AN EXPLORATION OF THE ECONOMIC EFFECTS ON UNIVERSITY ENDOWMENTS' INVESTMENTS WHEN TRANSFERRED FROM FOSSIL FUELS TO ALTERNATIVE ENERGY

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Abstract

The purpose of this thesis is to determine that if universities were to move their endowments from fossil fuel to alternative energy investments, if it would hurt their overall returns comparatively or not. There is a seemingly constant debate on whether or not the government, as well as private entities should move from fossil fuel dependence to renewable energies or not for a number of reasons, including innovation and environmental concerns. This thesis seeks to explore this question from a purely financial basis by exploring the investments of universities, entities already on both sides of the coin, to determine if renewable investment is worse than oil and gas investment. One of my findings was that renewable energy investment, in fact, had higher returns than oil and gas investments, returning 169.45% over ten years compared to 43.75%.

Part I: Introduction

Endowments are the centerpiece of the university education system. These financial assets keep these educational institutions competitive and allow for continued growth. Universities with larger endowments are allowed to build nicer facilities, offer more scholarships, and retain better professors thanks to their ability to spend money to gain advantages that attract students. And it is by no means a small amount of money. According to the National Center for Education Statistics, the current market value for US college and university funds was over 535 billion dollars. The goal of the universities is to maintain and grow this fund so that they can continue current spending levels as well as increase at a rate that competition sees fit. Therefore, they must invest these funds into different securities that they can get a return on. One area in which these endowments are invested into is the energy sector. Historically, this has been in oil and gas company stocks and other fossil fuel investments. However, there is a strong societal trend pushing universities to move away from fossil fuels and instead to invest in renewable energy.

The petroleum industry as we know it began as far back as 1859 and has a century and a half to become one of the center points for our economy. First used for commercial kerosene production, it has since been used as an energy source to provide everything from the warmth of one's home to the making of many plastics in everyday life. It was a component of the Industrial Revolution and helped develop other industries and inventions such as the automobile. The industry is supporting over 9.8 million jobs and contributing billions to the US GDP (PWC).

The United States has become the third-largest oil and gas producer in the world and continues to see growth, with projections of the industry contributing up to $1.9 trillion by 2035. Because of this strong industry, endowments have been able to historically gain good returns. However, there is likely more uncertainty with a newer industry such as renewable and alternative energy. This thesis seeks to explore the political and societal aspects that are pushing universities away from nonrenewable investment to alternative energy and whether or not it is actually hurting the returns that the universities are seeking.

With this being a new push to have colleges and universities to invest their endowments in renewable energy, there are still some general uncertainties on how this is going to affect the financials in the long-term as that requires years of returns. Therefore, much of the data that is explored in this subject are based around current investment returns and forward-looking predictions as well as societal trends that are pushing on the status quo. By exploring these areas, it will give a better idea on whether it is a plausible solution for universities to switch their investment strategies or if it will hinder them in the long run. If the returns on renewables are close to the same as fossil fuel investment, there could be an argument to switch over based on the pressures that society will likely continue to put forward.

If on the other end of this, research actually shows that the change in investment strategy hurts the returns for universities, it would give reason as to have universities stand up to those who are pushing for change. With about 20.4 million students being enrolled in American colleges and universities as of fall 2017, strong financial investments that can better education and make a stronger workforce for

the economy can be a determining factor for an investment approach (NCES, 2017). Before exploring this idea, this thesis seeks to prove or disprove the hypothesis that due to how strongly fossil fuels are tied into the economy as well as being more predictable, endowments that switch from fossil fuel to renewable energy-based investment portfolios will see lower returns.

The research will begin with looking at literature on this issue, examining the societal trends that are occurring and exploring and current investment approaches in both renewable and nonrenewable energy. This will help to understand why there is a "need" for change that could be potentially hindering to universities and then look at current data and trends that are happing in the market and see if there are other examples of success or failure from this time.

