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We affirm

Resolved: The United States should increase its use of nuclear energy for commercial energy production.

## Contention One is Fighting Climate Change.

In the status quo, the US nuclear industry is experiencing a dangerous decline. **Graham 19** explains that the pace of construction of new natural gas plants is far exceeding the few nuclear plants under development, and the existing fleet of nuclear plants is retiring **PREMATURELY** at an alarming rate.

Because of this the phase out of nuclear power has privileged natural gas companies. **Conca 16** writes that the closing of nuclear plants in areas like New England has increased reliance on natural gas, not renewables. **Plumer 19** furthers that the boom in natural gas usage driven by massive fracking projects is locking in decades of new fossil fuel use right as emissions need to fall to avert the worst impacts of global warming.

Fortunately, increasing nuclear power usage can offset the natural gas reliance. Even without building new reactors, **Plumer 12** explains that since the 1970s, nuclear electricity production has increased by nearly half because plants have been given permission from the Nuclear Regulatory Commission for uprates that have allowed them to increase output by as much as 20%. Moreover, **University of Calgary 19** explains that typical nuclear plants achieve efficiencies at around 33%, but newer upgrades are allowing existing reactors to achieve above 45% efficiency.

The implication is that nuclear energy production can be increased immediately simply by increasing production at existing reactor sites. Moreover, **Smith 12** writes that once built, nuclear plants produce some of the cheapest electricity available.

The impact is avoiding a climate disaster.

**The International Energy Agency 19** explains that because nuclear energy is emissions free, if the decline in nuclear energy continues, CO2 emissions will rise by 4 billion tons by 2040.

This is critical as **Gould 09** writes that climate change will drastically increase death rates especially in developing nations. It will speed the spread of infectious diseases, decrease crop yields leading to malnutrition, and lead to an increasing frequency of dangerous weather patterns. Because of this, **Parncutt 19** warns that for every 1,000 tons of carbon that is burned, one premature death is caused in the future.

## Contention Two is Exporting Nuclear Technology.

**Sivaram 18** explains that nuclear power is seeing a revival in emerging economies which are seeking nuclear energy technology from abroad. Though nuclear power is projected to stagnate in developed countries through 2040, it is also expected to grow nearly fivefold in developing and emerging countries during the same period in the Middle East, Africa, and Asia. However, the US, which used to lead in nuclear technology exports, has fallen behind as Russia and China race to dominate this space and win geopolitical leverage.

Problematically, declining nuclear energy usage in the United States has doomed our nuclear export industry. **Gordon 20** finds that the United States’ struggling domestic nuclear reactor fleet has hampered nuclear exports as it is near impossible to export a product that lacks a domestic market. **Neuhauser 18** furthers that domestic struggles have had significant implications for the competitiveness of US nuclear power overseas. The US has struggled to demonstrate that it can successfully bring nuclear reactors within its own market let alone overseas.

Critically, **Paraskova 19** writes that reviving nuclear energy in the US and developing new advanced reactors will reestablish US leadership on the global nuclear export market.

The impact is strengthening safety standards.

**Swanek 18** explains that US global nuclear engagement is critical because it brings with it a culture that promotes safety and security of nuclear materials and processes. Conversely, China and Russia’s overseas nuclear push has challenged the framework of nuclear safety laid out by the US. **Sukin 16** adds that the US nuclear industry has high safety standards all along the nuclear supply chain, standards that other exporters like China and Russia do not meet. By designing and exporting safer nuclear plants, the US could significantly reduce the global risk of nuclear accidents.

However, if the US allows Russia or China to build unsafe reactors in the developing world, millions could be at risk of death and poverty. **Higgins 12** explains that most of the developing nations contemplating using nuclear power can only build reactor sites within close proximity to population centers. Because of this a reactor meltdown would constitute a humanitarian challenge of unprecedented scope. Millions would be forced to inhale radiation and ingest contaminated fresh water and food, resulting in millions of casualties. But even if the casualty account is low, loss of exports would provoke a collapse of the national economy thus pushing tens of millions into poverty.

Thus, we affirm.

# CARDS

## C1 Climate Change

#### Plumer ‘12

Brad Plumer, WaPo, 18 July 2012, <https://www.washingtonpost.com/news/wonk/wp/2012/07/18/how-to-increase-nuclear-power-without-attracting-attention/>

**Since the 1970s, construction on new nuclear reactors in the United States has largely ground to a halt**, thanks to public protests, regulatory obstacles and tight financing. **Yet over that same period, U.S. utilities have managed to increase the amount of electricity they get from nuclear power. By quite a lot**, in fact. How is that possible? Through a process known as "uprating." According to a new analysis by the U.S. Energy Information Administration, **the operators of 98 of the country's 104 commercial nuclear reactors have asked regulators for permission to boost capacity from their existing plants.** All in all, **the Nuclear Regulatory Commission has approved more than 6,500 megawatts worth of uprates since 1977. That's the equivalent of building six entirely new nuclear reactors**—and during a period when fresh plants were impossible to build. **There are several ways to boost the capacity of a nuclear power plant.** The simplest approach, according to the NRC, is to improve the measurement tools used to gauge the capacity of the reactor, through modern sensors and other digital technology. This option is the cheapest and allows the plant to operate at a slightly higher level. Likewise, **"stretch uprates" allow nuclear plants to boost output by up to 7 percent, through replacing older components with newer designs** and materials. In recent years, however, **nuclear operators have started applying for much larger "extended uprates," which can increase the output of a plant by as much as 20 percent.** This process can include big changes to high-pressure turbines and other equipment. Or it can involve using more potent fuel in the reactor core. The first major expansion was approved in 1998, at the Monticello plant near Minneapolis. Since then, the EIA notes, **26 reactors have received permission from the government for extended uprates, which account for nearly half of the boost in nuclear-generated electricity since the 1970s.**

#### Power ‘20

Power, 1 January 2020. “Innovation Propels Nuclear Energy on New Trajectory.” <https://www.powermag.com/innovation-propels-nuclear-power-on-new-trajectory/>

