Vermont Legislative Research Shop

Nuclear Power

Nuclear power is a very important issue for the state of Vermont, as the Vermont Yankee plant in Vernon provides much of the state's energy. Nationally, the debate over global warming has spurred new interest in nuclear energy. The environmental benefit of nuclear energy is clear: nuclear reactors emit very little CO2 or greenhouse gases throughout their lifetimes. Coal power plants, on the other hand, are responsible for a third of America's total greenhouse gas emissions.[1] Unfortunately, nuclear power has other drawbacks, which include safety concerns, disposal of radioactive waste, and a lack of economic feasibility for new construction. Policy makers will have to make very difficult decisions regarding America's energy production, and each source has its own downsides. The following report will examine nuclear energy with regard to environmental benefits, safety, waste disposal, and economic feasibility.

Vermont Yankee

Vermont Yankee power plant opened in 1972, and has since provided the state with a fairly reliable and cheap source of energy. In 2003 the plant provided almost 35% of the state's power.[2] In recent years there have been a few accidents at the plant and there is widespread concern over the future of the aging plant. The license to operate the plant will expire in 2012.

Greenhouse Gas Emissions of Common Electricity Sources

Though nuclear power is sometimes characterized as a "carbon-free" energy source, this isn't wholly accurate: greenhouse gas emissions are created during plant construction, processing of fuel, and other necessary activities which draw power from existing emissions-producing sources of energy.[3]

Below we examine two studies which take into account the amount of greenhouse gas emitted over the entire life cycle of a variety of power sources, and compare this to the estimated amount of power generated over the life cycle of these sources. This information is expressed as the mass of greenhouse gas emissions produced (measured in grams of CO2 equivalents) per unit of electricity generated (kilowatt hour). By comparing the figures for each source, we can determine which power sources produce the least amount of global-warming gases per each

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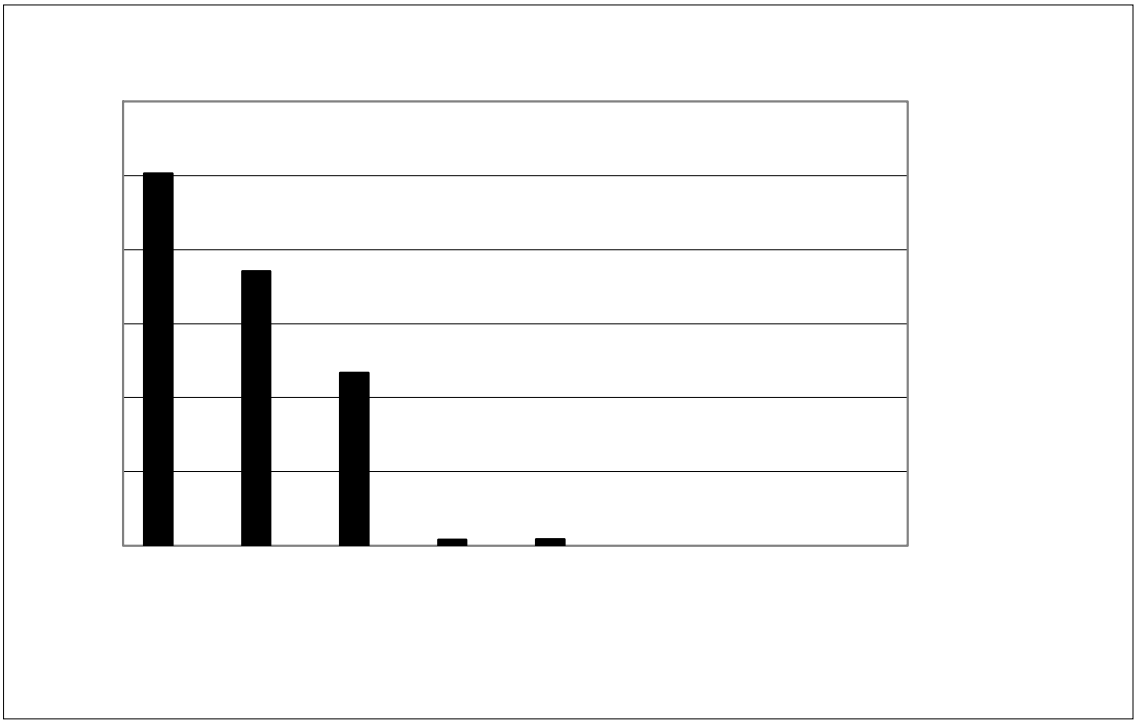
[1] William Sweet, *Kicking the Carbon Habit* (New York: Colombia University Press, 2006).
[2] Vermont Department of Public Service, "Nuclear Power – Vermont Yankee," retrieved April 16, 2008 from http://publicservice.vermont.gov/electric/vermont-yankee/vermont-yankee.html.
[3] Vassilis M. Fthenakis and Hyung Chul Kim, "Greenhouse-gas emissions from solar electric- and nuclear power: A life-cycle study," *Energy Policy*, Volume 35, Issue 4, April 2007, Pages 2549-2557.