This paper will examine current stock prices and investment portfolios consisting of the respective type of energy and examine the factors that go into the growth or decline of these investments. If, after examination of all of the facts, the switch in investment strategy confirms that it actually hinders endowments, the next analysis will be to look at how much is lost by the switch. To help determine this data, the goal will be to look into larger endowments with investments in energy and comparing past and current returns as well as future predictions.

Once the information is analyzed, it will be compared with both initial thoughts as well as the thoughts brought up after the literature review. The findings will need to be applied both quantitatively and qualitatively as they both will affect the outcome of the research topic. Once they have been successfully applied, it will

be able to be determined whether or not there are implications that university endowments will face from the change in status quo on investments.

Part II: Literary Review

With energy being such an influential part of the economy as well as the society as a whole, and the ever-changing landscapes due to new technologies and discoveries, there is a multitude of literature on the general topics on what direction the United States should be headed in energy use. The types of literature ranges from opinion pieces and journalistic informative pieces found in news sources such as The Wall Street Journal, the Economist, and New York Times to more scholarly pieces that are written by university professors and experts within the energy industry across the nation and the globe. While the information on the specifics of university endowment performance on their portfolio from energy investments is somewhat lacking, there is plenty information on both reasoning for universities to invest in the energy of their choice as well as adequate information on the returns each type of energy has in markets and the factors that go into obtaining these returns.

Literature on the Current Societal Inputs on Energy Use

Probably one of the most disputed subjects in society today is whether the United States should continue with the historical status quo and remain using fossil fuels or to transition to a new age in which renewable energy is the primary source of power. The first group, the pro-fossil fuel supporters, give a variety of reasons as to why the United States shouldn't vary from the current trends, believing that it is the best course of action for at least the time being. The overarching themes

include that they are way more efficient, cheaper, and already integrated into our economy compared to renewables and, therefore, it will be more of a hindrance to waver from it. Analyzing the information provided in articles on this subject will help in determining the validity on which to maintain the current path in energy and determine if it is worthy of continued investment in.

While there are many reasons given by the pro-fossil fuel group, the most critical argument in terms of sustaining current fossil fuel use is that it is a major factor within the economy. As discussed by *Energy in Depth*, detailing evidence found from a report by the American Petroleum Institute, they point out all the different characteristics of the oil and gas industry and its ties that make it an important element in the market (Fitzsimons, 2016). The article points out that that this is an industry that creates numerous jobs and will continue to create more jobs due to new, unconventional ways in which oil and gas can be pumped and distributed. It also brings up that due to the cheapness of oil and gas compared to other sources, the average household has more disposable income as having saved money because of it and, therefore, is able to spend it elsewhere, bolstering the economy. It also pointed out that due to savings, products created in part because of petroleum refining is cheaper and thus more affordable to consumers and able to spend more on. Finally, the argument is that because of the abundance of oil and gas in the United States, they are more able to maintain energy security, knowing that there is no need for dependence on other countries and, therefore, minimizing volatility due to external forces in the industry and on the economy. All three arguments validate the pro-fossil fuel side as these are factors that definitely play

into investment growth. The sustainability factor and demand for a continued product that is not dependent on something that may or may not be there when needed at the cheapest price is likely to point at less volatility and minimizes losses in investments.

The opposing side would argue that there are more than enough reasons that there should be a push for more renewable energy and less dependence on fossil fuels. One thought provoking point was brought up by two professors from European universities that made an argument that continued fossil fuel dependence and investment actually hindered innovation as it slowed down technological advancements at a faster rate than it was producing (Brutschin, 2016). This paper is a strong counter to the argument made about how continued innovation in fossil fuels would lead to an ever-increasing number of jobs in the market. By pointing out that fossil fuel research and development was taking away from alternative energy innovation that could lower prices and increase efficiency at a faster and more productive rate, there is reasoning that it will do more for the economy and job creation than the current status quo is producing. There is another article by other European professors that also discusses the effects that new technologies in renewables have on the economy, strengthening the arguments made (Maradin, 2017).

