Natural Gas: Analyzing the Relationship between the University of Richmond's Corporate Social Responsibility and Natural Gas as an Alternative Energy Source

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Introduction

On April 9, 2019, the Spotsylvania County Board of Supervisors approved a permit to begin construction on a 500 megawatt solar array managed by Sustainable Power Group (sPower) in Spotsylvania County, Virginia. A roughly $615 million project, sPower's solar array will cover almost 6,300 acres of Spotsylvania County and is set to be the largest such project east of the Rocky Mountains (Shenk, 2019). Alongside big players such as Microsoft and Etsy, the University of Richmond also has a stake in the project. 20 MW of the Spotsylvania solar array will be designated for the University of Richmond and is estimated to match 100% of the school's electricity needs once completed (Andrejewski, 2019a). Currently, the University of Richmond purchases all of its electricity from Dominion Energy, which derives its energy from natural gas, coal, nuclear, oil, and renewable sources (Dominion Energy, 2019). Going forward with the sPower solar project will allow the university to offset its majority nonrenewable-fueled electricity provided by Dominion and make a positive statement in the community as a leader in sustainability.

This study evaluates natural gas as an alternative energy source for the University of Richmond as it relates to the now-approved sPower solar project in Spotsylvania County and the University's long-term sustainability goals. I specifically analyze if it is more beneficial for the University to focus on natural gas or other renewable energies such as solar power. I begin my report by briefly outlining the theoretical framework I use to analyze my research and come to my conclusion. I then introduce the fundamentals of natural gas, the science behind it, and natural gas production and consumption in Virginia. My next section highlights the benefits of natural gas to the environment and economy. I then contrast this section by discussing the drawbacks of natural gas production and operations. Finally, I examine the University of Richmond's current energy profile and determine whether or not natural gas is a viable and socially responsible energy for the University to pursue in light of the approved sPower solar project and the school's long-term sustainability goals.

Theoretical Framework

My study investigates whether or not natural gas is the best energy source for the University to continue to invest in, keeping in mind the interests of students (both current and future), local communities, the environment, and, of course, the university itself. Therefore, a 'corporate social responsibility' (CSR) theoretical framework is appropriate to follow in this study. As Susith Fernando and Stewart Lawrence emphasize, there is no "one size fits all" for a corporate social responsibility theoretical perspective (Fernando and Lawrence, 2014). The concept of CSR has heavily evolved over time and is a complex term to ultimately define (Fernando and Lawrence, 2014). Among the many classifications of corporate social responsibility, my study utilizes those which look at CSR through *integrative* and *ethical* lenses.

An *integrative* view of CSR refers to a business or, in this case, a university, responding to the current will of its members and society at large (Garriga and Mele, 2004). An *ethical* perspective of CSR deals with the moral duties that businesses have to encourage and uphold ethically sound social norms (Garriga and Mele, 2004). The concept of 'sustainable development,' one that I especially emphasize in this report, is a vital part of both integrative and ethical corporate social responsibilities. Sustainability refers to meeting the needs of the present without sacrificing those of future generations (Garriga and Mele, 2004). Sustainable development, therefore, applies the concept of sustainability to development and progress. In the context of my study, sustainable development relates directly to these integrative and ethical facets of corporate social responsibility. It is highly important that this is understood. As the

University of Richmond progresses through the 21st century, it must be responsive to the social and ethical needs of its members and other stakeholders while ensuring that the future of the University is not threatened. So, the question of which energy source is best for the University to invest in can be answered by examining the ethical and integrative requirements that corporate social responsibility and sustainable development demand. I expand further on the University of Richmond's corporate social responsibility to develop sustainably in the final portion of my report, but it is vital to take these concepts into consideration as I move on to analyze natural gas in its entirety.

Fundamentals of Natural Gas

Natural gas is a fossil fuel mixture found deep below the earth's surface. The main component of natural gas is methane, but it also consists of propane, butane, pentane, and other hydrocarbons (UnionGas, 2017). Natural gas formed from plant and animal remains that sank to the ocean floor millions of years ago and were slowly buried underneath sediment and rock layers. Under extreme heat and pressure over time, these remains were converted into the hydrocarbonic mixture that is now natural gas, per Figure 1 (Barnes, 2019).

