Ari Langman

Annotated bibliography and Methodology

EGRS 352

Nuclear Fact Sheet

When deciding what to put on my fact sheet, I knew my information had to come from reliable and trusted sites. By deciding this I knew the majority of my information would come from the Environmental Protection Agency (EPA), Energy Information Associations (EIA), International Atomic Energy Agency (IAEA), or World Nuclear Association (WNA). I wanted to provide an understanding of the source where the fuel comes from for nuclear reactors. My first section portrays how uranium is mined from the earth and what the process is to convert this raw material into nuclear fuel. I used charts to show how much yellowcake the U.S. was producing each year to fuel our nuclear power plants. I also wanted to show how much uranium the world had and where we obtain the majority of our uranium. A pie chart seemed the most realistic and simple way to portray just this. The next section shows how much energy certain countries generate from nuclear energy as well as the total energy they produce, and the percentage of nuclear energy compared to their total energy. This displays the vast differences of energy production that countries have around the world. The third section contains information about the uranium reserves we currently have in the U.S. While much of our uranium is imported, it is also important to show how much uranium reserves we have and whether we can sustain our current nuclear consumption, or possibly expand it in the future relying solely on domestic uranium. After understanding where our nuclear fuel comes from, I thought it was important to describe how a nuclear reactor in its simplest form works. With the help of diagrams I explained the three major types of reactors that are used around the world and their differences. Below that, there is a more in depth description of the entire nuclear reactor process and how nuclear fuel is used to create steam. Much of my fact sheet up to this point consists primarily of graphs, so I felt that statistics would provide a better understanding of how much our country uses nuclear energy and why it is beneficial. This is done by providing information on nuclear reactors in the United States and showing how much electricity is produced. I also compared how many nuclear facilities exist in the world compared to the number in the U.S. and how much total energy was produced. I feel this gives a better understanding of how much of the world’s energy is produced from nuclear sources and how many reactors are actually running at one time in the world. My last section consists of a multitude of subjects, including safety, cost and environmental impacts of nuclear energy. While important, the amount of information I could have put in this section alone could fill an entire fact sheet. I included important information, such as the zero emissions associated with nuclear power plants, the energy equivalent of one nuclear pellet and how much a kWh costs to produce. Safety and environmental impacts were also portrayed by stating how spent nuclear fuel was dealt with and that unlike nuclear power plants, emissions are associated with the mining and milling of uranium, which is generally not recognized.

Works Cited

"Fact Sheets." *Nuclear Energy Institute*. N.p., Aug. 2013. Web. 10 Apr. 2014.

This source contains general information about the safety of nuclear reactors, energy output and reliability, information regarding uranium, and its economic and environmental benefits. The website is a reliable source as it is represented by 26 nuclear utilities, plant designers, architect/engineering firms and fuel cycle companies. The information is recent and relevant as it was updated in 2013 and most likely based upon statistics from 2012. There is a concern that this source would contain bias, since the data is provided by the industry, yet the statistics appear to be presented in a transparent fashion and therefore bias is not a major issue.

"How a Breeder Reactor Works." *The New York Times*. The New York Times, 16 June 2011. Web. 10 Apr. 2014.

The source explains in simple language, how a breeder reactor works and what it looks like. The New York Times, while a major newspaper, is not always the most reliable source, but considering that the article was written three years ago, it is still relevant for this technology, which has been used for decades and I assume that any error that was contained in the original article has been corrected. Also, the source that the New York Times article cites is the International Panel on Fissile Materials; Idaho National Laboratory, which is a reliable source on the topic.

"How Nuclear Reactors Work." *Nuclear Energy Institute*. N.p., n.d. Web. 10 Apr. 2014. The information in this article explains how nuclear reactors work, starting from the fission process and how uranium is used as fuel in pellets, which are actually small ceramic containers that are bundled together to form big tubes. Heat that is produced is used to create steam, which is pushed through a turbine that turns and produces electricity via a generator. There is no date regarding the information, but the video that is included in the article was uploaded in 2011, which gives me reason to believe the article itself is fairly recent. The website itself is still a reliable source as it represents the data from 26 nuclear utilities, plant designers, architect/engineering firms and fuel cycle companies.

"International Energy Statistics." *U.S Energy Information Administration*. N.p., 2012. Web. 10 Apr. 2014.

The information in this data set is the amount of electricity generated by nuclear power and total electricity generated, in billion kilowatt hours, by individual countries. The U.S. Energy Information Association (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. While it is a part of the government, it does not require approval to release statistics or data from any branch or member of the government, as all work is independent. The age of the information is from the second most recent report, and from the most recent full report release by the EIA. The information is from the year 2011 and breaks down individual country’s energy generation by sector.

"Nuclear Energy." *EPA*. Environmental Protection Agency, Oct. 2013. Web. 10 Apr. 2014.