Another argument that the pro-renewable energy group makes is that fossil fuels are not sustainable in the long run, as there is only a finite amount of them in the world. According to an academic journal written by the former President and co-founder of the Biomass Energy Research, details the need to increase renewable

energy production as there is an inevitable decline in fossil fuels that the world is going to witness (Klass, 2003). It argues that renewables are a key driver to maintaining the current energy and fuel demands that are going to just continue to grow as the world consumption grows. This argument is a persuasive piece for the pro-renewable group on investment as there is the idea that long-term investment growth could come from the group that seems to have the resources that will be around longer. As well, this article brings up other ideas about renewable energy and the push for the transition as it elaborates on the fact that there are many government incentives and mandates relating to renewable energy to increase growth as well as mandates that are potentially slowing down. This further spurs the ideas that investment in renewables could potentially be long-term decision that may bring better returns over time than nonrenewable energy. This is something that will need to be explored further and answered later in this thesis when trying to determine what is a better choice for endowment investment.

Looking at arguments from literature made by the pro-renewable group, the most societal based argument for switching to fossil fuels and the argument that heavily influences universities is that fossil fuels are negatively affecting the environment and contributing to global warming. A paper published by a professor in New Delhi gives evidence to climate change being the result of the industrial use of fossil fuels over the past century (Sarkar, 2016). The arguments made for this is that due to the high carbon emissions that are released by fossil fuels, it has caused for an increase in greenhouse gases which are gasses that keep heat within the Earth's atmosphere. This in turn has increased Earth's temperature and is

compromising the Earth's survivability. The pro-renewable energy group argues that because they see this as detrimental to Earth's health, it is up to universities to take the initiative to preserve future generations well-being by investing in renewables with their endowments as opposed to fossil fuels (Dyer, 2016). Ultimately this societal force seems to be one of the largest factors to the changes in the endowment of universities. While this thesis isn't focused on whether or not it is important to switch because of the environment, it is definitely a clarifying point to know that this is a key reason while still trying to understand what is the most profitable.

Literature on the types of Investment

The other area of literature that is important to explore for this thesis is the types of investments that universities can make in renewable and nonrenewable energy using their endowment funds. There are multiple ways of doing this. From direct investment in energy to public and private securities to companies themselves, universities have a lot of control on how they invest in energy. This is one of the reason's that they are targeted by people who want to see change in investment portfolios. They have such leniency in who they invest in that it can be a strong influencer in the markets.

One of the areas in which universities invest in energy is through public equities and bonds. According to the International Endowment Network, investing endowments in public equities and bonds is one of most common ways in which universities can invest and get a return on investments (Dyer, 2016). Due to the returns that are generated by stocks and bonds, especially over a long period of

time, this is an option in which most universities seek due to it having less risk than other options. While the returns vary on the types of stocks and bonds that are being invested in, it is something many universities think is a strong option to continue financial success. The purpose of this thesis will be to explore exactly what kind of returns come from different types of stocks on the public market between nonrenewable and renewable energy for this thesis.

Another type of investment option used for endowment portfolios that is fairly common is private market investments such as venture capitalist and private equity fund opportunities. An article that discusses the University of Michigan and their investments through private equity and other private market investments helps to detail how this is also an important aspect of the endowment as this can also get good returns and in different way than normal public investments (Michigan, 2015). Private market investments are definitely a more difficult way in which to gauge how the returns are for universities and their endowments. This is due to the fact that many private equity firms and other private investment areas keep much of the financial information confidential to the public. While there is a little bit of information present on private investments returns that could potentially help to influence the hypothesis, this thesis focus will not be on it due to the lack of available data to get a strong conclusion.

