

# Nuclear Power: Scientific Triumph, Human Tragedy

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Late in December, 1938, physicist Lise Meitner made an important discovery that would change the world forever. She effectively explained atomic fission, the curious phenomenon scientists had been wrestling with for several years. This discovery showed the potential power of atomic fission if it could be harnessed.<sup>1</sup> The after effects of this discovery have led to many advancements in energy and warfare technology through nuclear power. Nuclear power has been split into triumph and tragedy since its discovery and creation, shown by the uses of nuclear power as an energy source and as a military weapon.

During World War II, the US led the Allied Forces in atomic research by directing the Manhattan Project. This project served as a catalyst for the further development of nuclear fission because the main goal of the project was to create an atomic weapon to be used by the United States (US) and the Allied Forces against the Axis powers. This weapon would use the concepts of nuclear fission, the splitting of an atom into lighter elements, to create an explosion which would have thousands of times the destructive power of TNT or dynamite. The result of this project was a successful detonation on June 16, 1945, code-named "Gadget," which exploded at 5:30 AM at Los Alamos National Laboratory's Trinity Site in New Mexico.<sup>2</sup> The Manhattan Project was an important part of the development of nuclear power; it would set the stage for many positive and negative impacts on the world, but at its root was war.

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<sup>1</sup> Alan Chodos and Ernie Tretkoff, "This Month in Physics History: December 1938: Discovery of Nuclear Fission," ed. Jennifer Oullette, American Physical Society, last modified 2007, accessed March 2, 2019, <https://www.aps.org/publications/apsnews/200712/physicshistory.cfm>.

<sup>2</sup> White Sands National Monument, "Trinity Site," National Parks Service, last modified September 18, 2017, accessed March 2, 2019, <https://www.nps.gov/whsa/learn/historyculture/trinity-site.htm>.

At 8:16 AM local time the first atomic bomb to be used against civilians exploded over the Japanese city of Hiroshima. It was August 6, 1945. Three days later, another atomic bomb was dropped on Nagasaki, Japan. The bombs brought an abrupt end to the war, but their lasting legacy was one of tragedy and horror. Over 200,000 people died from the initial explosions and the aftermath of radioactive fallout.<sup>3</sup> Cancer rates increased by 10-50% as a result of the bombings in both cities.<sup>4</sup> The people of Hiroshima and Nagasaki suffered great horrors both physically and mentally. Those who were outside or not protected by thick walls had thousands of shards of glass and splinters of wood shot into their bodies and sustained horrible burns. Houses collapsed on people, killing some and injuring others.<sup>5</sup>

The survivors all witnessed great psychological horrors. Victims had flesh melting off of their bodies because of the burns. There were burned and mangled bodies everywhere. Keiko Murakami was eight years old when the bomb exploded over her hometown of Hiroshima. She recalls that, "Even with great effort not to step on the bodies, I did so many times. This memory is one I shall have to carry all through my life."<sup>6</sup> While this tactic was effective in ending World War II, the bombings of Hiroshima and Nagasaki were undoubtedly a tragedy. No other atomic bombs have been detonated during wartime.

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<sup>3</sup> "Hiroshima and Nagasaki Bombings," Icanw.org, accessed December 18, 2018, <http://www.icanw.org/the-facts/catastrophic-harm/hiroshima-and-nagasaki-bombings/>.

<sup>4</sup> "Solid Cancer Risks among Atomic-bomb Survivors," Radiation Effects Research Foundation, accessed April 16, 2019, [https://www.rerf.or.jp/en/programs/roadmap\\_e/health\\_effects-en/late-en/cancrisk/](https://www.rerf.or.jp/en/programs/roadmap_e/health_effects-en/late-en/cancrisk/).

<sup>5</sup> Keiko Murakami, "A-Bomb Survivor's Story: 'My Hiroshima,'" Mary Lim's Adventures on the Land of the Rising Sun, accessed March 8, 2019, <http://mezza1.tripod.com/japanstudentexchange/id13.html>.

<sup>6</sup> Ibid

The destructive military power demonstrated in these tragic bombings helped to instigate the nuclear arms race, which characterized many of the tensions between the US and USSR during the Cold War. After the USSR demonstrated nuclear capabilities in 1949, the arms race began.<sup>7</sup> During the Cold War, international relations between Communist and Capitalist countries were turbulent, and tensions skyrocketed due to the proliferation of nuclear weapons. Reasoning that their competitor's force was a threat to national and international security, both the US and the USSR rushed to build up their nuclear stockpiles.<sup>8</sup> Scientists and military commanders in both the US and the USSR began pushing for their respective countries to develop a 'superbomb'. Fearing the opposing side already possessed a more destructive bomb, neither country wanted to be caught unprepared in a nuclear arms race.<sup>9</sup> The Cold War forced some countries to choose sides between Capitalism and Communism, creating deeper international divisions.<sup>10</sup> The US and the USSR were not the countries developing and accumulating nuclear weapons; however, their roles as economic and military superpowers greatly impacted the nuclear programs of other countries. The divisions caused by the nuclear arms race prevented successful progress in global politics between the two ideological sides because each country feared the other's power.

