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Undergraduate



CLIMATE CHANGE AND THE NUCLEAR OPTION

BY MATT LUNDY

Unlike the theoretical dangers of nuclear holocaust or worldwide pandemic, climate change is a real threat that might soon cause irreversible devastation to humanity. Climate change is happening now, and if we wait for its more overt effects to be revealed before we act, it might be too late to avoid disaster. As such, it is of vital importance that policymakers and the general public alike understand the urgent threat it poses and how best to tackle it.

There is an overwhelming amount of evidence to suggest that current climate change is being caused by human activity. For roughly the last 150 years, the Earth has been rapidly getting hotter (Fig.1).¹ This temperature increase lines up with the huge amounts of carbon dioxide that fossil fuel consumption—as a byproduct of burning coal, oil, and natural gas—and deforestation—resulting from decreased carbon absorption—have released into the atmosphere over the same time period. As a greenhouse gas, carbon dioxide in the atmosphere absorbs and re-emits infrared

radiation, which causes warming. With no other likely candidate as a plausible cause of the huge increase in temperature (Earth's orbit, the sun, volcanoes, ozone and aerosol pollution all fail to fit the bill), human-produced carbon dioxide has taken the mantle of responsibility for the recent global warming.²

Because the idea of anthropogenic climate change is substantiated with such strong evidence, it comes as no surprise that the scientific community is almost unanimously in agreement regarding the theory's validity. In a meta consensus study spanning six independent studies, Assistant Professor John Cook at the Center for Climate Change Communication at George Mason University, along with over a dozen others, confirmed that 90-100% of publishing climate scientists agreed that humans were responsible for recent global warming.³ These results lend strong support to the oft-cited statistic that 97% of climate scientists agree with anthropogenic global warming (AGW). Another study con-

firmed that the side critical of AGW makes up a “vanishingly small proportion of the published research.”⁴

The effects of AGW are frightening to say the least. In the worst case scenario, where we take no action at all, temperatures would rise at the same rate they have been rising at thus far. A temperature change of just two to five degrees is enough to drastically heat up the planet; since 1880, the global average temperature has already risen roughly 0.8 degrees Celsius.⁵ Although a two to five degree change may seem minimal, the amount of heat necessary to achieve that average temperature difference across all of the land, oceans, and atmosphere of the Earth is monumental. Indeed, humanity is already seeing the effects of this temperature rise—from smaller ice caps and rising sea levels all the way to ocean acidification.⁶ These effects will worsen with more heat: rising sea levels will begin consuming coastlines and pushing people inland, while ocean acidification will destroy reefs and have a devastating impact on underwater

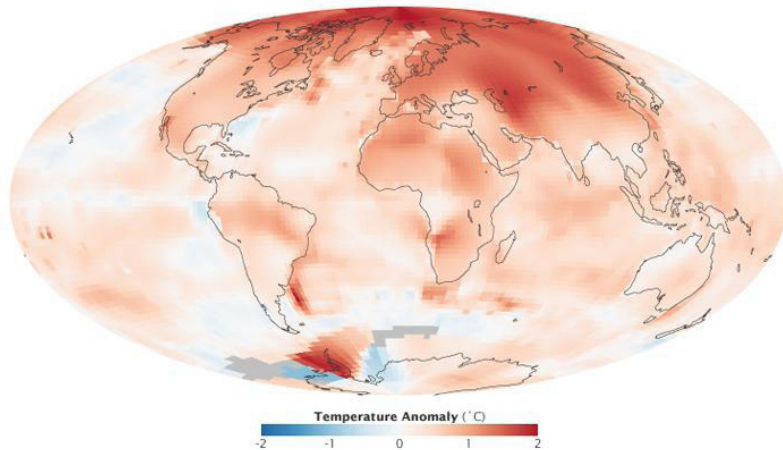


Figure 1: NASA representation of how current temperatures around the world compare to the average temperature since the late 1800s.²⁰

food chains.⁷

Accepting the existence of climate change allows us to explore avenues to combat it. While traditional renewable energy sources such as solar, wind, hydroelectric, or geothermal power are standard solutions, they each have their own drawbacks. Solar and wind energy require immense battery stores to be viable primary contributors to a large power grid. Meanwhile, hydroelectric energy, which arises from the natural movements of water, and geothermal energy, which originates from inside the Earth, are location- and resource-specific. Despite these challenges, these energy sources offer ample power and are undeniably cleaner in terms of carbon dioxide emissions than either coal, oil, or natural gas. In fact, many countries power themselves with these renewable energy sources, like Iceland and its use of geothermal energy, British Columbia and hydropower, Uruguay and wind, and

