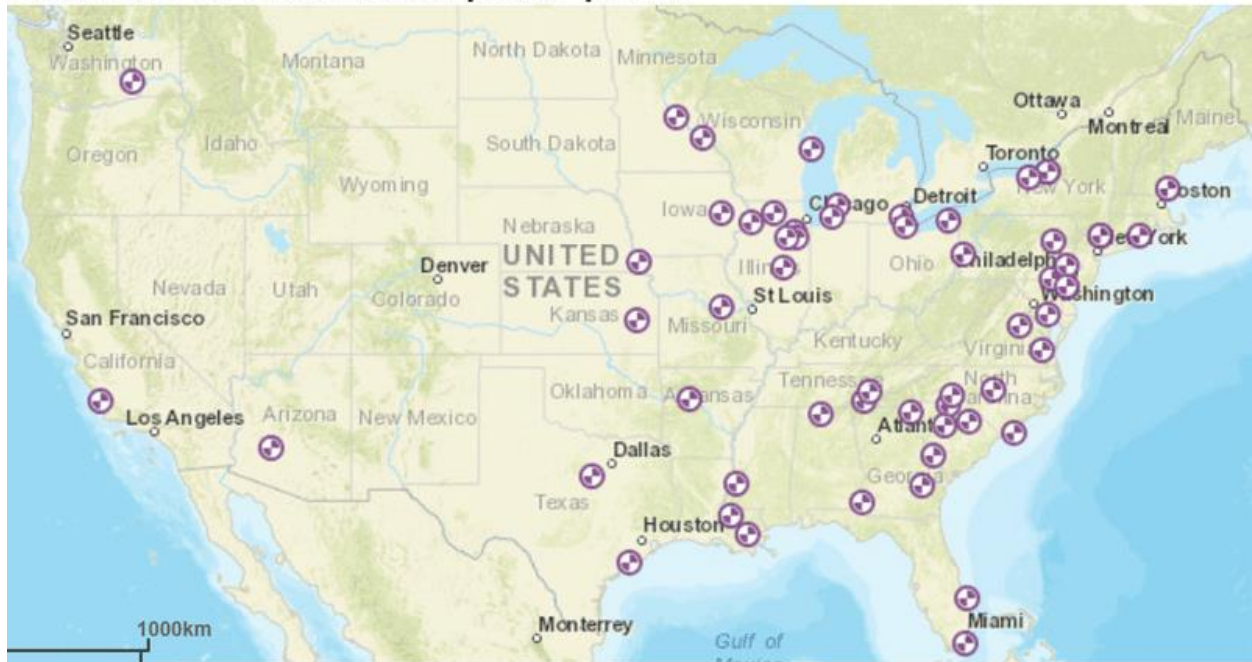


NUCLEAR POWER'S GREAT POTENTIAL: PERMANENTLY ELIMINATING UNSUSTAINABLE SOURCES

Locations of U.S. nuclear power plants



Source: U.S. Energy Information Administration, U.S. Energy Mapping System, April 2020



By Kento Mencil Instr: Catherine Winiarski

The United States is dependent on fossil fuels, and this has only become more apparent in recent years. While our reliance on coal has decreased over the past decade, overall dependance on unsustainable resources has increased exponentially. The use of nuclear and renewable energy has risen steadily since the 1970's, but only accounts for 20% of our total energy production. This is far below a thermal standard that would prevent or reverse the ravaging effects of greenhouse gas emissions on earth.

U.S. primary energy production by source (1950–2019)

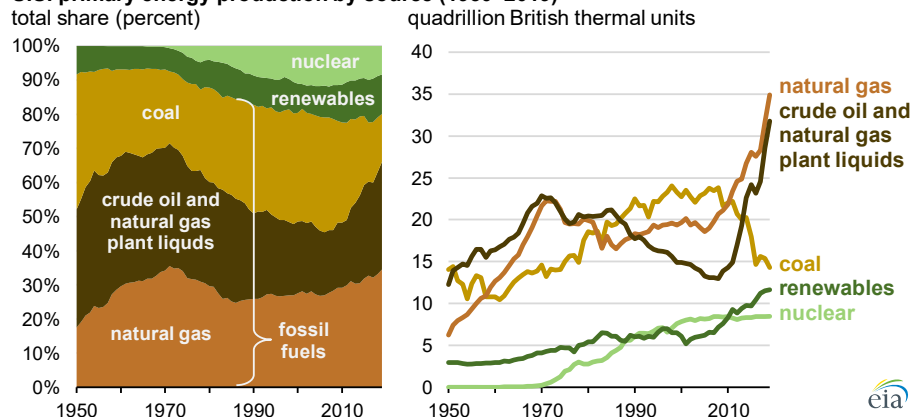


Figure 1: Breakdown of energy production from different sources, nuclear being around 10%. Source: [eia.gov](https://www.eia.gov)

NUCLEAR'S POTENTIAL

Nuclear energy is the key energy source, available to humanity today, that will most rapidly accelerate the transition away from fossil fuels. Nuclear contains qualities such as a decrease in waste, low operating costs, and a relatively low death toll in comparison to fossil fuels.