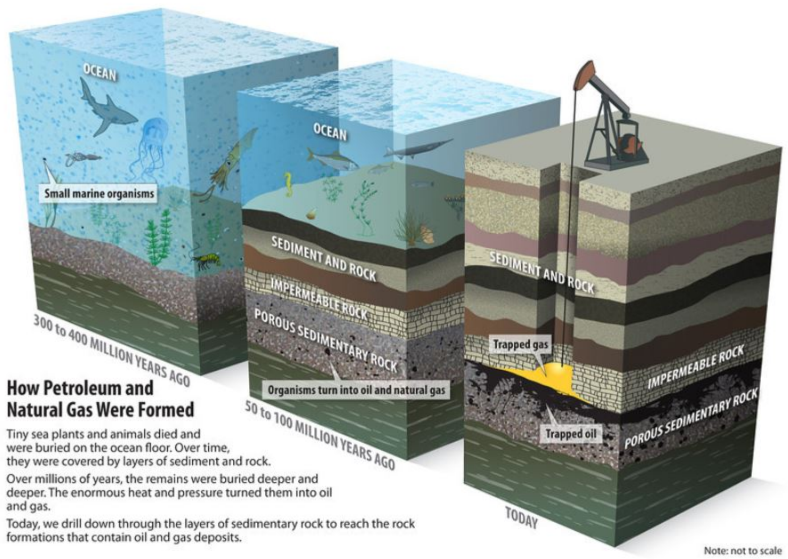

Figure 1. How petroleum and natural gas were formed
Source: Courtesy, North Dakota Geological Survey, Becky Barnes, artist

While there are many different types of natural gas and extraction methods, is generally understood that there are two broad categorizations of it: conventional and unconventional. Conventional gas is found beneath permeable rock barriers and is easily extractable, while unconventional gas is trapped below impermeable rock layers and is not easily extractable (Hanania et al., 2019). Both shale rock and coal bed gas fall under the latter category and are the most common types of natural gas that have been extracted and used in recent years. Hydraulic fracturing, commonly called fracking, is the primary method by which unconventional shale rock and coal bed gas are extracted. Fracking involves propelling a water-based fluid into the ground, which causes impermeable rock layers to crack and allows for the release and capture of natural gas (Healy, 2012). Once this gas is extracted, it is then transported, stored, processed, and prepared for distribution to consumers (Dismukes, n.d.). Sector-wise, natural gas is used residentially, commercially, industrially, for power generation, and for transportation (Dismukes, n.d.). In terms of end use, natural gas is used for heating cooling, refrigeration, lighting, electricity, and fuel production, among others (EIA, “Use of Natural Gas”).

In Virginia, the two primary natural gas producers and distributors are Appalachian Power and Dominion Energy, which are both managed by PJM Regional Transmission Organization (Dismukes, n.d.). Natural gas supplies a significant portion of consumption in Virginia, accounting for an estimated 32.5% of all energy consumed (EIA, “Virginia State Profile”). Roughly 43,000 miles of inter- and intrastate natural gas pipelines supply over 1.2 million households with electricity and energy in the state (DMME, 2018). Coal bed methane and conventional gas are the primary deposits found in Virginia and are mostly produced in southwestern regions of the state near the West Virginia, Tennessee, and Kentucky borders (Figure 2).

