Cover sheet for Assignment 2, NucE310W

Please insert this page sheet on the front of your completed assignment

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Scoring Grid assignment # 2 2010

1. Addressing the requirements in the assignment 20%

- Write at the level of college audience
- Follow the outline in discussing effects
- Abide by space constraints for your submission (about 2 pages single spaced, up to 3 pages, not counting references and quotes)
- Include the assignment sheet to your submission

2. Evaluation of the environmental effects of the energy technology and comparison to coal 50%

- Good background is given on current status (how much is produced, where does production occur, and what is the energy potential of this source in the US)
- Evaluation of effects is as follows:
  - Identify the main environmental and public health effects according to assignment (land use, air, etc.)
  - Consider whole fuel cycle, accident/normal, kwh etc. (use grid shown in class as a guide)
  - Weigh the costs with the benefits (effects per kwh produced)
- Comparison is well reasoned, and follows from preceding discussion

3. Writing style and form 30%

- Each assertion is supported by cogent evidence: logical reasoning, statistics, examples, credible references
- Clear connections exist between sentences in each paragraph and between paragraphs in each section
- Each sentence consists of one main idea, and each paragraph consists of a well connected group of ideas
- Language is precise, clear, and direct
- Proper form is followed for grammar, punctuation, usage, quotations, and spelling

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Nuc E 310W – Section 001
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Environmental Effects of the Production of Electricity by Coal and Natural Gas

Coal and Natural Gas are the first and second largest sources of electricity generation in the United States of America. Coal accounted for forty-five percent of total electricity generation in the U.S in 2009, while natural gas accounted for twenty-three percent [1]. That is roughly 1,764,486 thousand-megawatt hours of electricity from coal and 920,378 thousand-megawatt hours from natural gas.

All of the megawatts have to come from a source of natural gas. In the U.S. there are a total of roughly 480,000 production wells with Texas, West Virginia, Pennsylvania, Oklahoma and New Mexico being the most abundant in production wells of natural gas [1]. There are a total of about 5,500 electrical generators in the United States fueled by natural gas that generate the 920,000 thousand mega-watt hours every year. These power plants consist of steam generators, gas turbines, combustion engines and combined cycle gas turbines, which is the most efficient. Texas, Florida and California are the primary states producing the most electricity from natural gas, with Texas producing about 88,000 thousand mega-watt hours a year, Florida producing 60,000 thousand mega-watt hours a year and California producing 48,000 thousand mega-watt hours a year [1]. Compared to the rest of the state in the country, which produces an average of less than 10,000 thousand mega-watt hours a year, the electricity generated from Texas, Florida and California are significant because they produce electricity for a larger sector than the rest of the states.

The amount of electricity generated from natural gas has been steadily increasing since 1996. In total is has increased by about 500,000 thousand mega-watt hours since 14 years ago. According to the U.S. Energy Information Administration, there are almost 150 generating capacity additions from new generators planned through 2013 for electrical generators fueled by natural gas. The potential of growth for natural gas as an energy source for electricity production comes from the fact that it the combined cycle gas turbines have a much greater efficiency the older generators fueled by natural gas [2]. This new technology would increase production of electricity while using less natural gas because they use the fuel source twice, in the gas turbine and steam turbine. Another reason for natural gas to grow as an energy source for electricity generation is that it is environmentally cleaner than coal.

Compared to coal, natural gas emits 40% less carbon dioxide. Coal emits 2,249 lbs/MWh of carbon dioxide in electrical generators, while natural gas emits 1135 lbs/MWh. Additionally, natural gas emits negligible amounts sulfur dioxide and virtually no particulate matter, which eliminates a public health concern with respect to natural gas. While natural gas produces significantly less harmful sub products than coal, it is still producing 5-6 billion tons of carbon dioxide last year [3]. With the projected increase of natural gas as an energy source for the production of electricity, the Intergovernmental

Panel on Climate Change, IPCC, has predicted that 11 billion tons of carbon dioxide a year will be emitted from natural gas by the year 2030, which is the same amount of carbon dioxide the burning of coal and oil produces currently. The extraction of natural gas also has effects on the environment. The drilling at extraction sites could cause landslides which in turn could further affect natural habitats aside from the drilling itself. Also, the soil could become less productive as well and the quality of nearby water could be affected, especially from the drilling for Marcellus shale [4]. Water quality could also be affected from the electrical generators themselves. Water is needed for cooling of the turbines and could become contaminated. However, the water discharge from these power plants must be permitted and are closely monitored by the Environmental Protection Agency, EPA.

Construction of combined cycle power plants can take a little at 18 months, which is significantly less than the construction of coal plants. The less time the construction takes the smaller the risk of injury to construction workers. The transportation and distribution of natural gas sees many incidents but minimal injury to the public. According to the Bureau of Transportation Statistics, 2009 saw 279 incidents related to natural gas pipelines, leading to 59 injuries and 9 deaths [5]. Although death is always tragic, compared to the amount of incidents there were and the amount of electricity natural gas provide fuel for last year, the amount of deaths shouldn't be a reason to reduce the use of natural gas, especially compared to the impact coal has on public health. In 2010, the only serious incident with natural gas pipeline occurred in September in San Bruno, CA. A pipeline exploded destroying homes and causing 8 deaths. Although quite serious, these kinds of larger incidents should be and are usually prevented by the natural gas companies and they rarely happen.

Compared to the effects that coal has on the environment, natural gas is a much better alternative as an energy source for the production of electricity. Emissions wise, natural gas does produce carbon dioxide but it is significantly less than the amount coal produces as mentioned before. Both coal and natural gas have the somewhat the same impact on land use. Both sources need to be mined and could cause ill effects to soil and nearby water. What these two fuel sources don't have the same impact on is public health. Natural gas is mined with minimal use of human power, drills and pressurized pipes are what extract the natural gas from reservoirs. Coal, on the other hand, is mined by significantly more human power. Black lung and kidney disease are just some of the effects coal miners have to face. Not only do the coal miners face these illnesses, communities surrounding coal mines face the same. Citizens of coal mine communities are 70 times as likely to contract kidney and lung disease. Coal mines also pocket large amounts of methane, which is highly flammable and could cause large explosions. In conclusion, natural gas is the much better fuel source than coal for the production of electricity because of its much smaller effect on the environment compared to coal and since it produces no particulate matter, unlike coal, it has a much smaller effect on public health as well.

Bibliography:

[1] – U.S. Energy Information Administration - http://www.eia.doe.gov

[2] – Natural Gas - http://www.naturalgas.org

[3] – Intergovernmental Panel on Climate Change - http://www.ipcc.ch

[4] – Environmental Protection Agency - http://www.epa.gov

[5] – Bureau of Transportation Statistics - http://www.bts.gov