In its [annual forecast released last September](https://www.iaea.org/newscenter/pressreleases/iaea-releases-new-projections-for-nuclear-power-through-2050), the International Atomic Energy Agency (IAEA) presented a somber outlook for nuclear power. If current market, technology, and resource trends continue, and if few changes are made in explicit laws, policies, and regulations that govern nuclear power today, the world’s nuclear capacity will gradually decline from the 399 GWe installed at 449 operational nuclear reactors as of December 2019 until 2040, though it expects a slight rebound to reach 371 GWe—or about 3% of the global capacity share—by the middle of the century. While nuclear power’s share of global generation stood stable at nearly 11% this year, a critical concern voiced consistently by the heads of major nuclear organizations about the dismal capacity number is that it has already fallen by nearly 10% since 2006. As Nuclear Energy Agency (NEA) Director‑General William D. Magwood IV noted, the decline can be attributed to the post-Fukushima temporary shutdown of a number of plants in Japan, but also to safety-related permanent closures in Japan, market competitiveness concerns in the U.S., and political phaseout decisions in Europe. “[W]hile a number of reactors are under construction [mainly in China and Russia](https://www.powermag.com/the-big-picture-the-diffusion-of-nuclear-technology/), most of the new build projects in the United States and Western Europe have suffered schedule delays and budget overruns, making investors reluctant to further engage,” he said. The industry needs a reset, Magwood said, and the urgency to keep the sector relevant has been amplified lately by calls from global entities to include nuclear in the decarbonization movement. Cost competitiveness should be a critical imperative for technology developers because it directly translates to market opportunity, as Simon Irish, CEO of Terrestrial Energy, a company developing a 195-MWe Generation IV molten salt reactor, pointed out. “Nuclear power as an investment is unremarkable. It does not attract private capital.” That’s why future systems “must be commercially transformative,” he said. Irish noted that Terrestrial, which is [developing the Integral Molten Salt Reactor (IMSR)](https://www.powermag.com/joint-u-s-canadian-advanced-nuclear-review-may-focus-on-terrestrials-molten-salt-reactor-nuscale-smr/), is today the only private company participating in GIF, the international collaboration that is exploring six advanced reactor technologies with the expectation that they will be commercially deployed starting in 2030. Much attention is being paid to these six technologies because they operate at very high temperatures. Terrestrial’s IMSR operates at 700C, supplying steam turbines with superheated steam at 600C, which raises the system’s fuel efficiency to as much as 48%, he said. “A conventional reactor is stuck in the mid-30s, and if it’s a small conventional reactor, it may not achieve 30% at all,” said Irish. “If you operate at a much higher temperature, you can make power much more efficiently and you can do many more things with your nuclear reaction. You can provide [high-quality industrial heat](https://www.powermag.com/how-nuclear-hybrids-could-redefine-the-industrys-future/) that can be used in industrial process applications that are very different compared to the steam generated electric power provision—which is pretty much the sole activity of nuclear energy today,” he explained. Those applications include petrochemical processes, including for production of hydrogen and ammonia, fertilizers, and plastics—and they could open up new end-users and sources of revenue. But industrial heat could also drive desalination, and even synthetic fuels, which could help decarbonize the transport sector, Irish said. Flexibility appears to have also been firmly lodged into operational paradigms [at many existing nuclear plants](https://www.powermag.com/flexible-operation-of-nuclear-power-plants-ramps-up/) that have traditionally been operated at baseload, but which are increasingly grappling with fluctuating grid demand. According to nuclear technology giant Framatome, that transformation is partly being enabled by increased adoption of digital instrumentation and control (I&C) systems. “Equipment that would previously have been a single monolithic item can comprise smaller distributed packages in multiple rooms,” the company told POWER in December. “This offers greater safety because of physical ergonomic separation considerations.” Digital I&C systems could also boost nuclear plant efficiency and economics by improving operator actions, reducing surveillances, cutting the number of unscheduled outages, and enhancing diagnostics. “Digital equipment allows for automatic, remote diagnostic, analytical and self-testing capabilities, which means that utilities can gain time during outages and operations while having a better understanding of the state of their control equipment,” it said. Advancements in tooling are also paying off. Framatome, for example, in late 2018 rolled out a new solution for ultrasonic testing of stainless steel baffle bolts—components that secure removable liner plates around pressurized water reactor vessels. The tool, known as Falcon, has saved about 30 hours on average during outage schedules when it has been deployed. Meanwhile, in the spring of 2019, the company applied a new ultra-high-pressure (UHP) cavitation peening maintenance technique to primary pipe welds on reactor vessel primary nozzles at Dominion’s Millstone power plant in Connecticut (Figure 2). “UHP cavitation peening can extend the life of nuclear reactor primary components, including the hot leg primary nozzles, for up to 40 additional years,” it said.

#### Watts ‘20

Jonathan Watts, The Guardian, 19 February 2020, <https://www.theguardian.com/environment/2020/feb/19/oil-gas-industry-far-worse-climate-impact-than-thought-fossil-fuels-methane>

The oil and gas industry has had a far worse impact on the climate than previously believed, according to a study indicating that human emissions of fossil methane have been underestimated by up to 40%. Although the research will add to pressure on fossil fuel companies, scientists said there was cause for hope because it showed a big extra benefit could come from tighter regulation of the industry and a faster shift towards renewable energy. Methane has a greenhouse effect that is about 80 times more potent than carbon dioxide over a 20-year period and is responsible for at least 25% of global heating, according to the UN Environment Programme. In the past two centuries, the amount of [methane in the atmosphere](https://www.theguardian.com/environment/2019/feb/17/methane-levels-sharp-rise-threaten-paris-climate-agreement) has more than doubled, though there has long been uncertainty about whether the source was biological – from agriculture, livestock or landfills – or from fossil fuels. There were also doubts about what share of fossil methane was naturally released and what share was from industry. Earlier estimates were based on intermittent, bottom-up monitoring of oil and gas companies and comparisons with geological evidence from the end of the Pleistocene epoch, about 11,600 years ago. For a more accurate comparison, a team at the University of Rochester in the US examined levels of methane in the pre-industrial era about 300 years ago. This was achieved by analysing air from that period trapped in glaciers in Greenland. The sample – made up of about a tonne of ice – was extracted with a [Blue Ice Drill](https://icedrill.org/equipment/blue-ice-drill), capable of producing the world’s biggest ice cores. The findings, [published in Nature](https://www.nature.com/articles/s41586-020-1991-8), suggest the share of naturally released fossil methane has been overestimated by “an order of magnitude”, which means that human activities are 25-40% more responsible for fossil methane in the atmosphere than thought. This strengthens suspicions that fossil fuel companies are not fully accounting for their impact on the climate, particularly with regard to methane – a colourless, odourless gas that many plants routinely vent into the atmosphere. An [earlier study](https://science.sciencemag.org/content/361/6398/186) revealed methane emissions from US oil and gas plants were 60% higher than reported to the Environmental Protection Agency. Accidents are also underreported. A single blowout at a natural gas well in Ohio in 2018 discharged more methane over three weeks than the oil and gas industries of France, Norway and the Netherlands released in an entire year. At the time, the company said it was unsure of the size of the leak. The immense scale was only revealed a year later when [scientists analysed satellite data](https://www.pnas.org/content/116/52/26376) provided by the European Space Agency. Fracking also appears to have [worsened the problem](https://www.desmogblog.com/2019/12/22/methane-leaks-venting-blowouts-fracking-climate-change). Atmospheric methane had started to flatten off at the turn of the century, but rose again after a surge in [fracking activity](https://www.theguardian.com/environment/2020/jan/17/activists-warn-of-fracking-by-stealth-and-call-for-acid-fracking-ban) in the US and elsewhere. The industry, however, continues to claim that the energy source can be used as a “bridge fuel” because it has lower carbon emissions than oil or coal, but this fails to account for leaks and flares of methane and other gases during extraction.

#### McGinnis ’18

<https://www.energy.gov/ne/articles/3-innovations-transforming-nuclear-industry>

Despite what you might think, now is the perfect time to double-down on nuclear energy. A [new wave of innovation](https://www.energy.gov/ne/articles/new-wave-innovation-coming-nuclear-energy) is on its way, and it’s going to completely transform the energy sector. Nuclear plays a pivotal role in protecting our clean air, strengthening our national security and spurring the economy. That’s why we work every day to support industry and our university partners in developing and demonstrating game-changing technologies. These innovative and disruptive efforts will not only leap frog our nation into the future, but it will also re-establish our great nation as a global leader in nuclear energy. The United States is developing cutting-edge advanced reactor designs that have unprecedented versatility, can be paired with renewable generating sources, are much less expensive, burn waste as an energy resource, and are walk-away safe. [NuScale Power’s](http://www.nuscalepower.com/) advanced small modular reactor (SMR) is a prime example.