A third way in which university endowments can be invested in, but by far the most uncommon of the three, is direct purchase/ownership in certain assets. In terms of energy investment, this would mean that the university is purchasing assets such as solar panels, wind turbines, mineral rights, or oil extraction equipment

(Dyer, 2016). The returns for the university would then come from the revenues that come from these assets. This is obviously a much rarer investment strategy as there is usually a higher return in the markets than the profit that come from the asset itself. It is definitely something to note, although it is much harder to find accurate information for this type of investment and thus won't be explored.

Literature on Hypothesis that Fossil Fuel Investments have Higher Returns

Fossil fuels have been around for centuries, and with oil and gas not only coming to prominence in the last one hundred-fifty years, but actually advancing society forward in a number of ways, it has become a standard piece of our economy. Oil and gas in particular have become not only a way in which that society can power their vehicles, but also a key piece of national security, making it a strategical component for the United States Government (Yergin, 2009). Due to the importance of oil, and all of the many advancements that Yergin points out in his book *The Prize*, that a commodities market was developed for oil and gas. Starting in the 80s and only progressing further since then, it has become a security that countless people have put money into time and again.

The large majority of consumers are going to look for an energy source that is cheap, reliable, and currently in abundance. Because of this, most people are going to end up turning to oil and gas, as it fits all three requirements. Because this is what the majority of people want, it makes up the largest amount of demand in the United States. In turn, investments in oil and gas are constantly being sought after by someone. One reason that it seems that fossil fuels are going to be more successful than renewable in terms of investment returns is that due to the high

demands for cheap, reliable energy, even if someone divests for "moral reasons," someone who is fossil-fuel neutral or pro-fossil fuel is going to take that opportunity to invest and profit off of that. In turn, companies themselves aren't going to see any negative benefits from this transaction. As well, according to a study by a finance professor at Arizona State University, he concluded that if universities were to divest from fossil fuels, they could lose up to 12% of their endowments in a two-decade period (Bradley, 2017). Due to the relation in this study with the thesis and the demand for reliable, inexpensive energy, it seems that oil and gas stocks will have a higher return on investments.

The other reason that the hypothesis is made that fossil fuels will have higher investment returns over alternative energy sources is based on the limitations that are currently being experienced by the renewable energy sector. The first is that there are higher capital costs for renewable energy sources like solar panels or wind turbines than there are for oil and gas extracting sources (UCSUSA, 2017). Because of this, these companies must have more capital to invest in projects, especially since some financial institutions may see these higher costs as riskier investments, thus charging higher for loans. Unlike oil and gas that can easily pass costs off to consumers, the way that the current renewable market is does not allow them to do that as easily. Because they are perceived as riskier, there are also less financial channels for them to be invested in. Not as many investors are willing to invest in a company on the equity-side when there are safer alternatives like nonrenewables (Zeng, 2017). This in turn, has led to a shortage in investment in a number of small to medium-sized enterprises. These are huge factors in to why the

current thesis hypothesis is that renewable energy investments will have lower returns than nonrenewable energy investment. With the higher costs and the lack of investment, the assumption is that it will hinder the returns as opposed to a market that is ultimately tied to the economy and is readily accessible at the most reasonable price.

Part III: Methods & Results

The original idea for attaining data for this thesis was to look into the investment companies and university divisions that were in charge of investing university endowments and see if it was possible to find their returns for specific industries such as fossil fuels and alternative energy. However, there was a problem with this when it was realized that most public universities don't give their endowment returns and if they do, they don't break it down into specific industries, and that private universities, where a lot of this transitioning is occurring, are nonexistent in releasing financials. While this did create a setback, a solution was created by finding both renewable and fossil fuel stocks located within reliable indexes such as the Nasdaq and S&P 500 and then using the data from these stocks to do an analysis on their returns. Using this information, this thesis will analyze the data to determine returns which will ultimately help to support or disprove the hypothesis that universities switching their endowments from fossil fuels to renewables will see lower returns in their investments. The purpose is to find the returns per dollar and likelihood to sustainably invest in the two groups.