According to waste360.com, solar energy has a limited shelf life and 6 million metric tons of e-waste is accumulated annually. Only 275,000 metric tons of depleted or spent nuclear waste is stored globally today. Additionally, as stated by whatisnuclear.com, nuclear waste is reusable, and you could power the entire US electricity grid off of the energy in spent nuclear waste for almost 100 years. In the United States, nuclear waste has been safely contained and managed. This is largely due to operating standards and solid engineering (as stated by the U.S. Energy Information Administration).

Nuclear power operates with relatively low overheads. It has more expandability than other sources such as solar and wind; The core elements and materials can eventually be reused. Additionally, nuclear power plants require a low amount of physical material to produce and don't require as much land as solar or wind. 40 metric tons of metals are necessary to facilitate the construction of modern power plants, which produce an average of 1 gigawatt of power. <http://www.nextbigfuture.com>

According to Energy.gov, this amount of power is equivalent to 3.125 million PV solar panels or 431 utility scale wind turbines. [Energy.gov](http://www.energy.gov) Nuclear energy takes much less material to produce and saves the planet from tons of e-waste each year.

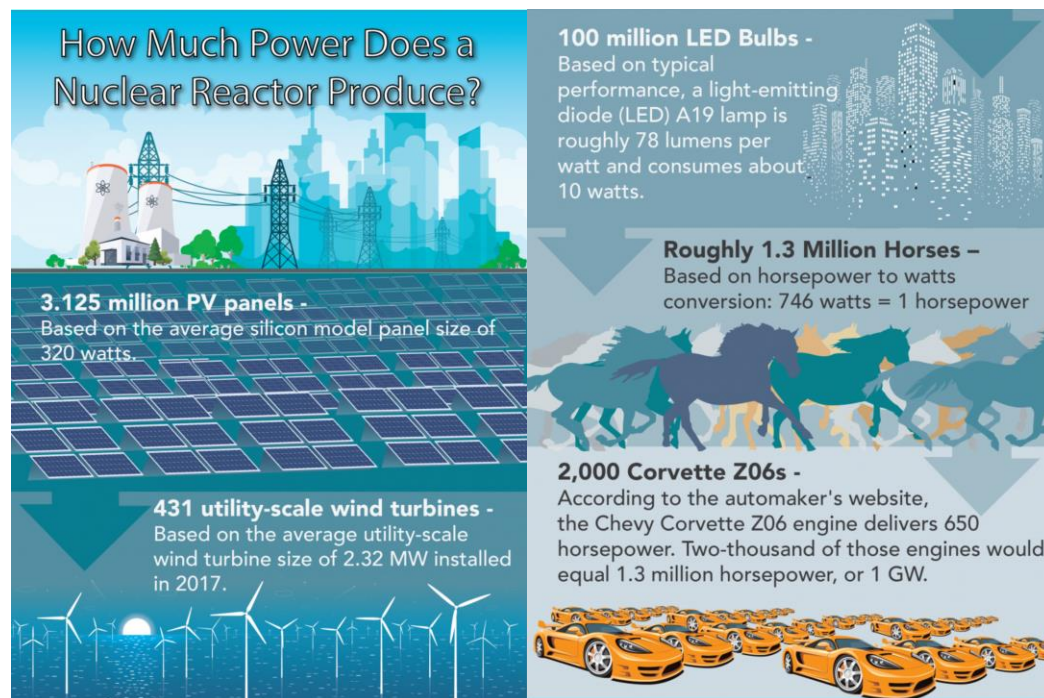


Figure 2: Equivalent power output of one nuclear reactor to other forms of energy. Source: [energy.gov](http://www.energy.gov)