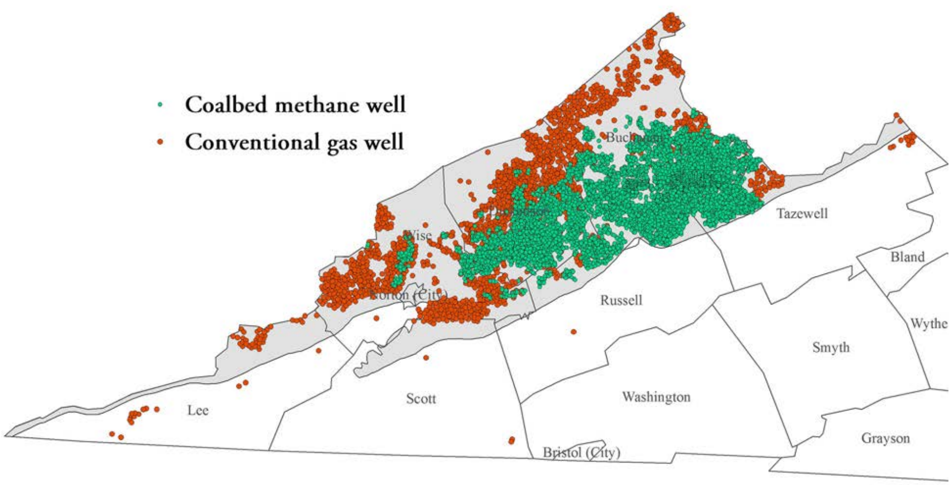

Figure 2. Natural gas production locations in Virginia
Source: DMME, Division of Geology and Mineral Resources

There are advantages and disadvantages to natural gas that relate to construction of its facilities, extraction methods, consumption, environmental and health impacts, and economics.

Both sides must be considered in order for the University of Richmond to make a well-informed and accurate decision regarding its possible future use of natural gas.

Advantages

Natural gas is regularly praised as an effective stepping stone from dirtier energies like coal to cleaner sources such as wind, hydropower, and solar. The most significant benefits of natural gas are environmental and economic, but other benefits have also been documented.

Environmentally, natural gas is cleaner than other nonrenewable energies. Although it is a fossil-fuel, natural gas produces two times less carbon dioxide than coal (Raimi, 2018). Natural gas emits the lowest amount of CO2 of all nonrenewables, followed by oil and coal, respectively (Rami, 2018). As natural gas becomes more efficient and accessible, demand for coal will fall. This decreased reliance on coal will reduce overall emissions of the most destructive greenhouse gas, CO2, that coal primarily generates. As Figure 3 shows, natural gas consumption surpassed coal consumption in 2009 and has been increasing ever since, while coal consumption continues to decrease.

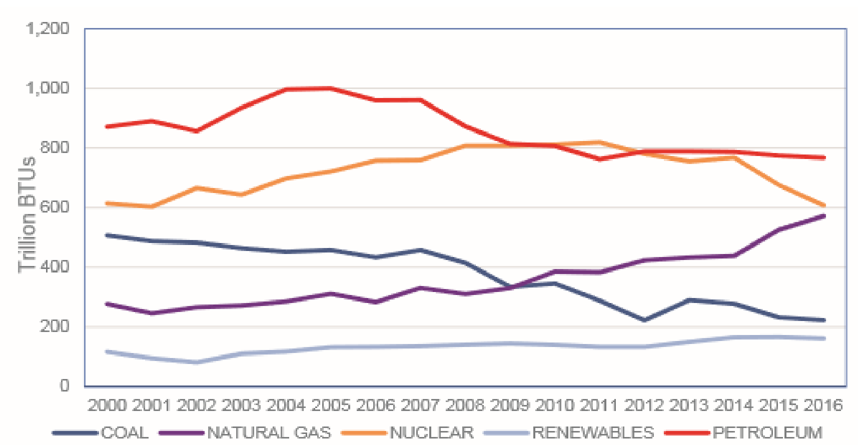

Figure 3. Historical Consumption by Source, 2000-2016
Source: DMME, 2018

Moreover, as demand for coal decreases and demand for natural gas increases, renewable energies can be further researched and integrated into the global energy infrastructure. Natural gas is beneficial, therefore, because it contributes to the mitigation of climate change and allows us to move towards a greener future powered by renewables.

Economically, natural gas operations create jobs and spur economic growth. In 2015, extraction, processing, and sales of natural gas created roughly 8.1 million jobs nationwide and added more than $1.3 trillion to the U.S economy (American Petroleum Institute, 2017). Likewise, in Virginia, natural gas operations created over 125,000 full and part-time jobs during 2015, boosting the state's economy by almost $12 million (American Petroleum Institute, 2017). As supplies and extraction of natural gas have increased since the 1990s and 2000s, demand for its energy has followed suit. Due to this, prices have fallen dramatically. One study estimates that, from 2008 to 2010, Americans spent about $70 billion less on natural gas, which corresponds to roughly $226 in total savings per person (Raimi, 2018). This drop in the price of natural gas has also driven the average price of oil down, therefore increasing the demand for natural gas production (Raimi, 2018).

