

Nuclear Energy: A solution to the biggest problems

How nuclear power could be the solution to decarbonizing the energy grid—without compromising our energy demands.

By Helena McDonald

The global discussion around climate change has shifted rapidly in the last several years. We have acknowledged that climate change is a pressing concern, but remain divided on how best to address it. In the wake of the 2015 Paris Climate Agreement, countries have begun putting forth clear-cut goals for decreasing their carbon emissions, as well as a variety of plans for how they might meet these goals. Some of these are what one would expect: an increased focus on renewable energy. The unexpected dark horse in these plans? Nuclear energy.

While green-energy solutions have a valuable part to play in the fight against climate change, some of the more immediate goals can easily be solved by nuclear energy. Renewables are not without their problems; while they are becoming cheaper, high installation costs and lack of widespread infrastructure mean that their implementation is quite costly and complicated.

The truth of green energy is that no currently existing plan is completely carbon-zero. While solar and wind power do not rely on fossil fuels to function, the mining and processing of raw parts require carbon-based energy to maintain. The fact that solar, wind, and hydro power are not in constant supply but rather variable means that the systems they are incorporated into require a backup supply of power, which is currently fossil-fuels based. Nuclear is also not completely carbon-zero (mining and processing of uranium and other fuels have an upfront energy cost, too), but it has a drastically lower 'carbon cost.' When you compare the carbon-cost (energy output versus carbon emission) of nuclear and renewables, nuclear is 1/3 as costly as solar power, and the only reliably more carbon-efficient method is hydro power.

Hydro power, however, cannot be scaled up to give an energy output comparable to nuclear, and the problem of unreliable supply remains. We cannot support the energy grid on hydro power alone, and so must turn to the next best solution. In the wake of the Paris agreement, both the IPCC and IAEA have recommended nuclear power as a viable means to slow global carbon emissions and reach Paris agreement goals within the agreed timeline.

The IPCC's view is slowly being adopted worldwide. Even before the Paris Agreement, nuclear energy systems have been drastically increasing. In the span of 15 years, France refactored its energy grid to be 70% supplied by nuclear power, showing that it's incredibly manageable for other countries to do the same. When giving their official climate plans to the INDC, ten governments listed nuclear expansion as part of their strategies, 5 of which already had operating nuclear programs, and 5 more with plans to construct reactors in the future.

Despite nuclear's gradually increasing popularity, many people—and governments—are hesitant to implement it in their climate strategies or energy grids. For many people, nuclear seems too dangerous to be implemented; the rewards are high, but the risk seems too great. This is patently false, a result of sensationalized stories blown far out of proportion.

Comparing the relative risks of power supply methods, nuclear once again comes out on top. Both in comparing the raw numbers of deaths, and in comparing the deaths/energy output ratio, nuclear is orders of magnitude safer than fossil fuels (400 times safer, on average), and safer than solar, wind, or hydro power. It seems like a perfect solution: fewer people are dying, carbon output is lowered, and more energy is made. So, if nuclear is really this much safer, why does the court of public opinion still maintain their discomfort?

The reason is, of course, that nuclear-related deaths are so highly publicized. When Chernobyl melted down or there was a disaster at Fukushima, everyone knew. It was a constant source of media attention; how a nuclear mishap was altering (or ending) thousands of lives.

Fossil fuels deaths are given no such attention. Discounting even the millions that have died and continue to die as a result of air pollution (asthmas, cancers, and the like), accidents in the fossil fuel industry are rarely sensationalized in such a manner. Thousands of people are allowed to die, quietly, as sacrifice to an energy industry that continues to poison the planet. There is no outrage. There is no media attention.

Nuclear power is already in-use in the United States; it's been providing roughly 1/5th of the nation's power since 2000, and US nuclear output was 33% of the world's nuclear output in 2018. Think about that: every 5 times you use something run on electricity, one of those things is powered by nuclear. And yet, the big, terrible, dangerous consequences the public expects have failed to materialize.

The question becomes, then, what the problem is. It is no longer a question of whether we should implement nuclear power; it's already been done. In 2012, 94 US plants were given 20-year operating licenses. Nuclear isn't going anywhere anytime soon. So the real question is: why aren't we as a country taking more advantage of it?

Within the US, Nuclear power is still a highly controversial topic. Even as some plants' licenses are being extended, many more are being decommissioned, and there are no plans to replace them. Much of this is due to public opinion; very few government representatives are willing to be positive about nuclear when so few of their constituents are voicing support for it. The construction of a long-term waste repository in Nevada has recently been delayed, resulting in permanent dry-cask storage at currently operating nuclear plants. This is impractical, and not a positive sign for the future of nuclear energy in this country.