#### Biello ‘13

David Biello, Scientific American, 12 December 2013, <https://www.scientificamerican.com/article/how-nuclear-power-can-stop-global-warming/>

As long as countries like China or the U.S. employ big grids to deliver electricity, there will be a need for generation from nuclear, coal or gas, the kinds of electricity generation that can be available at all times. A rush to phase out nuclear power privileges natural gas—as is planned under Germany's innovative effort, dubbed the [Energiewende](http://energytransition.de/)(energy transition), to increase solar, wind and other renewable power while also eliminating the country's 17 reactors. In fact, Germany hopes to develop technology to store excess electricity from renewable resources as gas to be burned later, a scheme known as “power to gas,” according to economist and former German politician Rainer Baake, now director of an energy transition think tank Agora Energiewende. Even worse, a nuclear stall can lead to the construction of more coal-fired power plants, as happened in the U.S. after the end of the nuclear power plant construction era in the 1980s. Hansen, for one, argues that abundant, clean energy is necessary to [lift people out of poverty](https://blogs.scientificamerican.com/observations/2011/06/30/how-do-we-solve-energy-poverty/) and begin to reduce greenhouse gas emissions from a [swelling human population](https://www.scientificamerican.com/article.cfm?id=human-population-reaches-seven-billion). Nuclear is one of the technologies available today—and with room for significant improvement and innovation. In that sense, natural gas is a bridge fuel to disaster, even with some form of [CO2 capture and storage](https://www.scientificamerican.com/article.cfm?id=carbon-capture-and-storage-not-happening-fast-enough-to-combat-climate-change), and the world must immediately transition to renewables and nuclear.

#### Gellerman ‘19

Bruce Gellerman, 17 Sept 2019, wbur, <https://www.wbur.org/earthwhile/2019/09/17/nuclear-power-future-history-controversy>

"Our analysis shows that the most effective and frankly least-cost path toward decarbonizing our economy includes nuclear energy," or, he says, another low carbon energy source available on demand. Renewables aren't. You can't control when the sun shines or the wind blows. And while the price for large-scale battery storage has been falling dramatically, it's still expensive. So MIT professor Buongiorno argues we will need new nuclear power — and a lot of it — to fuel our carbon-free future. "You want as many shots on goal as possible" he says. "You don't want to lock yourself onto only one path — in this case, it would be renewables plus storage.

#### Galey ‘19

Patrick Galey, Phys.Org, 2 July 2019, <https://phys.org/news/2019-07-natural-gas-boom-collison-climate.html>

A growing body of evidence suggests that upstream oil and gas activities are incompatible with mankind's plan to avert runaway planetary warming. A peer-reviewed study this week warned that future CO2 emissions from existing and proposed energy infrastructure would render the 1.5C limit unreachable. It was published in the scientific journal Nature by a team of researchers from the United States and China. In April the campaign group Global Witness said that any new investment in fossil fuel exploration was incompatible with the Paris goals—and found that oil and gas majors planned to invest $5 trillion doing precisely in years to come.

#### Adler ’17

“No, Trump's new offshore-drilling rule won't bring us 'energy independence'” Published April 28th, 2017, Cut August 8th, 2018. Written by Ben Adler, Climate Journalist, for The Washington Post. CCA. <https://www.washingtonpost.com/posteverything/wp/2017/04/28/no-trumps-new-offshore-drilling-rule-wont-bring-us-energy-independence/?utm_term=.0685e3422e68>

Throughout the Obama administration, companies pushed to build pipelines to the coasts from the interior regions where natural gas was found, so that they can sell liquefied natural gas to Asia and Europe. But building all of that infrastructure is a politically problematic endeavor, as it often meets with local opposition from liberal coastal communities that would rather not have dangerous and polluting fossil fuel infrastructure run through their town. Offshore gas drilling, however, will already be on the coast, making it that much cheaper and easier to export. But the energy-intensive process of freezing, shipping and reheating natural gas makes it especially bad for the climate. As for oil, since it is a comparatively easy commodity to sell internationally, oil prices are set by global supply and global demand. An increase in domestic production only affects U.S. gasoline prices to the extent that it increases global supply. ExxonMobil isn’t bound to sell its offshore oil to refineries serving American drivers instead of Europeans or Asians, after all. That’s why an Associated Press analysis of 36 years of data found, “More oil production in the United States does not mean consistently lower prices at the pump.” This will be all the more true since Congress repealed the crude oil export ban in 2015.

#### Hamberg (Undated)

EDF. Environmental Defense Fund. “Methane: The other important greenhouse gas.” https://www.edf.org/climate/methane-other-important-greenhouse-gas

While methane doesn't linger as long in the atmosphere as carbon dioxide, it is initially far more devastating to the climate because of how effectively it absorbs heat. In the first two decades after its release, methane is 84 times more potent than carbon dioxide. We must address both types of emissions if we want to effectively reduce the impact of climate change. About 25%of the manmade global warming we're experiencing is caused by methane emissions \* Where is it coming from? Methane can come from many sources, both natural and manmade. The largest source of industrial emissions is the oil and gas industry.

#### Plumer ’19

Plumer, Brad. June 26 2019. “As Coal Fades in the U.S., Natural Gas Becomes the Climate Battleground.” https://www.nytimes.com/2019/06/26/climate/natural-gas-renewables-fight.html

America’s coal-burning power plants are [shutting down at a rapid pace](https://www.nytimes.com/interactive/2018/06/13/climate/coal-nuclear-bailout.html?module=inline), forcing electric utilities to face the next big climate question: Embrace natural gas, or shift aggressively to renewable energy? Some large utilities, including Xcel Energy in the Upper Midwest, are now planning to sharply cut their coal and gas use in favor of clean and abundant wind and solar power, which have steadily fallen in cost. But in the Southeast and other regions, natural gas continues to dominate, because of its reliability and low prices driven by the fracking boom. Nationwide, energy companies plan to add [at least 150 new gas plants](https://www.eia.gov/electricity/annual/pdf/epa.pdf) and thousands of miles of pipelines in the years ahead. A rush to build gas-fired plants, even though they emit only half as much carbon pollution as coal, has the potential to lock in decades of new fossil-fuel use right as scientists say emissions [need to fall drastically by midcentury](https://www.nytimes.com/interactive/2018/10/07/climate/ipcc-report-half-degree.html) to avert the worst impacts of global warming. “Gas infrastructure that’s built today is going to be with us for 30 years,” said Daniel Cohan, an associate professor of civil and environmental engineering at Rice University. “But if you look at scenarios that take climate change seriously, that say we need to get to net zero emissions by 2050,” he said, “that’s not going to be compatible with gas plants that don’t capture their carbon.” Last fall, in North and South Carolina, a pair of utilities owned by Duke Energy [filed plans with state regulators](https://www.utilitydive.com/news/duke-15-year-plans-lean-heavy-on-gas-to-replace-coal/531924/) to continue retiring coal plants and largely replace them with more than 9,500 megawatts of new natural gas capacity by 2033. The utilities also plan to add a smaller amount of solar capacity, about 3,600 megawatts, over the same time frame. “Right now, gas is still the most cost-effective option for us,” said Kenneth Jennings, Duke’s director of renewable strategy and policy. One challenge with using more solar power, he noted, is finding a way to supply electricity when the sun isn’t shining. Although Duke is installing some large lithium-ion batteries to store solar energy for less-sunny hours, the company says batteries still haven’t reached the point where they’re as cheap or effective as gas power, which can run at all hours.

Biello ‘13

David Biello, Scientific American, 12 December 2013, <https://www.scientificamerican.com/article/how-nuclear-power-can-stop-global-warming/>

As long as countries like China or the U.S. employ big grids to deliver electricity, there will be a need for generation from nuclear, coal or gas, the kinds of electricity generation that can be available at all times. A rush to phase out nuclear power privileges natural gas—as is planned under Germany's innovative effort, dubbed the [Energiewende](http://energytransition.de/)(energy transition), to increase solar, wind and other renewable power while also eliminating the country's 17 reactors. In fact, Germany hopes to develop technology to store excess electricity from renewable resources as gas to be burned later, a scheme known as “power to gas,” according to economist and former German politician Rainer Baake, now director of an energy transition think tank Agora Energiewende. Even worse, a nuclear stall can lead to the construction of more coal-fired power plants, as happened in the U.S. after the end of the nuclear power plant construction era in the 1980s. Hansen, for one, argues that abundant, clean energy is necessary to [lift people out of poverty](https://blogs.scientificamerican.com/observations/2011/06/30/how-do-we-solve-energy-poverty/) and begin to reduce greenhouse gas emissions from a [swelling human population](https://www.scientificamerican.com/article.cfm?id=human-population-reaches-seven-billion). Nuclear is one of the technologies available today—and with room for significant improvement and innovation. In that sense, natural gas is a bridge fuel to disaster, even with some form of [CO2 capture and storage](https://www.scientificamerican.com/article.cfm?id=carbon-capture-and-storage-not-happening-fast-enough-to-combat-climate-change), and the world must immediately transition to renewables and nuclear.