Natural gas operations and consumption do have positive impacts on both the environment and economy, but these cannot be considered in isolation. There are important downfalls of natural gas that must be examined before a definitive conclusion about the viability of natural gas for the University of Richmond can be made.

Disadvantages

Although there are tangible benefits of producing natural gas, there are significant disadvantages that must be acknowledged. The major costs of natural gas manifest in human health and safety, economic, and environmental impacts, all of which are interconnected.

To begin, natural gas operations can severely harm the health and wellbeing of local communities, workers, and society at large. Emissions from constructing and maintaining pipelines, compressor stations, and other natural gas facilities cause pollution and depletion of air, water, and soil quality. Areas near fracking wells have higher concentrations of benzene, formaldehyde, hexane, and hydrogen sulfide than in similar areas without fracking wells (Carpenter, 2016). Most of these toxins are carcinogenic and likely to harm nearby human populations (Carpenter, 2016). Health issues associated with these hazardous air pollutants include respiratory problems such as asthma, COPD, chronic bronchitis, and lung cancer, among others (CITE). Additionally, natural gas leakage can contaminate ground and well water, causing further health problems to local communities (Schwartz, 2016). Fard et. al found that the average cost of such health damages created by a single natural gas-fired power plant is approximately $4.76 million annually (Fard et. al, 2016).

Threats to safety caused by explosions and fires at natural gas facilities are also a prime concern. Pipeline and compressor station explosions have widespread, detrimental, and sometimes fatal impacts on local communities, workers, and the environment (Compendium, 2018). According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), there were, nationally, 284 “significant incidents” along pipelines and at compressor stations in 2018 alone (PHSMA, 2019). “Significant incidents” refer to any explosion or ignition that occurs along natural gas infrastructure (PHMSA, 2019). The incidents in 2018 resulted in 7 fatalities and over a billion dollars in internalized damages (PHSMA, 2019). I emphasize that this number only accounts for internalized damages because the external impacts on nearby communities, the overall environment, and society at large are generally not included in such calculations. Therefore, the actual cost associated with these 284 significant incidents is likely much greater than $1 billion, but have not (and probably, cannot) be fully accounted for. Therefore, fears of natural gas facility explosions and fires are well-founded and have been a leading reason for the Virginia community of Union Hill, Buckingham County to oppose the potential compressor station in their neighborhood.

Finally, although natural gas is cleaner emissions-wise than other nonrenewable sources of energy, its impacts on the environment are still severe. Fracking is an extremely intrusive extraction method that decimates and upsets the balance of ecosystems. Methane, the largest component of natural gas, is the second most prominent greenhouse gas after carbon dioxide. Shale gas fracking can potentially contaminate groundwater due to fluid injection and possible methane leakage (Healy, 2012). More importantly, methane emissions from natural gas construction and operations still contribute massively to climate change and many studies have argued that, because of this, natural gas might not be significantly better emissions-wise than coal (Raimi, 2018). Extracting natural gas from shale and coal beds wastes massive amounts of water, threatens the health and safety of humans, destroys ecosystems, and can cause seismic disruptions that lead to unnatural regional earthquakes (Lieberman, 2018).

Although natural gas is generally recognized as the cleanest and most sustainable nonrenewable resource, it is still a fossil-fuel-based energy that has a higher impact on humans and the environment than any renewable source.

Natural Gas for the University of Richmond?

Currently, the University of Richmond purchases 100% of its electricity from Dominion Energy. Figure 4 shows a breakdown of Dominion's energy production in Virginia. According to the figure, roughly 33.6% of Dominion's energy production comes from natural gas, which falls shortly behind nuclear energy (Dominion Energy, 2019).

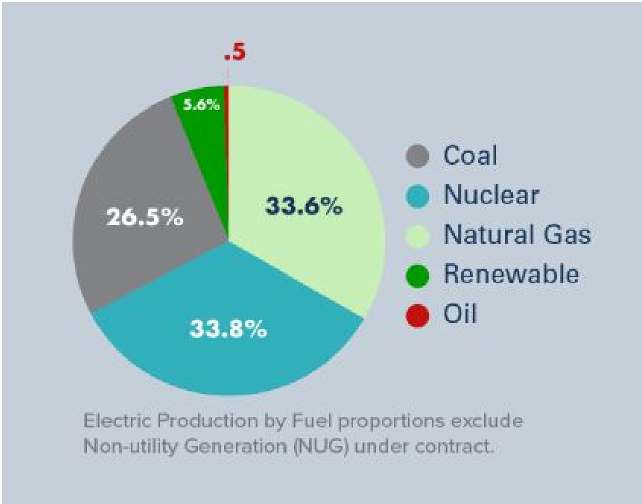

Figure 4. Breakdown of Dominion's energy production in Virginia, 2019
Source: Dominion Energy

