

# The Development of Nuclear Energy

- 1895** Roentgen discovers X-rays  

- 1896** Becquerel discovers rays emitted spontaneously from uranium salts  

- 1898** The Curies identify 2 radioactive nuclides, coin term "radioactive"  

- 1899** Rutherford distinguishes alpha and beta radiation and discovers half-life  

- 1909** Rutherford discovers that most mass is concentrated in a small nucleus  

- 1920** Rutherford theorizes a "neutron"  

- 1935** Chadwick identifies neutrons  

- 1938** Hahn and Strassman split uranium atoms with neutrons, Meitner and Frisch explain what's happening and name it "fission"  

- 1939** Fermi and Szilard measure neutron multiplication, conclude that a nuclear chain reaction is possible  

- 1939** Szilard, Wigner, and Teller convince Einstein to sign a letter warning Roosevelt of possibility of nuclear weapons  

- 1939** Roosevelt authorizes creation of Advisory Committee on Uranium, begins US nuclear bomb effort (though not vigorously)  

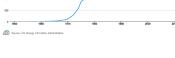
- 1942** Fermi achieves first nuclear chain reaction in a squash court at U. of Chicago. Manhattan project in full swing. Secret cities are built in Oak Ridge TN (to enrich uranium), Hanford WA (to produce plutonium), and Los Alamos NM (to design and assemble bomb)  

- July 1945** The world's first nuclear weapon test, the Trinity shot, is successful  

- Aug 6 & 9, 1945** Atomic bombs Little Boy and Fat Man dropped on Japanese cities, Hiroshima and Nagasaki. Up to 240,000 people died.  

- Aug 15, 1945** Japan surrenders unconditionally, ending WWII.  

- 1951** EBR-1 reactor is the first to generate electricity in Arco, ID  

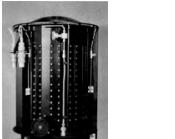
- 1953** Eisenhower gives Atoms for Peace speech, launching civilian program  

- 1954** USS Nautilus launches, the first nuclear-powered submarine  

- 1954** Obninsk reactor in the Soviet Union becomes the first commercial nuclear power plant  

- 1957** Shippingport reactor begins operation, first commercial nuclear power plant  

- 1974** French Prime Minister Messmer launches huge nuclear power program in response to oil crisis. In 2004, 75% of France's electricity is nuclear  

- 1979** Three Mile Island reactor suffers a partial meltdown. Radiation largely contained  

- 1986** EBR-II reactor demonstrates that advanced, sodium cooled reactors can passively shut down without backup systems  

- 1986** Chernobyl reactor suffers a large power excursion resulting in the release of large amounts of radiation. 50+ firefighters die, up to 4000 civilians estimated to die of early cancer  

- 1994** Megatons to Megawatts program started, turns 20,000 nuclear weapons into electricity. By 2000, ~10% of US electricity comes from dismantled Russian warheads  

- 2004** After decades of electricity generation with no deaths in the US, a Nuclear Renaissance discussed, with talks of more reactor builds to offset carbon emissions  

- 2011** 4 reactors at Fukushima Daiichi lose backup generators due to tsunami and suffer core meltdowns, hydrogen explosions. Radiation release estimated 10-30% of Chernobyl. Zero people's health affected by dose, but land is evacuated  

- 2013** Climate guru James Hansen publishes paper claiming nuclear has saved 1.8 million lives total (including worst-case estimates for all accidents) by offsetting air-pollution related deaths  

- 2013** Voyager I enters interstellar space after traveling the solar system for 36 years. It is powered by a Plutonium-238 radioisotopic thermal generator  