#### Conca ‘16

James Conca, Forbes, 16 May 2016, <https://www.forbes.com/sites/jamesconca/2016/05/16/natural-gas-is-replacing-nuclear-power-not-renewables/#77c8e5d3cdb6>

Across some parts of the country, nuclear power plants have been closing amid political pressure and warped financial markets, even though they contribute the overwhelming majority of their region’s clean power, and are the economic strength of their [local economies](https://northwestcleanenergy.wordpress.com/2015/08/07/pain-from-closing-vermont-yankee-lingers/). As an example, the sad and unnecessary closing of the Vermont Yankee Nuclear Power Station at the end of 2014 led to an increase in fossil fuel use, [specifically natural gas](http://yesvy.blogspot.com/2016/03/natural-gas-replaces-vermont-yankee.html#.VzgI5WNCBQM), that completely filled the gap (see figure). The potential closing of a few more nuclear plants in the region will increase gas use even more. As all energy experts know, renewables will never replace any of nuclear’s clean power lost by the closing of nuclear plants. Renewables are having enough trouble replacing significant amounts of coal or keeping pace with demand, and require taxpayer subsidies to get built. So natural gas is the obvious choice for new electricity generation in all regions of the country

#### Graham ‘19

The Hill, Thomas Graham Jr, 25 May 2019, <https://thehill.com/opinion/national-security/445550-national-security-stakes-of-us-nuclear-energy>

In the United States, nuclear energy is responsible for a fifth of the United States’ total electricity and more than 55 percent of our emissions-free energy, but the pace of domestic construction of new natural gas plants far exceeds the few nuclear plants under development, and the existing fleet is retiring prematurely at an alarming rate. Which brings us back to the domestic nuclear industry. U.S. global competitiveness and leadership are inextricably linked to a strong domestic nuclear program. Without a healthy domestic fleet of plants, the U.S. supply chain will weaken against international rivals.

#### Watts ‘20

Jonathan Watts, The Guardian, 19 February 2020, <https://www.theguardian.com/environment/2020/feb/19/oil-gas-industry-far-worse-climate-impact-than-thought-fossil-fuels-methane>

The oil and gas industry has had a far worse impact on the climate than previously believed, according to a study indicating that human emissions of fossil methane have been underestimated by up to 40%. Although the research will add to pressure on fossil fuel companies, scientists said there was cause for hope because it showed a big extra benefit could come from tighter regulation of the industry and a faster shift towards renewable energy. Methane has a greenhouse effect that is about 80 times more potent than carbon dioxide over a 20-year period and is responsible for at least 25% of global heating, according to the UN Environment Programme. In the past two centuries, the amount of [methane in the atmosphere](https://www.theguardian.com/environment/2019/feb/17/methane-levels-sharp-rise-threaten-paris-climate-agreement) has more than doubled, though there has long been uncertainty about whether the source was biological – from agriculture, livestock or landfills – or from fossil fuels. There were also doubts about what share of fossil methane was naturally released and what share was from industry. Earlier estimates were based on intermittent, bottom-up monitoring of oil and gas companies and comparisons with geological evidence from the end of the Pleistocene epoch, about 11,600 years ago. For a more accurate comparison, a team at the University of Rochester in the US examined levels of methane in the pre-industrial era about 300 years ago. This was achieved by analysing air from that period trapped in glaciers in Greenland. The sample – made up of about a tonne of ice – was extracted with a [Blue Ice Drill](https://icedrill.org/equipment/blue-ice-drill), capable of producing the world’s biggest ice cores. The findings, [published in Nature](https://www.nature.com/articles/s41586-020-1991-8), suggest the share of naturally released fossil methane has been overestimated by “an order of magnitude”, which means that human activities are 25-40% more responsible for fossil methane in the atmosphere than thought. This strengthens suspicions that fossil fuel companies are not fully accounting for their impact on the climate, particularly with regard to methane – a colourless, odourless gas that many plants routinely vent into the atmosphere. An [earlier study](https://science.sciencemag.org/content/361/6398/186) revealed methane emissions from US oil and gas plants were 60% higher than reported to the Environmental Protection Agency. Accidents are also underreported. A single blowout at a natural gas well in Ohio in 2018 discharged more methane over three weeks than the oil and gas industries of France, Norway and the Netherlands released in an entire year. At the time, the company said it was unsure of the size of the leak. The immense scale was only revealed a year later when [scientists analysed satellite data](https://www.pnas.org/content/116/52/26376) provided by the European Space Agency. Fracking also appears to have [worsened the problem](https://www.desmogblog.com/2019/12/22/methane-leaks-venting-blowouts-fracking-climate-change). Atmospheric methane had started to flatten off at the turn of the century, but rose again after a surge in [fracking activity](https://www.theguardian.com/environment/2020/jan/17/activists-warn-of-fracking-by-stealth-and-call-for-acid-fracking-ban) in the US and elsewhere. The industry, however, continues to claim that the energy source can be used as a “bridge fuel” because it has lower carbon emissions than oil or coal, but this fails to account for leaks and flares of methane and other gases during extraction.

#### International Energy Agency ‘19

May 2019, <https://www.eenews.net/assets/2019/05/28/document_ew_01.pdf>

A collapse in investment in existing and new nuclear plants in advanced economies would have implications for emissions, costs and energy security. In the case where no further investments are made in advanced economies to extend the operating lifetime of existing nuclear power plants or to develop new projects, nuclear power capacity in those countries would decline by around two-thirds by 2040. Under the current policy ambitions of governments, while renewable investment would continue to grow, gas and, to a lesser extent, coal would play significant roles in replacing nuclear. This would further increase the importance of gas for countries’ electricity security. Cumulative CO2 emissions would rise by 4 billion tonnes by 2040, adding to the already considerable difficulties of reaching emissions targets. Investment needs would increase by almost USD 340 billion as new power generation capacity and supporting grid infrastructure is built to offset retiring nuclear plants.

#### Conca ‘19

James Conca, Forbes, <https://www.forbes.com/sites/jamesconca/2019/01/16/u-s-co2-emissions-rise-as-nuclear-power-plants-close/#582e94cb7034>

More importantly, the U.S. nuclear fleet avoided 547 million metric tons of CO2 in 2017, similar to most years. At the same time, hydro only avoided 203 million metric tons, wind 176 million metric tons, solar 37 million metric tons, and everything else less then 15 million. Since the [U.S. emits](https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions) about 1,900 million metric tons of CO2 from fossil fuels that generate electricity, nuclear is the most effective tool we have to decrease or avoid emissions.

#### Smith ‘12

Rebecca Smith, 15 March 2012, The Wall Street Journal, <https://www.wsj.com/articles/SB10001424052702304459804577281490129153610>

Once built, nuclear plants produce some of the cheapest electricity available other than big hydroelectric dams. In the U.S., even believers in nuclear energy are responding to the allure of abundant gas. [Dominion Resources](https://quotes.wsj.com/D) Inc., [D -0.95%](https://quotes.wsj.com/D?mod=chiclets) Virginia's biggest utility company and operator of seven nuclear reactors, put one new gas-fired plant in service last May and recently got approval to build another that is twice as big. On the drawing board are two more plants that would nearly double the company's gas-fired generating capacity.