Specific data detailing the consumption of Dominion's energy in Virginia is not readily available. However, Virginia's consumption of natural gas *from all distributors* in 2016 accounted for 32.5% of total energy consumption (EIA, "Virginia Energy Profile"). It can therefore be assumed that Virginia's consumption of *Dominion's* natural gas energy follows similar percentages as those shown in Figure 4. Likewise, although a source-specific breakdown of the University of Richmond's electricity is unknown, it is safe to assume that natural gas also makes up a significant portion of the school's electricity consumption, as Figure 4 and other data exhibit.

Once completed, the sPower solar array will match 100% of the University of Richmond's electricity needs with renewable energy, but the school will still purchase all of its electricity from Dominion Energy (Andrejewski, 2019b). Rather than taking the University off the grid, its investment in the sPower solar project will contribute to Virginia's overall renewable energy share and decrease the state's reliance on nonrenewables, more specifically allowing for a statewide transition away from coal. Natural gas is commonly perceived as a bridge from fossil fuels like coal to renewables like solar, which begs the question of whether or not the University of Richmond should pursue natural gas initiatives to help us reach its sustainability goals. Weighing the advantages and disadvantages discussed in this report, I conclude that natural gas is not in the University's best interest.

Conclusion

I have thus far presented the theoretical framework of corporate social responsibility that my research follows, provided an overview of natural gas, discussed the advantages and disadvantages of natural gas production and use, and analyzed whether or not the University of Richmond should pursue additional natural gas initiatives. I have determined that, due to economic, social, educational, and environmental reasons, the University of Richmond should not invest in further natural gas projects. Economically, the costs associated with continuing to pursue natural gas are greater than the benefits that will come from renewable energy investments such as the sPower solar array. Corporate social responsibility requires that the University of Richmond makes decisions with the interests of its members (students, faculty, staff, donors, etc) at the forefront. Members of progressive institutions like the University of Richmond tend to support efforts towards being more sustainable and eco-friendly, which would indicate the need to pursue projects rooted in sustainability. Additionally, integrative and ethical CSR imply that universities should offer educational opportunities to their members through environmentally-related projects. Doing so would enhance the University of Richmond's attractiveness as a progressive institution to prospective members, further benefiting the school. Finally, pursuing renewable energy projects and aiming to offset our emissions through them will, obviously, contribute to the health and stability of the planet. These stipulations reveal that initiatives such as the Spotsylvania solar array should be pursued by the University of Richmond over natural gas projects in order to fulfill our social responsibilities and long term sustainability goals.

As previously stated, natural gas is commonly seen as a bridge fuel to move the energy and electricity sectors from nonrenewables to renewable energies. While investing in the sPower solar project *and* continuing to purchase all of its electricity from Dominion, the University of Richmond will contribute to this shift. A significant portion of Dominion's energy derives from natural gas, which will only grow in future years, reducing production and consumption of coal. As the University of Richmond continues to purchase this electricity from Dominion, it will still support and benefit from natural gas production. Therefore, offsetting its emissions via the Spotsylvania solar array will allow the University of Richmond to use natural gas as a bridge while contributing to and supporting the growth of Virginia's renewable energy share.

Promoting the advancement of Virginia's renewable energy sector by investing in the sPower solar array is highly socially responsible and environmentally conscious, but it should not be the University of Richmond's end goal. Ultimately, the University should strive to eventually go off-grid and terminate its reliance on Dominion's supplies, including natural gas. Indeed, this seems an ambitious goal to promote, but it must be understood that achieving such an objective will take time, funding, and patience. SPower's Spotsylvania solar project takes the University in the right direction and sets it apart as a leader in sustainability. This will help the school gradually achieve more sustainable practices and lessen its reliance on Dominion Energy, eventually reaching a totally self-reliant, renewable future.

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