THE BREAKTHROUGH

Frequently Asked Questions About Nuclear Power

No technology is more enshrouded in myth than nuclear energy. The urgency of addressing global poverty and reducing emissions demands that we consider this technology without ideological blinders. The basic facts of the technology — both good and bad — must be confronted. This Breakthrough Institute Frequently Asked Questions is backed by primary sources and addresses the toughest questions asked of nuclear.

May 22, 2013 | Michael Shellenberger, Ted Nordhaus, Jessica Lovering

Do we really need nuclear in order to deal with global warming?

Preventing dangerous warming of the planet due to human emissions of greenhouse gases will require that we cut our emissions by 80 percent over the next 40 years at the same time that global energy demand is expected to double or triple. Doing so will require that we produce vast amounts of zero carbon energy. At present, the only way we know how to do that is with nuclear energy.

Isn't the real problem that we simply consume too much energy?

Most people on the planet actually need to consume more energy, not less. Energy consumption is highly correlated with better health outcomes, longer life spans, and higher living standards.[1] High-energy societies have liberated billions of us from lives of hard agricultural labor. More than a billion people around the world still do not have access to electricity at all. Ensuring there is abundant energy to power the planet over the coming century promises to unleash the creative potential of billions more. But the basic math of global development and global warming is unforgiving. If we are going to meet the needs of a growing global population while keeping global warming in check, we will need technologies that can produce enormous amounts of energy without emitting carbon.

Isn't that why we need to control population growth?

Providing universal access to abundant, cheap clean energy is one of the best population growth strategies we have. Consuming more energy allows people to live wealthier, healthier, and longer lives, which translates into lower population growth.[2] As people become wealthier and more economically secure, they have fewer children. This is why leading advocates for human development and environmental sustainability, like Bill Gates[3] and Jeffrey Sachs,[4] strongly support the development and deployment of nuclear energy.

Even if we produce energy with minimal pollution, won't more energy use incur a greater, more devastating environmental impact?

Cheap clean energy allows us to reduce our impact on the environment. With it, we can grow more food on less land and leave more wilderness for nature.[5] We can reprocess wastewater and desalinate seawater, rather than depleting aquifers and draining majestic rivers. We can also recycle fiber and pulp rather than cutting down ancient forests. A world with abundant clean energy allows us to protect natural resources and leave more of our ecological inheritance undisturbed.

Can't we become more energy efficient instead of using more energy?

We are vastly more energy efficient than we were just a few decades ago, much less a few centuries ago. Yet, even as we've become more efficient, we've also continued to use more energy. That's because energy efficiency makes energy cheaper, and the result is that we find more ways to use it. Just a few years ago, nobody had heard of the cloud, and two decades ago nobody had heard of the Internet. Today, more of us than ever are able fly around the world. We fill our homes with 50-inch televisions and all manner of networked devices. We transform billboards and skyscrapers into gigantic LED video screens. Efficiency is good and we should strive for more, but it won't eliminate the need to develop enormous quantities of cheap and zero carbon energy to meet the demands of the growing global economy.[6,7]

Can't we solve global warming with renewables?

We've made a lot of progress with renewables, but they are still costly, intermittent, and difficult to scale.[8] Without utility scale energy storage technologies, which remain unviable, you simply can't run a modern society on wind and solar alone. Some places, like Germany and Denmark, have achieved higher levels of wind and solar, but they have done so through heavy, historically unprecedented deployment subsidies[9,10] that can't be sustained.[11] Furthermore, these societies remain overwhelmingly dependent upon fossil energy: Germany got 70 percent of its electricity from fossil fuels in 2012[12] versus 5 percent from solar and 7 percent from wind.

But aren’t solar and wind growing rapidly?

It’s easy to achieve high rates of growth when you start from a tiny amount of installed wind and solar. But the fact remains that solar generated just 0.01 percent of US electricity generation in 2011, and wind 3.5 percent, in 2012.[13] This was after more than $50 billion in renewable electricity subsidies over the last three decades. Even Germany, which since 2000 has committed over $130 billion to solar PV in the form of above-market-price 20-year feed-in tariff contracts,[14] only gets 5 percent of its annual electricity from solar.[15]

But isn't nuclear energy also too expensive?