kilowatt of electricity, and therefore, which energy sources are the most environmentally efficient.[4]



thousands of new cancer cases. The UN Chernobyl Forum estimates that 9,000 people will eventually die of Chernobyl related cancer, while Greenpeace puts the number much higher.[10]

Terrorism

Another concern regarding nuclear safety is the potential of nuclear plants and waste storage sites as terrorist targets. One study found that U.S. nuclear facilities were not susceptible to airplane attacks such as those of September 11, 2001. It would be possible to crash a plane into a nuclear plant, but not possible to breach the containment areas that would result in massive damage to the plant, and possibly the populace.[11] Other types of terrorist attacks on nuclear plants would be possible, but one MIT study argues that plant safety considerations that take into account natural disasters (tornados, earthquakes, etc.) would also prevent terrorist attacks due to the amount of fortification that the buildings receive.[12] Obviously increasing plant security budgets would help prevent terrorist attacks on nuclear plants.

Perhaps the most vulnerable part of the U.S. nuclear infrastructure is the radioactive waste while it is being transported to storage sites. The idea of a l7idea of a l7idea of a l7idea of ra l7o0.0004ib-1.tj0.0002 f,

events such as earthquakes.[17]

The other main problem is finding somewhere to store the waste. In the 1980's the Federal Government promised nuclear power plant owners that they would soon begin to accept and dispose of waste from the plants. This has yet to happen, largely due to delays in the construction of a facility at Yucca Mountain, Nevada. The project has not received proper financing, and has been the subject of heated debate throughout the country. The facility will certainly not open until 2017, and many question whether it would be possible to open it even then. The waste is still being stored at the plants where it was generated, and the utility companies have sued successfully the government numerous times for the cost of storing the waste. One estimate says that if the facility does open in 2017, it will cost the government $7 billion in payments to the utilities.[18] The people of Nevada are generally opposed to the plan, for fear of accidents or radiation seeping out. Some people also have questioned the sites geological suitability. The problem is that the country needs somewhere to store its waste, and nobody is going to want it anywhere near their homes.[19] Government scientists insist that the project is feasible and safe, and that the natural rock walls and floors will provide an adequate barrier against possible leaks.[20]

Temporary Storage Methods

While the government struggles to find a place to permanently store the waste, plants are forced to store it onsite. The spent nuclear fuel is stored in cooling pools, which decrease the temperature of the spent fuel in a contained area away from the environment, the workers, and the public. The spent nuclear fuel produces extremely high temperatures due to radioactive decay, and for cooling pools to work properly high temperatures must be continuously constrained. To ensure this, the correct levels of air, steam, or water need to be maintained at a precise level. If these levels are disturbed, it increases and sustains the oxidation rate of the spent fuel and increases the temperature. The increase in oxidation produces higher amounts of radioactive gasses than the original spent fuel, increasing the gas pressure inside the fuel rod, and causes rupture and leakage of radioactive emissions. Regulation and oversight of this process at commercial reactor sights is necessary due to the dangerous results of an accident.[21]

To maximize storage space, plants have started utilizing the dry cask storage method. This

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[17] John M. Deutch and Ernest J. Moniz, "The Nuclear Option,"

allows for higher amounts of storage space and also provided plants with a way of transplanting their nuclear fuel waste to other locations. Even with the increased capacity space for nuclear waste at plants, more space will be needed to meet the demands of constant growing population and increased utilization of nuclear power.[22]

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