#### Parncutt ‘19

Richard Parncutt, Frontiers in Psychology, University of Graz (Graz, Austria), 16 October 2019, <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02323/full>

It implies that one future premature death is caused every time roughly 1,000 (300–3,000) tonnes of carbon are burned. Therefore, any fossil-fuel project that burns millions of tons of carbon is probably indirectly killing thousands of future people. The prediction may be considered valid, accounting for multiple indirect links between AGW and death rates in a top-down approach, but unreliable due to the uncertainty of climate change feedback and interactions between physical, biological, social, and political climate impacts (e.g., ecological cascade effects and co-extinction). Given universal agreement on the value of human lives, a death toll of this unprecedented magnitude must be avoided at all costs. As a clear political message, the “1,000-tonne rule” can be used to defend human rights, especially in developing countries, and to clarify that climate change is primarily a human rights issue.

#### Gould ‘09

Gordon Gould, Scientific American, 17 June 2009, <https://www.scientificamerican.com/article/global-warming-and-health/>

A team of health and climate scientists from the World Health Organization (WHO) and the University of Wisconsin at Madison published these findings last year in the prestigious, peer-reviewed science journal Nature. Besides killing people, global warming also contributes to some five million human illnesses every year, the researchers found. Some of the ways global warming negatively affects human health—especially in developing nations—include: speeding the spread of infectious diseases such as malaria and dengue fever; creating conditions that lead to potentially fatal malnutrition and diarrhea; and increasing the frequency and severity of heat waves, floods and other weather-related disasters.

#### University of Calgary ‘19

Energy Education. “Nuclear Power Plant.” https://energyeducation.ca/encyclopedia/Nuclear\_power\_plant

The [efficiency](https://energyeducation.ca/encyclopedia/Efficiency) of a nuclear power plant is determined similarly to other [heat engines](https://energyeducation.ca/encyclopedia/Heat_engine)—since technically the plant is a large heat engine. The amount of [electric power](https://energyeducation.ca/encyclopedia/Electric_power) produced for each unit of [thermal power](https://energyeducation.ca/encyclopedia/Thermal_power) gives the plant its [thermal efficiency](https://energyeducation.ca/encyclopedia/Thermal_efficiency), and due to the [second law of thermodynamics](https://energyeducation.ca/encyclopedia/Second_law_of_thermodynamics) there is an upper limit to how efficient these plants can be. Typical nuclear power plants achieve efficiencies around 33-37%, comparable to fossil fueled power plants. Higher [temperature](https://energyeducation.ca/encyclopedia/Temperature) and more modern designs like the [Generation IV nuclear reactors](https://energyeducation.ca/encyclopedia/Generation_IV_nuclear_reactors) could potentially reach above 45% efficiency.[[6]](https://energyeducation.ca/encyclopedia/Nuclear_power_plant#cite_note-wna-6)

## C2 Exporting Nuclear Tech

#### Gordon ‘20

Jennifer T Gordon, 9 January 2020, The Atlantic Council, <https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/international-co-financing-of-nuclear-reactors-between-the-united-states-and-its-allies/>

It is critically important for global safety standards, nonproliferation agreements, and geopolitics that the United States play a leading role in the export of nuclear energy technologies. However, the domestic reactor fleet has struggled due to the deregulated US electricity market, inexpensive gas, and subsidies for renewables, which—in turn—has hampered US nuclear exports, since it is challenging to export a product that lacks a domestic market. However, building new reactors and bringing first-of-a-kind reactors to demonstration involve high capital costs and financial risk, for the purchasing party as well as the vendor. If the United States is to play a role at all in building new nuclear plants, it must address the challenges inherent in financing new nuclear builds; one mechanism to do this is through partnering with close US allies to co-finance new nuclear projects.

#### Neuhauser ‘18

Alan Neuhaser, 1 June 2018, US News, <https://www.usnews.com/news/world/articles/2018-06-01/the-us-has-lost-the-nuclear-race>

The domestic struggles have had significant implications for the competitiveness of U.S. nuclear power overseas. As electricity consumption in the U.S. and other developed nations has [leveled off and even fallen slightly](https://www.statista.com/statistics/201794/us-electricity-consumption-since-1975/), the future of nuclear power is believed to be in developing nations in Southeast Asia and Africa, where booming populations, the need for electrification and an expanding middle class are driving huge demand for power. Nuclear, though expensive, offers far more base-load power than solar or wind can match. Unlike natural gas, it doesn't require pipeline infrastructure or a means to import natural gas. And while coal is cheap, it is also dirty – nuclear power, by contrast, generates electricity with virtually no emissions. The U.S., however, has struggled to demonstrate that it can successfully bring its latest nuclear reactors within its own market, let alone overseas. "It's dead in the water, with respect to proving that their reactors are buildable in this country itself," says Ahmed Abdulla, a fellow studying energy policy at the University of California, San Diego School of Global Policy and Strategy. "There is a noticeable lack of competitiveness of U.S. nuclear reactor vendors on the world stage. And, therefore, the U.S. has been forced to fight over scraps." U.S. firms as a result have taken a back seat, entering into contracts to supply nuclear fuel rather than build plants from the ground-up – a profitable enterprise but one that carries nowhere near the prestige, or the geopolitical or economic benefits, of constructing a nuclear plant. "That's where the U.S. has been forced to compete, not on the grand scale of building reactors as a whole," Abdulla says.

#### Swanek ‘18

Thaddeus Swanek, NEI, 5 April 208, <https://www.nei.org/news/2018/china-russia-us-nuclear-leadership>

The Trump administration must not neglect the influence the of the U.S. commercial nuclear industry in building alliances and spreading American norms for nuclear safety and nonproliferation in the face of increasing Chinese and Russian competition, a [new report from the Atlantic Council](http://www.atlanticcouncil.org/publications/issue-briefs/us-nuclear-power-leadership-and-the-chinese-and-russian-challenge) urges. “Nuclear power should be elevated in the Trump administration’s U.S. National Security Strategy, including its ‘energy dominance,’ defense-industry capacity development, and international partnership efforts with allies,” the report says. “U.S. global nuclear engagement is critical—not only because it supports military needs and advances commercial interests, but also because it brings with it a culture that promotes safety, security of nuclear materials, and nonproliferation.” The report from the influential Washington, D.C.-based [think tank](http://www.atlanticcouncil.org/) analyzes the growing clout of China’s and Russia’s growing commercial nuclear industries and how the nations use these industries to further their foreign policy agendas. It points out that as China and Russia push to expand their domestic nuclear industries, they also are aggressively exporting their reactor technologies into new international markets. “The results of these efforts are striking—nearly two-thirds of the new reactors under construction worldwide are estimated to be using designs from China and Russia,” the report says. “The two countries’ overseas nuclear push challenges the post-World War II nuclear-safety and nonproliferation policy and legal framework, which were put in place through the combined efforts of the U.S. government and industry, as well as U.S. leadership in international organizations.”