The tragedy caused by the fear of atomic bombs led to international policies which hindered progressive international relations, such as rebuilding countries postwar,

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<sup>7</sup> "Soviet Atomic Program - 1946," Atomic Heritage, last modified June 5, 2014, accessed March 5, 2019, <https://www.atomicheritage.org/history/soviet-atomic-program-1946>.

<sup>8</sup> Wayne C. McWilliams and Harry Piotrowski, *The World since 1945: A History of International Relations*, 6th ed. (Boulder, CO: Lynne Rienner, 2005), 2, accessed March 5, 2019, <https://www.rienner.com/uploads/47e016b88b5ad.pdf>.

<sup>9</sup> Stephen M. Younger, *The Bomb: A New History* (New York City, NY: HarperCollins, 2009), 50.

<sup>10</sup> McWilliams and Piotrowski, *The World*, 1.

restoring relations between countries, and accepting the emergence of different political ideologies. What could have been a triumph for a world in shambles, having the opportunity to build a truly peaceful global community, was never fully accepted. Shortly after the Soviet Union had joined the nuclear club on August 29, 1949, many US military commanders called for a first-strike against the USSR as a preventative measure. President Harry S. Truman was against this idea, but he did allow for contingency planning in case the USSR should attack. This shifted our military and political focus from destroying the USSR towards preventing them from destroying the US.<sup>11</sup> This shift in focus pushed the world to embrace the doctrine of Mutually Assured Destruction.

Mutually Assured Destruction is defined as protecting a country's people by leaving them vulnerable, provided their enemies face corresponding vulnerabilities.<sup>12</sup> This strategy would result in both sides being destroyed if either were to attack. Although this doctrine never reached a violent conclusion, during the course of the Cold War, it was a tragedy because it hindered global politics. The Euromissile crisis of 1977 is an example of this. The USSR placed missiles in an Eastern European country, and western North Atlantic Treaty Organization (NATO) bases perceived the missiles as threats. In response to this, the US positioned 572 Pershing II cruise missiles and rockets in Europe. The two countries attempted to reach disarmament negotiations in Geneva during 1982, but neither country was willing to back down for fear that the other

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<sup>11</sup> Younger, *The Bomb*, 50.

<sup>12</sup> "Mutual Assured Destruction," Nuclearfiles.org, accessed March 10, 2019, <http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/history/cold-war/strategy/strategy-mutual-assured-destruction.htm>.

would strike.<sup>13</sup> By not removing their missiles, they sent a message that if the opposing side attacked, they would be destroyed too. During the Euromissile crisis, the policy of Mutually Assured Destruction prevented successful international negotiations from occurring, and hostilities persisted between the two superpowers.

Nuclear power, when used as a military weapon, is a tragedy because it causes fear, not only of the weapon, but also of the people who could wield it against you. This infectious fear strikes not only the heart and mind of the politician, but also that of the common citizen, which can influence governmental decisions. The Red Scare in the US during the 1950s is an example of this fear and how it impacts citizens and the government. Accelerated by anti-Communist propaganda and actions, the Red Scare grew out of fear of the power of Communism. Republican Senator Joe McCarthy of Wisconsin, the main instigator of the Red Scare, widely accused prominent social figures of Communism, claiming they were infiltrating the government and our state departments.

McCarthy's claims created a fear of Communists in the United States and Communism in general.<sup>14</sup> Anti-Communist rhetoric was portrayed in the media and in entertainment, helping to promote fears of an invasion or attack by the USSR and the countries under their control.<sup>15</sup> Fears of Communists were greatly heightened by the trial and execution of Julius and Ethel Rosenberg during the early 1950s. The couple

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<sup>13</sup> "The Arms Race and 'Star Wars,'" CVCE.eu, accessed March 10, 2019, <https://www.cvce.eu/en/education/unit-content/-/unit/55c09dcc-a9f2-45e9-b240-eaef64452cae/aeef1b65-8332-4c9c-9819-1d21617d8a8d>.

<sup>14</sup> "McCarthyism and the Red Scare," Miller Center, accessed March 9, 2019, <https://millercenter.org/the-presidency/educational-resources/age-of-eisenhower/mccarthyism-red-scare>.