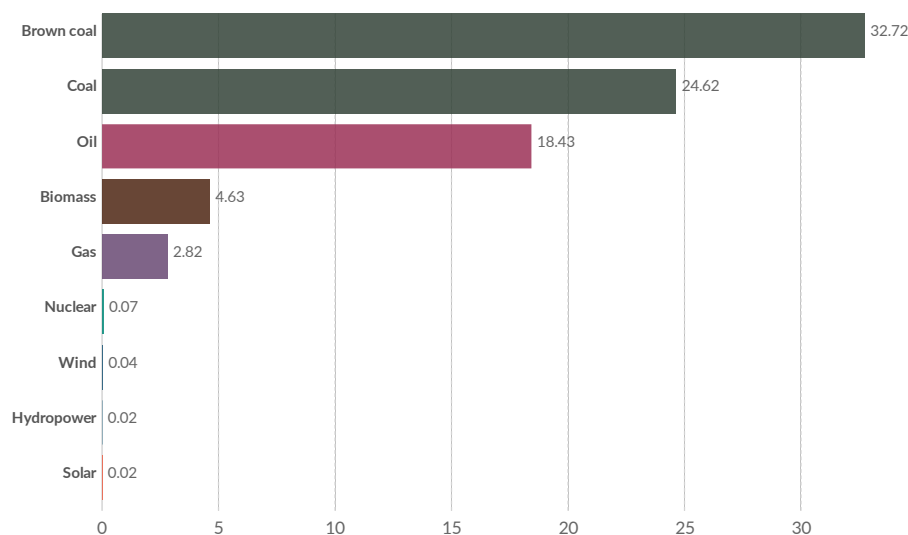
From the mere 94 nuclear energy plants that are operating in the United States, they account for 20% of our electricity generation. According to Energy.gov, “They also provide more clean energy to the grid than any other energy source, accounting for more than half of the country’s clean energy electricity production.” [Energy.gov](https://www.energy.gov/eere/energy-factsheets/nuclear-energy-factsheet)

Modern nuclear power plants achieve the goal that climate scientists are fighting to achieve: the reduction of greenhouse gas, replacement of unsustainable energy sources, and a quick transition away from fossil fuels. Nuclear checks all these boxes. When evaluating all methods of energy generation, it is the only resource that fits.

Nuclear energy works well as a replacement for fossil fuels such as brown coal, coal, oil, and natural gas. Examining the human toll from energy production per terawatt-hour, the death rate from nuclear energy is 0.07 deaths/TWh, compared to 32.72 deaths/TWh for brown coal, 24.62 deaths/TWh for coal, and 18.43 deaths/TWh for oil (OurWorldInData.org/energy). Nuclear is a highly viable solution to climate fluctuation as well as from an economic perspective. This source of electricity poses a lesser threat to human lives. Examining the data further, nuclear energy’s death rate of 0.07 aligns more closely to wind power at 0.04, solar at 0.02, and hydropower at 0.02 (ourworldindata.org). Replacing the bulk of our unsustainable energy with nuclear is of utmost importance in the coming decades.

Death rates from energy production per TWh

Death rates are measured based on deaths from accidents and air pollution per terawatt-hour (TWh).



Source: Markandya & Wilkinson (2007); Sovacool et al. (2016)

OurWorldInData.org/energy • CC BY

Figure 3: Death rates of different types of energy, compared. Nuclear’s rate is 0.07 per TWh, significantly lower than any fossil fuels, including natural gas. Source: ourworldindata.com

Events such as the 2011 Fukushima nuclear meltdown have distorted the public perception of nuclear energy. However, no deaths resulted from the Fukushima meltdown (forbes.com). Additionally, the WHO stated that “for the general population inside and outside of Japan, the predicted risks are low and no observable increases in cancer rates above baseline rates are anticipated” (who.int). Due to dilution, the effects are negligent in comparison to fossil fuels. Additionally, nuclear energy plants need to be built in locations that have low risk to tsunamis, earthquakes, and natural disasters.

In the case of the 1986 Chernobyl meltdown, two hundred deaths were attributed to the radiation emitted from the failed plant. forbes.com Although these numbers cannot be overlooked, the Soviet Union's management of the Chernobyl nuclear plant was abysmal when comparing them to how plants operate in the US today. The accident is attributed to a flawed reactor design as well as untrained workers. According to the NRC, "Many factors protect U.S. reactors against the combination of lapses that led to the accident at Chernobyl. Differences in plant design, broader safe shutdown capabilities and strong structures to hold in radioactive materials all help ensure U.S. reactors can keep the public safe." nrc.gov While attempting not to disregard the tragic death toll of the Chernobyl incident, the cause of the meltdown was due to errors in their construction and operation, not due to nuclear energy's attributes. These deaths, while still tragic, were avoidable. The act of operating a nuclear plant is not dangerous. Incorrect practice alongside underwhelming engineering without safeguards is. nrc.gov