If the US continues to refuse to create infrastructure for nuclear energy, we will not achieve the same progress towards decarbonization that the rest of the planet will. Though research suggests that the public is about evenly split on their opinions towards nuclear, if representatives do not feel that their constituents are voicing that support, they will not support it. Many of the leading presidential candidates—Bernie Sanders and Elisabeth Warren, for example—opposed nuclear energy as a means of combating climate change, despite its many potential advantages. Others, such as Andrew Yang, were more vocally in support, though this message became less impactful upon Yang's early departure from the race.

Generally, when asked about nuclear, politicians will default to talking about nuclear weapons, proliferation, negotiations, and disarmament. Nuclear energy is, if anything, an afterthought. If we do not divorce these two concepts, and begin convincing politicians that nuclear energy is something they should support, we will not be able to make meaningful change towards improving the planet. Nuclear energy is safer, more cost-effective, and more carbon-efficient than any other power supply method we currently have. It has the capacity to provide more power more easily than any other system we have in place. All we have to do is use it.

<https://www.iaea.org/sites/default/files/16/11/np-parisagreement.pdf> IAEA on role of nuclear power in reaching Paris Agreement goals:

- Energy-related emissions make up three-quarters of global greenhouse gases (GHG)
- IAEA officially recommends nuclear as a low-carbon substitution for fossil fuel plants. (or fossil fuel power plants equipped with carbon capture and storage (CCS) technology)
- In the INDC submissions, ten countries explicitly listed nuclear power in their national climate strategies, including 5 countries currently with nuclear power programmes (Argentina, China, India, Islamic Republic of Iran, Japan), two with reactors under construction (Belarus, United Arab Emirates), and three prospective users (Jordan, Niger, Turkey).
- Also, the targets set by China, in its 13th Five Year Plan, pave the way for a 5-fold increase in nuclear capacity by 2030 relative to current levels.
- Almost two thirds of nuclear power plants are more than 30 years old, with 60% of them located in France, Japan and the United States
- Large nuclear power plants have high up-front capital costs and long lead times, which are common to major infrastructure projects such as hydroelectric dams or airports. This makes the economics of nuclear power projects highly dependent on the cost of capital, requiring careful management and allocation of project risks to secure financing at favourable terms.

<https://www.world-nuclear.org/nuclear-essentials/how-can-nuclear-combat-climate-change.aspx>

- Nuclear power plants produce no greenhouse gas emissions during operation, and over the course of its life-cycle, nuclear produces about the same amount of carbon dioxide-equivalent emissions per unit of electricity as wind, and one-third of the emissions per unit of electricity when compared with solar
- The use of nuclear energy today avoids emissions roughly equivalent to removing one-third of all cars from the world's roads.
- France generates over 70% of its electricity from nuclear power. France's electricity sector carbon emissions are 1/6 of European average. In 15 years, France shifted to nuclear as majority of its electricity supply. Resulting conclusion: nuclear energy can be expanded at the speed required to combat climate change.

https://www.ontheissues.org/News_Nuclear_Energy_+_Weapons.htm

- Cory Booker and Andrew Yang supported expansion of nuclear energy capacity as a means to combat climate change
 - Yang also cited thorium-based plants as being a safer option
- Elizabeth Warren was staunchly against it, citing storage risks as too big of a problem. She planned on no new nuclear development and slow decommissioning of US' current nuclear plants
- Bernie Sanders also stated nuclear waste was too large of a problem and called for implementing other carbon-free energy sources first.

<https://www.nei.org/resources/statistics>

- Nuclear power has been providing 19-20% of US' energy since 2000.

[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(07\)61253-7/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(07)61253-7/fulltext)

- Comparison of different forms of commercial power generation by use of the fuel cycle methods developed in European studies shows the health burdens to be greatest for power stations that most pollute outdoor air (those based on lignite, coal, and oil). The health burdens are appreciably smaller for generation from natural gas, and lower still for nuclear power.
- Nuclear energy has lowest death rate – it results in more than 442 times fewer deaths than the 'dirtiest' forms of coal; 330 times fewer than coal; 250 times less than oil; and 38 times fewer than gas. To be clear: the figures in this analysis were based on energy production in Europe where anti-pollution regulation and technologies are already well ahead of many countries in the world; in this case the death rate from fossil fuels may even be understated.

<https://www.usatoday.com/story/news/politics/2018/06/03/yucca-mountain-congress-works-revive-dormant-nuclear-waste-dump/664153002/>

<https://world-nuclear-news.org/Articles/US-public-opinion-evenly-split-on-nuclear>

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