<sup>15</sup> Lisa Reynolds Wolfe, "R Is for Red Scare," Cold War Studies, last modified March 15, 2018, accessed March 9, 2019, <https://coldwarstudies.com/category/red-scare/>.

was accused and sentenced to death on the charge of a conspiracy to commit espionage by selling atomic secrets to the USSR.<sup>16</sup> Judge Irving Kaufman delivered the final verdict saying, "I consider your crimes worse than murder" because of the horrific repercussions sold secrets could have on the US.<sup>17</sup> The Rosenbergs were common citizens; their conviction pushed others to be suspicious of their neighbors, who could be dealing nuclear secrets to the USSR.<sup>18</sup> The popular anti-Communist views in the US, driven by the fear of nuclear retribution, prevented peaceful and positive progress in international relations between the US and USSR, as well as the countries on different sides of the Cold War.

Nuclear weapons and fear of those who controlled them were tragedies that made way for triumphs in the modern world. As other countries initiated nuclear weapons programs, President Dwight D. Eisenhower had an idea to develop the Atoms for Peace program. This program encouraged countries to develop nuclear power for peaceful purposes and avoid using it as a military power, thus encouraging less warlike uses of a potentially creative force. In Eisenhower's December 1953 address to the United Nations proposing this program, he repeatedly mentions the fears which have been cultivated and fueled by atomic weapons, using phrases including "fears of the world," "inertia imposed by fear," and "fearful atomic dilemma." These fears are acknowledged as being detrimental to human relations both within countries and

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<sup>16</sup> "The Rosenberg Trial," Atomic Heritage Foundation, last modified April 25, 2018, accessed April 17, 2019, <https://www.atomicheritage.org/history/rosenberg-trial>.

<sup>17</sup> Mintz, S., & McNeil, S. (2018). Judge Kaufman's Statement Upon Sentencing the Rosenbergs for Atomic Espionage. Digital History. Retrieved April 17, 2019 from [http://www.digitalhistory.uh.edu/disp\\_textbook.cfm?smtID=3&psid=1118](http://www.digitalhistory.uh.edu/disp_textbook.cfm?smtID=3&psid=1118)

<sup>18</sup> "The Rosenberg," Atomic Heritage Foundation.

internationally.<sup>19</sup> Only part of this proposal, which promoted the sharing of nuclear knowledge, passed in the United Nations Council.<sup>20</sup> Although this program was not completely passed by the United Nations, the promise of nuclear energy's peaceful applications triumphed for international relations because it promoted international collaboration.

Since 1953, when the Atoms for Peace program was proposed, many other accomplishments in international relations involving the productive application of nuclear power have emerged. One such accomplishment is the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), passed in 1970. In order to decrease the danger of a nuclear war, the treaty proposed the strict regulation of nuclear weapons. Besides acting as a partial safeguard against a nuclear war, the NPT urges countries to develop peaceful uses of nuclear power. Article IV of the NPT states that this treaty should not be interpreted in any way that would hinder the research and development of nuclear energy for peaceful purposes.<sup>21</sup> This promotion of peaceful applications of nuclear power triumphed over the fear of the destructive power of nuclear arms, by encouraging progressive international relations.

Developing nuclear energy for peaceful purposes resulted in many scientific triumphs. Atomic fission produces large amounts of energy that can be used for nonviolent purposes, even potentially fulfilling the human dream of efficient energy. The

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<sup>19</sup> Dwight D. Eisenhower, "Atoms for Peace" (speech transcript, General Assembly of the United Nations, New York City, NY, December 8, 1953).

<sup>20</sup> "Atoms for Peace," United States History, accessed March 12, 2019, <https://www.u-s-history.com/pages/h1814.html>.

<sup>21</sup> United Nations, *Treaty Series*, vol. 729, No. 10485



first successful nuclear power plant started operating in 1954.<sup>22</sup> Nuclear energy now provides 11% of the world's energy.<sup>23</sup> Nuclear power has played an important role in providing the world with energy since we have triumphed over the fear of nuclear arms.

Nuclear power is most commonly generated with Uranium. One kilogram of uranium-235 produces 3,000 times as much energy as one kilogram of coal.<sup>24</sup> Nuclear energy not only uses less fuel to produce more energy, but it also produces different kinds and amounts of waste than fossil fuel energy. Roughly 97% of nuclear waste can be recycled, and using nuclear energy as opposed to fossil fuel energy saves on average 2.6 billion metric tonnes of carbon dioxide from being emitted annually.<sup>25</sup> Nuclear power provides clean energy to the world and will continue to advance in both efficiency and safety, as long as we pursue it for peaceful purposes.