Installed nuclear generation in the United States is among the cheapest sources of electricity we have – cheaper even than coal.[16] France, which generates over 80 percent of its electricity with nuclear energy, has some of the cheapest electricity prices in Western Europe.[17] Nuclear plants cost a lot of money to build up front, but they operate for 60 to 80 years, producing massive amounts of energy with virtually no fuel costs. Over the long term, this makes them a bargain.[18]

The Olkiluoto 3 nuclear power plant in Finland – the poster child of expensive nuclear – is $6.5 billion over budget and six years behind schedule. Even still, recent analysis shows that this beleaguered plant will produce electricity at almost one-fourth the cost of Germany’s solar program. These are good technologies to compare, as the Finnish plant is a first-of-a-kind design – an Areva EPR – which is significantly safer, more reliable, and more efficient than existing nuclear power plants. Successive builds, such as the second EPR under construction in France, are expected to be cheaper. But even this extreme case isn’t unreasonably expensive when compared to another innovative carbon-free electricity source like solar PV.

In order to meet our climate goals, nuclear will need to get cheaper. A new generation of advanced nuclear designs is presently under development. They will be simpler, safer, and can be constructed modularly and shipped to the site. All of these features give them potential to be significantly cheaper. Nevertheless, these powerful and complicated machines will require federal help to develop and commercialize.

So if nuclear plants are so cheap, why aren’t we building them anymore?

Many nuclear plants are being built, they’re just not being built in the United States. China, India, and other developing countries, which need to keep up with massive growth in energy demand as they develop, are building nuclear plants as fast as they can. The high up front costs of building nuclear plants and the uncertainty about how fast energy demand would grow in rich countries populated with high-energy consumers resulted in the United States and other developed countries turning away from nuclear. However, President Obama recently approved loan guarantees for two new reactors in Georgia and South Carolina and development funding for new reactor designs that are smaller and cheaper to build.

Doesn't cheap natural gas make nuclear uncompetitive?

Cheap gas is making coal, nuclear, renewables, and virtually all other energy technologies less competitive. But that didn't happen by accident. The shale gas revolution, which dramatically lowered the price of gas in the United States, was made possible thanks to three decades of public investment in better drilling technologies. This is why investing in next generation nuclear technologies right now is so important – so that we have a new generation of cheap nuclear technologies that can replace fossil energy in the coming decades.

Isn't nuclear power too risky to qualify for insurance, so the government has to cover liability insurance through the Price-Anderson Act?

Nuclear is among many activities and circumstances for which we have established liability limits. Others include plane crashes, oil spills, product liability, and medical malpractice. The largest renewable energy project, hydroelectric dams, has limited liability too. Societies frequently cap or socialize liabilities for events when costs are difficult to predict, quantify, or bound, and where responsibility is difficult to apportion. These are highly uncertain, infrequent, and high consequence events. Even so, nuclear operators still have to buy an enormous amount of liability insurance. That risk is pooled, with current pooled insurance for the US nuclear industry amounting to $12.6 billion.[19]

Even if nuclear is as cheap as you say, isn't the risk of meltdown simply too great?

Meltdowns are very serious industrial accidents. They are extremely expensive to clean up and may result in radiation exposure that can create serious health risks. But those risks need to be put in context. Compared to virtually all other forms of energy production and generation, nuclear energy is remarkably safe. The most comprehensive peer-reviewed studies done by independent scientists evaluate air pollution, worker safety, and all of the other risks in energy production and find that nuclear is safer than coal, oil, natural gas, and even solar.[20,21]

In the 60 years that we have been operating nuclear plants, there have been three serious accidents globally. Three Mile Island resulted in no deaths and no observable health problems. According to comprehensive UN and WHO reports, Chernobyl resulted in 27 confirmed deaths of workers and firefighters who were exposed to high doses of radiation during the accident[22] and will cause an estimated 4,000 premature deaths from cancer over the lifetimes of those exposed to significant levels of radiation in the wider region. There has, however, been no observable increase in cancer deaths thus far in the affected regions.