Germany and solar.^{8,9,10,11}

However, one renewable energy source that often gets overlooked is nuclear power. Nuclear energy is generated from either splitting the nucleus of an atom or from fusing multiple nuclei together. The former process, known as fission, is how energy is generated in modern day nuclear plants.

People are often hesitant about nuclear energy due to its association with catastrophes—such as the atomic bombings in Japan and the meltdowns of Chernobyl, Three Mile Island, and Fukushima. While these events provide reason to reflect on how to properly and safely utilize nuclear power, the negative stigma that they have bestowed on what is in fact a remarkably clean source of energy is unfortunate. The greatest testament to nuclear safety is that it has the lowest deaths per watt hours of energy generated; nuclear energy causes far fewer deaths globally per Petawatt hour (90) than coal (100,000), oil (36,000), hydro (1,400), wind (150), or even solar (440).^{12,13}

It is worth noting that one of the greatest concerns regarding nuclear energy, namely the threat of meltdown as seen at Fukushima and Chernobyl, is almost entirely preventable. These large-scale failures were largely due to human error, resulting from key safety procedures and requirements being neglected.¹⁴ Overall, nuclear energy has a very low death rate of 0.1 per Petawatt

hour of energy. This means that even if the entire U.S. were powered by nuclear energy, there would only be around one death every other year due to energy generation. In comparison, there are roughly 10,000 deaths per year in the U.S. from coal alone.¹³ Nuclear energy, like anything, will never be completely foolproof, but with strong and well-enforced regulation, its drawbacks can be mitigated immensely.

In addition to its safety, nuclear power is also highly adaptable. It can be implemented anywhere that has enough space to build a power plant, and—much like a coal power plant—provides a steady stream of energy. Because of this, it circumvents the problems that afflict the other forms of green energy, such as the need for better battery supplies to make up for the volatility of wind and solar, or the geographic limitations to hydro and geothermal.

Even though nuclear energy may very well be the golden ticket out of climate change, many countries are hesitant to adopt it. A recent study revealed that although many Australians do see nuclear as a clean alternative, they are fearful of the possibility of a nuclear meltdown.¹⁵ In a global survey, 62% of participants opposed nuclear power to some degree. Even in France, where nearly all electricity is generated by nuclear energy (Fig. 2), 67% opposed this energy source in the aftermath of the Fukushima disaster.¹⁶ The sentiment against nuclear energy is strong in the U.S., too. Just recently, Californians voted unanimously to close down their last nuclear power plant, the Diablo Canyon Power Plant.¹⁷ Much of the stigma surrounding nuclear seems to be bred out of ignorance, which is understandable, as most people only hear about nuclear power when disaster strikes. This phenomenon often leads to a negatively biased view of nuclear power, making it more likely that people will oppose it. Indeed, a study on American public perceptions of nuclear power found that with greater education and understanding of energy issues, people were more likely to support nuclear energy.¹⁸

Currently, the public's perception of nuclear energy is founded on a lack of information. The threat of disaster, biased media portrayal, and an overall lack of understanding

“Even though nuclear energy could be the golden ticket out of climate change, many countries are hesitant to adopt it.”



Figure 2: A nuclear power plant in Cattenom, France. France's nuclear energy accounts for 76.3% of its total electricity production. The stacks rising out of the four large towers in this image are made of steam and are harmless.

when it comes to nuclear has scared the public and policymakers away from a potentially planet-saving energy source.¹⁹ But the merits that nuclear has over its alternatives, coupled with the pressing threat of climate change, make it more than worthwhile to reconsider our attitudes towards nuclear energy.

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