Advances in safety are critical to the productive usage of nuclear energy. The Chernobyl tragedy was a result of a flaws in the design of a Soviet nuclear reactor and improper operation procedures. On April 26, 1986, a meltdown occurred, releasing 5% of the radioactive material from the reactor into the air. Thirty-one people died as a direct result of the accident, while thousands more were exposed to dangerous levels of

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<sup>22</sup> Will Davis, "Anniversary at Obninsk: The First Commercial Nuclear Power Plant," ANS Nuclear Cafe, last modified June 24, 2015, accessed March 14, 2019, <http://ansnuclearcafe.org/2015/06/24/anniversary-at-obninsk-the-first-commercial-nuclear-power-plant/#sthash.Lw3fxg3c.XMjIOnhX.dpbs>.

<sup>23</sup> "Nuclear Power in the World Today," World-nuclear.org, last modified January 2019, accessed February 10, 2019, <http://www.world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx>.

<sup>24</sup> European Nuclear Society, "Fuel Comparison," European Nuclear Society, accessed March 16, 2019, <https://www.euronuclear.org/info/encyclopedia/f/fuelcomparison.htm>.

<sup>25</sup> "Energy for the World- Why Uranium?," World Nuclear Association, last modified December 2012, accessed March 16, 2019, <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/energy-for-the-world-why-uranium.aspx>.

radiation.<sup>26</sup> This accident alerted people to the potential dangers of nuclear power. Only 13 years later, in 1979, the US experienced a nuclear meltdown scare during the Three Mile Island accident. While no harmful radiation was released, this accident forced the US to redesign nuclear reactors to be safer.<sup>27</sup> Nuclear power is still overcoming tragic legacies today, such as the Fukushima Daiichi accident in Japan during 2011, but we have achieved many great scientific triumphs to overcome these tragedies and turn nuclear energy into a safer source.

As the population of the world increases, so does our demand for energy. In 1950, the global energy consumption was 27,972.24 Terawatt Hours (TWh).<sup>28</sup> Fifty years later, in 2000, our global energy consumption rose to 112,416.26 TWh. In 50 years, the population of the world doubled, and our energy consumption quadrupled. Nuclear energy may only provide 11% of the world's energy, but in comparison with other clean energy sources, nuclear power produces the second largest amount of clean energy in the world.<sup>29</sup> Advances in science lead to nuclear power playing a key role in providing clean energy for the world.

Our world has become an increasingly polluted place as a result of the rise in population and the demand for energy. The human race has been on a hunt for decades to find a sustainable, clean energy source that can supply adequate amounts

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<sup>26</sup> "Chernobyl Accident 1986," World-nuclear.org, last modified April 2018, accessed February 15, 2019, <http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx>

<sup>27</sup> "Three Mile Island Accident," World Nuclear Association, last modified March 2001, accessed April 17, 2019, <http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/three-mile-island-accident.aspx>.

<sup>28</sup> Hannah Ritchie and Max Roser, "Energy Production and Changing Energy Sources," Our World in Data, accessed March 28, 2019, <https://ourworldindata.org/energy-production-and-changing-energy-sources>.

<sup>29</sup> Ibid.

of energy to large amounts of people in a variety of areas. Since 1974 when France decided to expand its nuclear power capacity, France has become one of the leading nuclear energy producers in the world.<sup>30</sup> Generating 407,438 gigawatt-hours annually, nuclear power accounts for 74.8% of France's electricity.<sup>31</sup> France is second in nuclear energy production to the United States, which produces 770,719 gigawatt-hours annually.<sup>32</sup> While this only accounts for 19% of energy in the United States, as a society we have triumphed over fear of nuclear power as a weapon to use it as a productive energy source.

Just as the atom has been split, so has the legacy of nuclear power. We demonize nuclear power as an apocalyptic weapon while simultaneously embracing it as a sustainable renewable energy source. Perhaps it is time to abandon the former and focus on the latter. We must choose triumph or tragedy. Using nuclear power as a weapon is dangerous and results in tragedies such as the bombings of Hiroshima and Nagasaki. The threat of nuclear weapons in our society has warped international relationships to the brink of war. After international treaties which supported the peaceful use of nuclear power, it was realized that nuclear power can be used as a sustainable energy source. Humans have not finished learning the capabilities of atomic power. Research continues today to develop nuclear power into a cleaner, more stable, and more efficient energy source. Nuclear power has played a large role in the history

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<sup>30</sup> "The History of Energy in France," Planete Energies, last modified April 20, 2015, accessed April 17, 2019, <https://www.planete-energies.com/en/medias/saga-energies/history-energy-france>.

<sup>31</sup> Harrison Jacobs, "The 17 Countries Generating the Most Nuclear Power," Businessinsider.com, last modified March 6, 2014, accessed February 10, 2019, <https://www.businessinsider.com/countries-generating-the-most-nuclear-energy-2014-3>.

<sup>32</sup> Jacobs, "The 17 Countries," Businessinsider.com.

of our world and will be an important factor in our future; however, society and our leaders must make the choice to use it for triumphs or to cause tragedies.

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