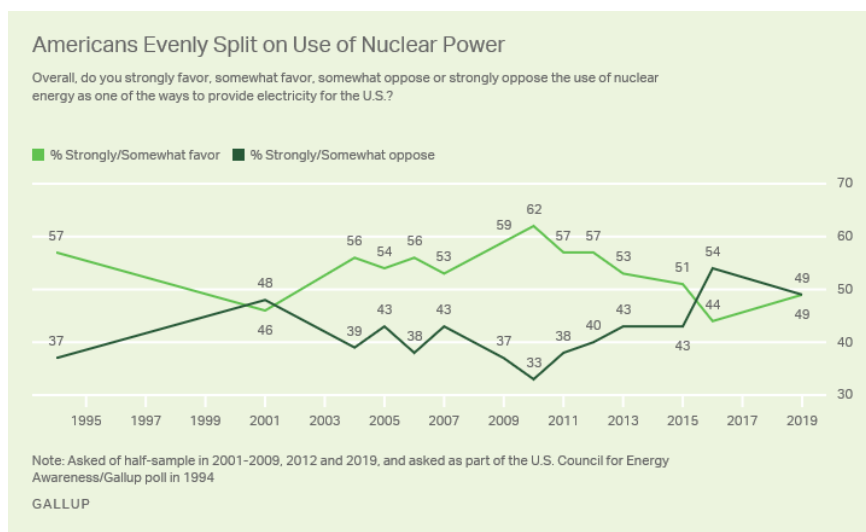
While events such as WWII, Fukushima, and Chernobyl are important to understand the dangers behind nuclear energy, the modern operating standards of nuclear plants, a relatively low death toll from nuclear related incidents, and the relatively minor effects of nuclear plant radiation on the environment demonstrates nuclear energy's best use case – to replace fossil fuels at the fastest rate.

SOCIAL MISCONCEPTIONS

A study published by NASA scientists Pushker A. Kharecha and James Hansen suggested that 1.8 million air pollution-related deaths were prevented by nuclear energy between 1971-2009. They also state that by 2050, up to an additional 7 million lives could be saved (pubs.acs.org). This is mainly due to the energy source it replaced over the decades. Through nuclear, our overall carbon footprint can be reduced without crippling the high energy needs in the United States at a high rate of speed and efficiency compared to other renewables. While common to attribute the idea of nuclear energy with meltdowns, death, and destruction, it has been silently saving millions of lives for years.

The use of nuclear fission in general has been a highly debated topic for the last few decades, attributable to nuclear meltdowns such as Fukushima and Chernobyl, the invention and deadly use of U.S. nuclear warheads codenamed "Fat Man" (Plutonium) and "Little Boy" (Uranium), and the nearly 5 decade long Cold War. With so much deadly history and misinformation surrounding the use of nuclear energy, public opinion of nuclear-based generators has been split down the middle in the US. According to a Gallup poll, 49 percent are in favor of nuclear energy and 49 percent are opposed. 65% of Republicans support nuclear, while only 43% of Democrats support nuclear (news.gallup.com).

Poll on acceptance of nuclear energy in the United States. Source: news.gallup.com



Acceleration of nuclear energy needs bipartisan support. I urge you to contact your local governmental representatives and voice your support for nuclear energy.

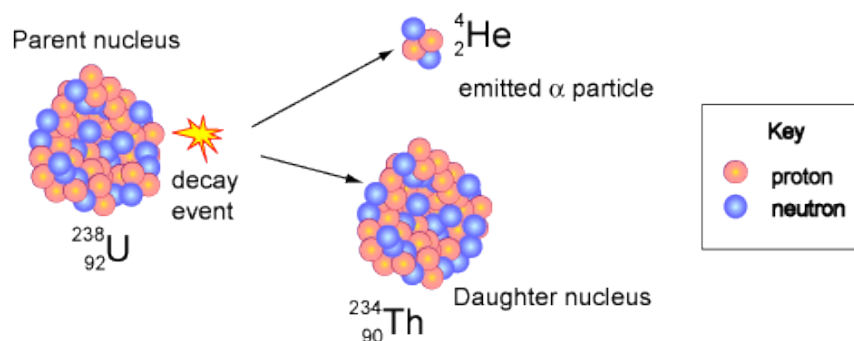
1. Changing the public perception on nuclear,
2. convincing legislators to lobby against the use of fossil fuels, and
3. increase spending on nuclear energy and nuclear/chemical engineering

is the most effective way to ensure livable conditions for future generations, speed up our understanding of electricity storage, and prevent air-pollution related deaths.

While energy sources such as wind and solar are helpful in this process, their downsides and high costs hold them back.

Fission has an energy output to cost ratio that is generally untapped at a large scale.

Alpha Decay of a Uranium-238 nucleus



“The use of
nuclear
power from
1971 to 2009
prevented
more than 1.8
million
premature
deaths.”

-E360 Digest, Yale School of the Environment

image source:

<https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML20113E839>