The Environmental Protection Agency (EPA) article gives a list of information regarding nuclear energy and its effects on the environment. Such subjects include, air emissions, water resource usage, water discharges, spent fuel and radioactive waste generation from nuclear energy. The EPA is a government agency that is tasked with protecting human health and the environment through laws and regulations. While the agency is a subsidiary of the U.S. government and can be biased in regards to who directs it, the agency does provide information on the effects that nuclear energy could or does cause to the environment. There is no actual date as to when the information was released, but considering that nuclear energy has been around for a long time, the information has definitely been updated. Also, the citations used in the article were from 2011 and 2010 respectively.

"Supply of Uranium." *World Nuclear Association*. N.p., Aug. 2012. Web. 10 Apr. 2014. This article contains information regarding the amount of Uranium reserves certain countries have in tonnes and their totals compared to the world supply as of the year 2011. The World Nuclear Association is an international organization that promotes nuclear energy. Its members consist of all the parts of the nuclear process, including uranium mining, conversion and enrichment, as well as the transportation and nuclear energy fabrication. The WNA is a non-profit independent organization. Much like the NEI, the WNA has many knowledgeable experts in the nuclear field. Since the organization directly profits from nuclear energy, their information can contain a bias towards the use of nuclear energy. Yet, the information I used is an objective data point and is not subject to bias.

"Trend in Electricity Supplied." *IAEA Power Reactor Information System*. N.p., Apr. 2014. Web. 10 Apr. 2014.

The information contained within this article describes the total electricity produced from nuclear energy in the world and documents the number of on line nuclear reactors. The data is up to date as of 2013. The website, the International Atomic Energy Agency (IAEA), serves as an intergovernmental forum for scientific and technical cooperation for the peaceful use of nuclear technology and nuclear power worldwide. The IAEA is a reputable international agency that employs some of the world’s most knowledgeable people in their fields.

*Types of Nuclear Reactors*. Georgia State University, n.d. Web. 10 Apr. 2014.

This article explains the three different types of reactors that nuclear facilities would use to generate electricity. The source is of a collection of diagrams from Georgia State University, an accredited academic university. Coming from the physics department of a university leads me to believe that the diagrams and explanations given are accurate.

Ulmer-Scholle, Dana S. "Uranium — How Is It Mined?" *Uranium: How Is It Mined?* New Mexico Bureau of Geology and Mineral Sources, Mar. 2014. Web. 10 Apr. 2014.

The article explains how uranium is mined out of the ground in three different ways. The article also gives the positive and the negative effects from the different mining techniques. The article was revised as of early April 2014, and the information would be considered to be up to date. The website that it was retrieved from was the New Mexico Bureau of Geology, a state government organization. The organization itself would seem to be knowledgeable in the subject of mining and effects from it. The information could be biased, but my assumption is that the researchers involved are knowledgeable in mining and understand every effect and process of mining uranium.

"Uranium Mining Overview." *World Nuclear Association*. N.p., May 2012. Web. 10 Apr. 2014.

This article contains information about the process of how uranium ore is broken down and converted into yellowcake, U3O8. The information was updated as of 2012.

"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *U.S. Uranium Reserves Estimates*. N.p., July 2012. Web. 10 Apr. 2014.

"U.S. Energy Information Administration." *How Much Coal, Natural Gas, or Petroleum Is Used to Generate a Kilowatthour of Electricity?* N.p., July 2012. Web. 10 Apr. 2014.

This article contains energy conversion data between, the three fossil fuels, coal, natural gas and petroleum and compares it to nuclear energy. It also contains the amount of KWh a specific unit of fuel contains and how to calculate it.

"U.S. Energy Information Administration." *How Much Electricity Does an American Home Use?* N.p., n.d. Web. 10 Apr. 2014.

This article contains the average annual and monthly U.S. consumption of energy for a household in kWh as of 2012.

"U.S. Energy Information Administration." *Total Production of Uranium Concentrate in the United States*. N.p., Jan. 2014. Web. 10 Apr. 2014.

This article contains data from the previous 17 years on how much yellowcake, U3O8, the United States has produced. The last entered data was for the predicted 2013 yellowcake production.

"U.S. Energy Information Administration." *The U.S. Relies on Foreign Uranium, Enrichment Services to Fuel Its Nuclear Power Plants*. N.p., Aug. 2013. Web. 10 Apr. 2014.

This article provides information about the countries from which the United States purchases Uranium (yellowcake weight equivalent). The data is from 2012 and accounts for the purchases from owners and operators of commercial nuclear reactors in the United States.

"U.S. Energy Information Administration." *U.S. Uranium Reserves Estimates*. N.p., n.d. Web. 10 Apr. 2014.

This article contains data regarding the amount of uranium ore and recoverable yellowcake reserves that are in the three different types of mines (underground, open pit, in situ) in the United States. The data was taken from the end of the 2008 year and published in 2010.

"US Nuclear Power Plants." *Nuclear Energy Institute*. N.p., 2012. Web. 10 Apr. 2014. This article contains facts regarding nuclear power plants, such as the total energy generated from all the reactors in the U.S., the number of reactors in the U.S., industry capacity factor, the number of nuclear plants under construction and statistics on the amount of electricity that can be generated from a reactor with a certain capacity factor compared to fossil fuel quantities. The information is from 2012.