#### Sukin ‘16

Lauren S Sukin, The National Interest, 19 March 2016, <https://nationalinterest.org/feature/how-america-can-dominate-global-nuclear-energy-16274>

The benefits of nuclear exporters aren’t just domestic, either. Nuclear power plants’ vast benefits for their host countries—comparatively low environmental impact, economically efficient energy production, suitability for powering desalination plants—make nuclear power a worthy industry for additional attention. Nuclear-power exports would also provide the United States with a leg up when it comes to proliferation concerns. First, U.S. nuclear-energy partners must negotiate [123 agreements](http://www.nei.org/Issues-Policy/Exports-Trade/Nuclear-Cooperation-Agreements), which help monitor nuclear activities and limit countries’ abilities to develop offensive nuclear capabilities. Second, the U.S. nuclear industry has [high safety standards](http://bipartisanpolicy.org/wp-content/uploads/sites/default/files/Nuclear%20Report.PDF) all along the nuclear supply chain, standards that other exporters do not necessarily meet. By designing and exporting safer nuclear plants, the United States could reduce the global risk of nuclear accidents. Third, U.S. nuclear exports would allow the United States to utilize scientific diplomacy to build significant and sustainable partnerships throughout the world; these relationships could translate not only to cooperation on additional nonproliferation issues, but on other areas of security and scientific policy as well. These relationships would also be essential for nuclear security, in that the United States could serve a helpful advisory role in importing states’ efforts to build the educational, regulatory and infrastructural institutions needed to sustain a safe nuclear industry. Finally, U.S. exporting capabilities would also provide intimate knowledge of international partners’ nuclear-energy industries, giving the United States a potential guidance role in the case of nuclear accidents as well as intelligence that could be useful for nonproliferation activities.

#### Sivaram ‘18

Varun Sivaram, Council on Foreign Relations, 4 September 2018, cfr.org/blog/america-risks-missing-out-global-nuclear-power-revival

However, nuclear power is seeing a revival in emerging economies, which are seeking nuclear energy technology from abroad. China and Russia are racing to dominate this space and win geopolitical leverage through potentially predatory state financing and full construction and operation packages. The United States, which used to lead in nuclear technology exports, has fallen behind because of restrictive export regulations. To get back in the game—and secure economic and security advantages that the growing export market presents—the United States should simplify export controls and invest in innovative nuclear technologies. To begin the task, the White House should turn to Saudi Arabia, which is looking to develop its own nuclear energy program. We’ve collected a series of essays and articles exploring nuclear’s growth in the developing world, the commercial and national security concerns connected to Russia and China’s growing control, and policy options for the current administration to revitalize America’s domestic nuclear industry without sacrificing safety and security. A New “Half-Life” Though nuclear power is projected to stagnate in OECD countries through 2040, it is also expected to grow [nearly fivefold](https://www.eia.gov/outlooks/aeo/data/browser/#/?id=31-IEO2016&region=0-0&cases=Reference&start=2010&end=2040&f=A&linechart=~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~Reference-d021916a.11-31-IEO2016~Reference-d021916a.26-31-IEO2016&map=&ctype=linechart&chartindexed=1&sourcekey=0) in non-OECD countries in the same time period, with the Middle East and Asia accounting for much of the growth. In the latest issue of the [Washington Quarterly](https://twq.elliott.gwu.edu/sites/g/files/zaxdzs2121/f/downloads/TWQ_Summer2018_HolgateSaha.pdf), Laura Holgate and Sagatom Saha explore the forces driving this growth. Among them is the growing need to combat climate change and local pollution, they write: “For many developing countries, the dangers that climate change pose are catastrophic. The 46 most polluted countries and the 146 cities with the worst air quality are all in the developing world. [...] While China and India expectedly dominate the list, countries in the Gulf, Southeast Asia, and Sub-Saharan Africa also populate it. These nations may see China’s and India’s fates—economic growth at the expense of public health—as an obstacle to bypass.” Notably, ten countries accounting for about 40 percent of global energy demand—including three without reactors—incorporated nuclear into their Paris climate pledges. Holgate and Saha also expect innovative designs, like the nearly-commercial small modular reactor (SMR), to bring nuclear to untapped markets. Nuclear has been traditionally limited to the world’s wealthiest nations because today’s reactors have high upfront costs and generate far too much power for smaller electricity grids. SMRs stand to eliminate both of these barriers: First, each module of an SMR only generates about 50 megawatts (MW), so SMRs can be sited on virtually any grid anywhere. Second, SMRs are scalable—that is, additional modules can be added over time as power needs grow and financing becomes available. Third, SMRs have lower construction costs and benefit from economies of scale as they can be uniformly mass produced in a central factory and transported by truck or rail. For developing countries, the dangers that climate change pose provide a pressing need for zero-carbon power, and new nuclear designs provide a viable option. Even in a future with far more wind and solar, nuclear reactors could benefit—rather than suffer—from renewables’ explosive growth (see a 2017 [Greentech Media](https://www.greentechmedia.com/articles/read/nuclear-can-be-friends-with-renewables#gs.sn14f9k) article for an explainer on synergies between nuclear and renewables).

Despite the barriers it faces, the U.S. nuclear industry is still regarded as the leader in nuclear technology, and can compete if given a fair playing field. The Trump administration has pledged to revitalize the U.S. nuclear energy industry— to do so, it can guide its companies by streamlining and clarifying the export process and by supporting technological innovation.

#### Gordon ‘20

Jennifer T Gordon, 9 January 2020, The Atlantic Council, <https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/international-co-financing-of-nuclear-reactors-between-the-united-states-and-its-allies/>

The World Nuclear Association has identified thirty countries as emerging markets for nuclear energy technologies, and most of the countries in question are not members of the OECD. The regions focused on acquiring civil nuclear capabilities include: Eastern Europe; the Middle East and North Africa; Western, Central, and Southern Africa; Central and South America; and East and Southeast Asia.[52](javascript:void(0)) Russia and China have identified these new markets as opportunities to expand their spheres of influence by forging diplomatic and economic relationships. However, nuclear commitments between Russia or China and third-party countries may lack the safety guarantees and nonproliferation standards that are integral to nuclear-export agreements made by the United States or its allies.

#### Paraskova ‘19

OilPrice, 23 May 2019, Tsvetana Paraskova, <https://oilprice.com/Alternative-Energy/Nuclear-Power/The-US-Is-Losing-The-Nuclear-Race-To-Russia-And-China.html>

The U.S. lawmakers believe that reviving nuclear energy in the U.S. and developing new and advanced reactors will raise the share of clean energy generation in America on the one hand, and reestablish U.S. leadership on the global market, on the other. “If the U.S. does not reassert global leadership in this sector, others will. Russia and China today account for more than 60 percent of new nuclear plants under construction worldwide,” Senators Crapo and Whitehouse said. “Given the mounting challenges of climate change and geopolitical and national security threats, we cannot afford to allow rival nations to define the nuclear energy landscape,” the Senators wrote. In the U.S., nuclear power plants come under pressure from competition from low natural gas prices, growing renewable power generation, and limited growth in overall electricity demand, the EIA [said](https://www.eia.gov/todayinenergy/detail.php?id=36112) in May last year, noting that the future of nuclear power will depend on natural gas prices and potential carbon policies.

#### Higgins ‘12

James Higgins, Homeland Security Affairs Journal, “Responding to a Nuclear Meltdown in the Developing World”, February 2012, <https://www.hsaj.org/articles/205>