No one was killed during the Fukushima accident due to radiation exposure, and the UN's Scientific Committee on the Effects of Atomic Radiation expects the long-term effect on the surrounding public to be extremely low,[23,24] with estimates ranging from as high as 180 to as low as zero additional cancers in a country where 353,000 people died of cancer in 2010. In other words, additional cancer deaths will be so few as to be impossible to distinguish from the more than 30 percent of the population that dies of cancer.[25]

More than 500 people die every year from accidents in the coal, oil, and gas industries in Europe alone.[26] Globally, more than 170,000 people die annually from respiratory ailments associated with burning coal.[27,28] We think of solar energy as the cleanest and safest of all energy technologies, but manufacturing solar panels is actually an extremely toxic process, releasing all sorts of pollutants harmful to human health.[29] Moreover, installing solar panels involves two of the riskiest occupations: roofing and electrical work. Calculations drawing on roofing mortality data and solar installation data suggest there are approximately 2 deaths per terawatt-hour in the solar PV industry just from roofing falls.[30,31] By contrast, nuclear power results in 0.05 deaths per terawatt-hour due to all causes, including meltdowns.[32]

Did Fukushima kill hopes of a nuclear renaissance?

China, India, the United States, and several Middle Eastern countries paused their new nuclear programs for a safety review after Fukushima, but all have gone forwardwith planned nuclear plant construction. Even Japan, which shut down all of its 54 nuclear power plants immediately after the earthquake, has begun to restart its reactors.

Germany did accelerate its nuclear phaseout after Fukushima, but this had been underway since 2000. Not a single country cancelled a new nuclear power plant in response to Fukushima. Several countries, like the United Arab Emirates, Turkey, and Jordan, are currently moving forward with plans to build their first commercial nuclear power plants.

How can we go forward with nuclear as long as we have waste that lasts up to 100,000 years?

Whereas today's light water reactors, which were developed in the 1950s, use only asmall amount of the energy in their fuel, a range of advanced reactor designs can burn waste as fuel. Many of them are at least a decade or two away from commercialization. But by 2050 and likely before, these reactors will be using what we now call waste as fuel.[33]

Given how much energy human societies are going to need in the coming century, and the reality that fossil fuels are finite, we will almost certainly be reprocessing and reusing waste as fuel. Until that time, all countries will store it. While the proposed US waste facility at Yucca

Mountain has been controversial, the dispute is the exception, not the rule. Most nations have moved forward with uncontroversial waste storage facilities.

Didn't we try advanced nuclear designs and they failed?

The United States developed a number of alternative designs in the 1960s. Following the Navy's lead, the commercial sector settled on light water reactors and there was little demand for newer and better designs. Today, it has become clear that some of the alternative designs are much more resistant to meltdowns and are modular (thus cheaper to build). Big advances in materials science, nuclear engineering, and modularization will make it feasible to commercialize these new designs soon. China and India are pushing the hardest and the fastest for them, with large teams of engineers developing thorium, metal-fueled, and salt-cooled reactors.

Is it true there are nuclear reactors that can't melt down?

Many new reactor designs feature fuels that stop reacting when temperatures rise too high, fuel cladding that cannot melt, and coolants that can cool the reactor with no human or mechanical intervention even if there is a total loss of power. These features make meltdown and serious accidents virtually impossible.[34]

What about the risk that terrorists will attack a nuclear plant?

Nuclear plants are not good targets for terrorists. They have high security, extensive perimeters, and are built to withstand the impact of a plane crash or large explosion. Were terrorists somehow able to infiltrate a plant and escape undetected with fuel or waste — a highly improbable scenario — they would still need costly, difficult to obtain equipment and highly sophisticated technical knowledge to turn the material into a weapon. It has taken decades and billions of dollars for nations like India, Pakistan, North Korea, and Iran to build a single bomb. The prospect of non-state actors marshaling the technical and financial resources to do the same is highly unlikely.

Doesn't the spread of nuclear energy increase the risk of nuclear proliferation?

There is no relationship between the global expansion of nuclear energy and nuclear proliferation.[35] No nation has ever developed a weapon by first developing nuclear energy. To the degree that there has been a progression from one to the other, it has always been the opposite, with nations first developing weapons and then energy.

Some nations claimed to be developing nuclear energy capabilities when they were in fact attempting to develop a weapon,[36] but these claims were transparently false to virtually all observers. By international law, nuclear energy facilities must be open to international inspections. The International Atomic Energy Agency has an extensive monitoring and inspection network, and it is not difficult to distinguish a weapons program from an energy program.

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