling. Similarly, wind energy is also very efficient, but also requires a lot of rare and expensive materials. Also the electricity production from solar and wind are intermittent, which also indicates that it may not be suitable to become a primary source of electricity and energy. However, some renewables including hydroelectricity and geothermal energy can provide baseload power, and the intermittency issue may be resolved as technology and storage options improve (Krey & Clarke, 2011). Some may argue that fossil fuel also has room for improvement as technology advances, and there indeed were major improvements in

production. Fracking is already a mature technology that is currently extracting gas and oil that were previously difficult or uneconomical to extract. Shale gas is still under development, meaning it is currently not economical for immediate operation, but is still being developed.

Nuclear, despite its notoriety, can be safe and effective if handled properly. However, the impacts of meltdowns have been emphasized due to infamous accidents in Chernobyl, Three Mile Island, and Fukushima. These events have resulted in public mistrust of nuclear energy, causing NIMBY effects. Just the term radiation came to cause fear for a lot of people although we are exposed to radiation every day, just in smaller amounts. But the efficiency of nuclear fission is much higher than fossil fuel and produces no carbon dioxide emission.

The problem with high carbon dioxide emissions can be easily seen with climate change. Carbon dioxide is a type of greenhouse gas (GHG), and GHG traps the heat within the earth's atmosphere. In detail, according to Boltzmann's law, the sun can and does emit shorter wavelengths as its temperature is so high, but the Earth emits longer wavelengths as its temperature is much lower. This combined with the principle of radiation balance states that the radiation from the sun has to equal the terrestrial radiation, making the Earth send the radiation energy back to space with longer wavelengths, with is trapped by GHG while it does not capture shorter wavelengths. Therefore, the thermal radiation energy trapped in the earth's atmosphere increases the temperature. Some GHG is necessary for planets to be inhabitable, without it, planets become extremely cold with temperatures below livable levels like Mars with -55℃. On the other hand, Venus is around 450℃, with too much GHG. The GHG level on Earth has been constantly rising since the 1960s, and this is out of the Earth's natural cycle. The atmospheric temperature and Earth's GHG levels both have been oscillating in livable temperatures but with hydrocarbon combustion–fossil fuel use–the GHG and temperature have both diverged away

from naturally oscillating geological patterns. The Intergovernmental Panel on Climate Change (IPCC) announced that the world needs to cut GHG emissions to zero in 25 years. In response, the European Union (EU) and European governments intend to transition to low-carbon and zero emissions in this century (Gençsü, 2020).

The demand for fossil fuels is not fully produced from market equilibrium. Governments and states provide financial support through aid, tax breaks, and public lending, large sums of capital from fossil fuel-related state enterprises (Gençsü, 2020). Such public financial flows tend to help businesses that would otherwise be unfeasible or uneconomic and consequently distorts the energy market (Gençsü, 2020). This means the market demand for fossil fuels is artificial, making the comparison with demands for alternative energy sources disproportionate. If we were to compare the costs of fuels without any kinds of subsidies, solar energy is the cheapest, or otherwise known as having the lowest levelized cost. Considering these factors, the cost of fossil fuels is underestimated due to subsidies, and the prices are overstated if we acknowledge that the tax money that goes into the subsidies is embedded in the prices. such disequilibrium suggests that fossil fuels are not inherently superior to other fuels except for their accessibility and cheap price due to economies of scale. If alternative energy sources are as proliferated as fossil fuels, they may be cheaper in the long run. However, this brings up the question of breakeven and efficiency. Energy production output must be greater than the input, and obviously, the greater the output the better. The same logic applies to building plants and facilities for production. Building plants that will generate energy in gigawatts initially requires greater energy.

Finally, there is a major distribution problem with fossil fuels. Not all countries or continents have fossil fuels. It was geologically predetermined long ago. This causes distribution and transportation issues. Coal deposits tend to be far away from their demand, so transportation

through railways is common (Bergerson & Lave, 2005). Such transportation is costly both from an environmental and energy perspective. Another problem following the transportation problem is that companies would be willing to continue shipping coal unless it becomes uneconomical. In other words, if the slightest profit could be made, they would be willing to transport. This is then two things to worry about; the environmental damage from coal mining and transportation. While coal was more straightforward, it is more difficult to transport natural gas. Natural gas is gaseous and highly flammable, so is typically transported through pipelines which have to be monitored for safety as it has risks of corrosion, equipment failure, flooding, injuries, and death (Union of concerned scientists, 2014). But regardless of how good the management and monitoring are, leaks occur in pipelines and studies have found that such leaks of methane have significant influences on global warming (Union of concerned scientists, 2014). Although LNG–liquified natural gas–is widely used for transportation purposes, in the end, the LNG still has to be converted again to gas and transported into pipelines, so still has the risk of leaks.

In conclusion, no energy sources provide complete solutions. All of them have their shortcomings. However, most companies that use–whether subsidizing or subsidized by–fossil fuels tend to point out the shortcomings of renewable energy because keeping the use of fossil fuels high is profitable to them. Renewables are often politically accused of being uneconomical or dangerous, especially so with nuclear, causing irrational fear. But the shortcomings can be managed or mitigated in the long run with technological advances, while fossil fuel reserves cannot replenish in our lifetime. In geological timescale, they eventually will, but we would have to find other ways to replace fossil fuels albeit partially.

References

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