Most of the developing nations using, or contemplating using, nuclear power plants share a problem confronting Japan and its handling of the Fukushima disaster: close proximity of the reactor site to population centers. For example, Bangladesh has contracted with a Russian firm to construct two reactors at the Rooppur site in Pabna District.[41](https://www.hsaj.org/articles/205" \l "fn41) The Rooppur site is only about 180 km (112 miles) from Dhaka; a reactor explosion that distributes radionuclides (Table 2) over an area equivalent to only half that of the Kyshtym disaster of 1957 (for example) would hypothetically contaminate the largest population center in Bangladesh.[42](https://www.hsaj.org/articles/205" \l "fn42) It is unclear if the Bangladesh government would be able to execute an evacuation of large numbers of people from a heavily populated area, such as that surrounding the Rooppur site, should an accident take place. The alternative to evacuation, having people remain within contaminated zones, may be the only recourse available to the Bangladesh government. Such a scenario would constitute a humanitarian challenge of unprecedented scope, since it is doubtful the government would be able to supply the affected multitudes with necessary quantities of uncontaminated drinking water and food for what may be months (if not years) of post-accident habitation. Indeed, it is likely that millions of Bangladeshis would unwillingly be forced to inhale radionuclides in their air, as well as ingesting them from contaminated fresh water, crops, and food animals. Providing adequate medical care to such a large number of exposed persons would be an extremely difficult endeavor for the Bangladesh government, thus, morbidity and mortality due to exposure to beta- and gamma-radiation emissions presumably would be very high. Particularly worrisome with regard to potential casualties is the prevalence of malnutrition among Bangladeshis, particularly women and children; in a 1984-2005 survey of admissions to a hospital in Dhaka, 47 percent of children were underweight, 30 percent were stunted, and 22 percent were “wasting” (i.e., losing weight).[43](https://www.hsaj.org/articles/205" \l "fn43) Such individuals, with their immune systems already handicapped by malnutrition, will face additional immunosuppression from the effects of ionizing radiation. This will exacerbate their vulnerability to infectious diseases, which may be a major threat to public health if large numbers of exposed persons are gathered into refugee camps. The historical experiences of Bangladesh in regard to cyclone-associated mortality are of import in this regard; for the 1970 and 1991 cyclones, the estimated mortality figures were 300,000 and 138,000 deaths, respectively. A considerable proportion of this mortality was assumed to be derived from causes not directly associated with drowning, or severe physical injuries, associated with the cyclone per se, but rather from disease spreading in the storm’s aftermath.[44](https://www.hsaj.org/articles/205" \l "fn44) In the event of a catastrophic nuclear accident in Bangladesh, mortality statistics of this magnitude are depressingly likely. Even if casualties due to exposure to radionuclides would be small, the economic consequences of a nuclear disaster in a developing nation such as Bangladesh would be significant. The lesson from the Chernobyl accident is sobering: milk throughout much of northern Europe and the British isles was discarded due to contamination with 131I and, to a lesser extent, 90Sr. When testing indicated that many livestock had accumulated significant quantities of radionuclides in their tissues, restrictions were placed on the slaughter of animals for use in the human food chain. With regard to international trade, many nations imposed bans and restrictions on a variety of agricultural products; for example, Germany banned the importation of Italian vegetables, while Italy in turn banned imports from Austria, the Eastern Bloc, Scandinavia and Switzerland. Outside the European Economic Community, Sri Lanka destroyed imports from Europe, and Jordan refused imports of goods from some countries for up to three months following the accident.[45](https://www.hsaj.org/articles/205" \l "fn45) Early on in the Fukushima disaster many countries restricted food imports from Japan, particularly seafood.[46](https://www.hsaj.org/articles/205" \l "fn46) In July 2011, the disclosure that nearly 1,500 beef cattle had consumed rice straw from the Fukushima area; that beef from these animals harbored concentrations of radioactive cesium well in excess of government thresholds; and that some citizens had unwittingly consumed this beef, has had a deleterious impact on the Japanese beef industry.[47](https://www.hsaj.org/articles/205" \l "fn47) For developing nations, particularly those that rely on agricultural exports as a major source of revenue, loss of such income for an indefinite period of time may provoke a collapse of the national economy. Such economic travails may exacerbate the increased movement of refugees or migrants from the affected country.

#### Grunlond ‘07

Union of Concerned Scientists, December 2007, Nuclear Power in a Warming World, http://www.ucsusa.org/assets/documents/global\_warming/Nuclear-Power-in-a-Warming-World.pdf

An operating nuclear power plant contains a large amount of radioactive material, and an accident that results in the release of this material could cause significant harm to people and the environment. People exposed to high levels of radiation will die or suffer other health consequences within days or weeks. Lower radiation levels can cause cell damage that will eventually lead to cancer, which may not appear for years or even decades. People may need to be permanently evacuated from areas contaminated with radiation. The costs of evacuation and environmental remediation, and those of the loss of usable land, could be enormous. Radioactivity released by a severe accident could lead to the death of tens of thousands of people, injure many thousands of others, contaminate large areas of land, and cost billions of dollars.

# FRONTLINES

### F/L Climate Change Inevitable

1) Yeah but its scalar, every 1000 tons of carbon leads to one death in the future.

### F/L Uranium Runs Out

1) Uranium isn’t running out. Conca 16 writes that there is enough uranium to last for 100,000 years under the sea and new technological breakthroughs have made uranium removing from seawater completely feasible. More importantly, uranium extracted from seawater is replenished continuously so it’s completely renewable.

2) Partanen 18 finds that estimates that we are going to run out of uranium are based on our current known reserves. However, he finds that every time these have been depleted and we’ve prospected for more uranium we have found it. This is because overall there is an estimated 25,000 billion tons of uranium in the upper mile of the earth’s crust.

3) New reactor designs have been optimized to reuse already spent nuclear fuel multiple times thus reducing uranium demand. These have already been implemented in countries like Great Britain, Japan, and France.

Conca ’16, <https://www.forbes.com/sites/jamesconca/2016/07/01/uranium-seawater-extraction-makes-nuclear-power-completely-renewable/#4b5158b6159a>

America, Japan and China are racing to be the first nation to make nuclear [energy](http://www.forbes.com/energy/) completely renewable. The hurdle is making it economic to extract uranium from seawater, because the amount of uranium in seawater is truly inexhaustible. And it seems America is in the lead. New technological breakthroughs from [DOE’s Pacific Northwest (PNNL) and Oak Ridge (ORNL) national laboratories](http://www.pnnl.gov/news/release.aspx?id=4271) have made removing uranium from seawater within economic reach and the only question is - when will the [source of uranium for our nuclear power plants](http://energyeducation.ca/encyclopedia/Uranium) change from mined ore to seawater extraction? Nuclear fuel made with uranium extracted from seawater makes nuclear power completely renewable. It’s not just that the 4 billion tons of uranium in seawater now would fuel a thousand 1,000-MW nuclear power plants for a 100,000 years. It’s that uranium extracted from seawater is replenished continuously, so nuclear becomes as endless as solar, hydro and wind.

Partanen ’18, <https://www.fennonen.fi/en/article-page/will-we-run-out-uranium>

As the price of uranium starts to rise, so starts prospecting for more uranium. And every time we have seriously looked for more uranium, we have also found it. Rising price also makes some of the already known deposits economic for production and encourages us to develop more advanced and efficient production technologies. By enriching our uranium more efficiently, recycling and reprocessing the used fuel, we can effectively halve the uranium use of current reactors3. None of this means that uranium would not be a finite resource, but it is worth noting how finite it is. In the upper mile of the earth’s crust, there is an estimated 25,000 billion tons of uranium. This is more than 4 million times the known reserves (at a price of $130 / kg) discussed above.

Rubio ’18, Stanford University, 30 April 2018, <http://large.stanford.edu/courses/2018/ph241/rubio1/>

There also now exist ways to reuse nuclear waste that its environmental impact is minimized. The standard and a most widely used process is currently PUREX (Plutonium and Uranium Recovery by Extraction). [4] In this process, the spent fuel is divided into small pieces and then dissolved in nitric acid. [4] Using tributyl phosphate, a surfactant, the uranium and plutonium are taken up and separated from the rest of the waste. [4] This process leaves behind a smaller volume of radioactive waste - fission products and neutron-activated isotopes - that must be disposed of. In France and Japan, the nuclear material that is not reused is embedded in glass. [5] In France Great Britain and Japan, the PUREX technology is greatly used. In addition, they have started to develop alternative versions of PUREX. In France, in particular, nuclear energy accounts for about 80% of the energy production. [6] A large amount of this nuclear energy comes from fuel that is reprocessed in plants such as the La Hague Reprocessing Plant shown in Fig. 1. In the end, repossession on a ton of nuclear waste is equivalent to saving 100,000 barrels of oil. [5]

### F/L Natural Gas Can’t Compete with Renewables

Natural Gas will continue to replace nuclear for 2 reasons

1. Alter 20 finds that in the status quo renewables have been unable to compete with natural gas because it is so cheap. Moreover, they find that as natural gas plants are being implemented, they are locking in years of fossil fuel usage. Critically, he finds that this is unlikely to change, because the problem with renewables is while the price of the renewables themselves (like the solar panels, or the wind trubines) is going down, you have to also invest in huge energy storage facilities to make renewables useful because renewables only work when the sun is shining or wind is blowing. This extra investment in battery storage means that natural gas will always stay cheaper than renewables.
2. Biello 13 of Scientific American explains that the US will always need generation from either coal, nuclear, or gas because these are the only kinds of electricity generation that can be available at all times (can only have wind when its windy, or solar when its sunny for example). Because of this, renewables don’t actually compete with nuclear because they are supplemental energy sources not baseload energy that provide energy to grids 24/7. It is for this exact reason that the Conca 16 evidence we read in case makes it very clear that the decline in nuclear has privilege natural gas as an alternative baseload energy source, specifically citing New England where natural gas was built in the place of closed nuclear reactors.

Alter ’20, <https://www.treehugger.com/fossil-fuels/cheap-natural-gas-making-it-very-hard-go-green.html>

It's[natural gas is] killing everything, including renewable energy. We recently noted that the US is drowning in cheap natural gas, and that ["Gasmaggedon" will make it even harder to electrify everything.](https://www.treehugger.com/fossil-fuels/gasmaggedon-will-make-it-even-harder-electrify-everything.html) Now we learn from Bloomberg Green that solar and wind power can't compete with gas that's this cheap. [Naureen Malik and Brian Eckhouse write:](https://www.bloomberg.com/news/articles/2020-02-14/solar-and-wind-power-can-t-compete-with-gas-that-s-this-cheap?sref=dYPvZQvk) Gas is such a bargain that it’s being viewed less as a bridge fossil fuel, driving the world away from dirtier coal toward a clean-energy future, and more as a hurdle that could slow the trip down. Some forecasters are predicting prices will stay low for years, making it tough for states, cities and utilities to achieve their goals of being zero-carbon in power production by 2050 or earlier. The authors note that there is an upside to this, that gas is replacing coal for power generation, which is the main reason that CO2 emissions have flatlined in the USA. But having gas this cheap makes it difficult for everyone else, and [it's getting "locked in."](https://www.treehugger.com/green-architecture/what-are-locked-emissions-and-why-do-they-matter.html) Just look at the largest grid in the U.S., which stretches from Washington to Chicago and serves more than 65 million people: It has been boosting the amount of power generated with gas and drawing in renewables at a slower rate. That grid happens to crisscross a section of the U.S. that’s home to some of the world’s most abundant natural gas reserves. It’s also squeezing margins for nuclear reactors, which are the U.S.’s biggest source of carbon-free power. And it’s driving utilities to lay down infrastructure that could ensure gas remains central to the power mix for decades. Cheap gas means there is little incentive to invest in batteries or other storage technologies needed to go totally renewable, especially when the gas companies keep calling it a "bridge fuel" that's cleaner than coal; the bridge just keeps getting longer and longer until the other end is out of sight.

Eckhouse ’20, Brian Eckhouse, Seattle Times, 14 February 2020, <https://www.seattletimes.com/business/solar-and-wind-power-cant-compete-with-gas-this-cheap/>

Solar and wind power can’t compete with gas this cheap. This will almost certainly be a record-breaking year for the advance of solar and wind power across the U.S. The additions that are in progress or planned are significant enough to boost hopes for emissions-free electrical grids within a generation — if natural gas doesn’t get in the way. It just may. Gas is such a bargain that it’s being viewed less as a bridge fossil fuel, driving the world away from dirtier coal toward a clean-energy future, and more as a hurdle that could slow the trip down. Some forecasters are predicting prices will stay low for years, making it tough for states, cities and utilities to achieve their goals of being zero-carbon in power production by 2050 or earlier. “The fact that there’s an abundance of it makes the move to complete decarbonizaton much harder,” says Ravina Advani, head of energy, natural resources and renewables at BNP Paribas. Gas is a tough competitor. “It’s reliable and it’s cheap.” The flood of inexpensive gas does have a big environmental upside, because it’s putting increased pressure on struggling coal plants that contribute significantly to global warming. But it’s also squeezing margins for nuclear reactors, which are the biggest source of carbon-free power in the U.S. And it’s driving utilities to lay down infrastructure that could ensure gas remains central to the power mix for decades. Solar and wind are certainly winning in many markets on price alone. Without cheap gas, though, the renewables build-out would be faster, says Cody Moore, head of gas and power trading at Mercuria Energy America. “Absolutely, 100%.” Rising exports of liquefied natural gas from the U.S. Gulf Coast to Siberia will probably keep prices down and expand developing economies’ reliance on the fuel. The International Energy Agency expects global gas consumption to climb through 2040. “We’re using solar and wind more than ever, but until we’re very purposeful about trying to subtract some fuels that we’re using, history shows us that market forces alone won’t successfully push fossil fuels out of the energy mix,” says Noah Kaufman, a research scholar at Columbia University’s Center on Global Energy Policy.

Biello ‘13

David Biello, Scientific American, 12 December 2013, <https://www.scientificamerican.com/article/how-nuclear-power-can-stop-global-warming/>

As long as countries like China or the U.S. employ big grids to deliver electricity, there will be a need for generation from nuclear, coal or gas, the kinds of electricity generation that can be available at all times. A rush to phase out nuclear power privileges natural gas—as is planned under Germany's innovative effort, dubbed the [Energiewende](http://energytransition.de/)(energy transition), to increase solar, wind and other renewable power while also eliminating the country's 17 reactors. In fact, Germany hopes to develop technology to store excess electricity from renewable resources as gas to be burned later, a scheme known as “power to gas,” according to economist and former German politician Rainer Baake, now director of an energy transition think tank Agora Energiewende. Even worse, a nuclear stall can lead to the construction of more coal-fired power plants, as happened in the U.S. after the end of the nuclear power plant construction era in the 1980s. Hansen, for one, argues that abundant, clean energy is necessary to [lift people out of poverty](https://blogs.scientificamerican.com/observations/2011/06/30/how-do-we-solve-energy-poverty/) and begin to reduce greenhouse gas emissions from a [swelling human population](https://www.scientificamerican.com/article.cfm?id=human-population-reaches-seven-billion). Nuclear is one of the technologies available today—and with room for significant improvement and innovation. In that sense, natural gas is a bridge fuel to disaster, even with some form of [CO2 capture and storage](https://www.scientificamerican.com/article.cfm?id=carbon-capture-and-storage-not-happening-fast-enough-to-combat-climate-change), and the world must immediately transition to renewables and nuclear.

### F/L Uranium Mining

1) According to Wills 17, though uranium mining and enrichment does release some CO2, on net nuclear generation produces just 1/3 the CO2 produced by a natural gas plant.

Wills ’17, Ann Wills, New Scientist, 27 September 2017, <https://www.newscientist.com/letter/mg23531450-700-7-generating-nuclear-power-also-emits-carbon/>

Though nuclear reactors emit little CO2 at the point of generation, they are just a small part of the nuclear fuel cycle. Uranium mining, milling the ore, converting it to uranium hexafluoride, enriching that and fabricating fuel rods all emit large amounts of CO2. Much energy is also used in the treatment, conditioning, transport and disposal of nuclear products. Jan Willem Storm van Leeuwen and Philip Smith [found](https://www.stormsmith.nl/aboutstudy.html) that [but] nuclear generation produces a third as much CO2 per unit of electricity generated as conventional, mid sized, gas-fired electricity generation – and more if lower-grade ores have to be mined. Decommissioning old radioactive nuclear power stations also consumes energy.