Returns on Investment in the Stock Market on Oil & Gas

The first step to collecting data was to determine which stocks should be used as a simulation for the type of stock investment that a university would use when deciding to pursue an investment portfolio in oil and gas. Based on research, universities are likely to invest a lot of their endowments into different types of funds. As a way to give an overarching idea on public funds performance in fossil fuels, the assumption that an index would simulate investments in a fund was used. After looking into it further, the S&P 500 was a good index to use as it helps imitate how business's stocks are faring in the economy. Using CNNMoney, it was determined which stocks were in the oil and gas industry. From there, 33 stocks were found in this category.

Then, an approximate timeline was established to simulate the length in which a university would be investing their endowments into this grouping so as to determine what the overall returns would be for the endowments. The timeline needed to be for a period that would have some ups and downs in the market to establish the fact that endowments wouldn't be able to predict when there was going to be a bad year as well as the assumption that just because there is one bad year, a university isn't going to completely pull its investment. Using this as a basis, it was established that the last 10 years returns would be a good time period, covering the recession, recovery from the recession, and the last few years that have seen positives and negatives within the oil and gas industry. With the time period established, the yearly returns were determined, using Bloomberg, over the last ten

years for each of the 30 company's stock prices that had public stock information dating back to January 1, 2008.

S&P 500 Company	Ticker	Y/Y Returns										10 year return
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Anadarko Petroleum Corp	APC	-41.32%	61.92%	22.01%	0.22%	-2.65%	6.74%	4.01%	-41.12%	43.54%	-23.07%	**-18.36%**
Andeavor	ANDV	-72.39%	2.89%	36.83%	26.00%	88.57%	32.80%	27.09%	41.72%	-17.01%	30.75%	**139.70%**
Apache Corporation	APA	-30.70%	38.43%	15.57%	-24.03%	-13.34%	9.48%	-27.08%	-29.04%	42.73%	-33.48%	**-60.74%**
Baker Hughes, a GE Company	BHGE	-60.46%	26.22%	41.23%	-14.92%	-16.02%	35.28%	1.47%	-17.69%	40.78%	-51.30%	**-60.99%**
Cabot Oil & Gas	COG	-35.60%	67.65%	-13.17%	100.53%	31.07%	55.85%	-23.61%	-40.26%	32.05%	22.43%	**183.32%**
Chesapeake Energy	CHK	-58.75%	60.05%	0.12%	-13.97%	-25.44%	63.30%	-23.77%	-77.01%	56.00%	-43.59%	**-89.32%**
Chevron Corp.	CVX	-20.74%	4.08%	18.52%	16.60%	1.64%	15.51%	-10.19%	-19.81%	30.84%	6.36%	**34.14%**
Cimarex Energy	XEC	-37.03%	97.80%	67.13%	-30.08%	-6.74%	81.73%	1.04%	-15.68%	52.05%	-10.22%	**186.90%**
Concho Resources	CXO	10.72%	96.76%	95.26%	6.94%	-14.07%	34.06%	-7.64%	-6.91%	42.80%	13.29%	**628.90%**
ConocoPhillips	COP	-41.34%	-1.41%	33.35%	7.00%	4.39%	21.83%	-2.25%	-32.39%	7.39%	9.47%	**-18.46%**
Devon Energy Corp.	DVN	-20.74%	4.08%	18.52%	16.60%	1.64%	15.51%	-10.19%	-19.81%	30.84%	6.36%	**34.14%**
EOG Resources	EOG	-25.40%	46.14%	-6.05%	7.77%	22.62%	38.95%	9.71%	-23.11%	42.82%	6.74%	**141.85%**
EQT Corporation	EQT	-37.03%	30.91%	2.09%	22.19%	7.65%	52.22%	-15.68%	-31.14%	25.46%	-12.97%	**6.83%**
Exxon Mobil Corp.	XOM	-14.79%	-14.58%	7.23%	15.92%	2.11%	16.93%	-8.65%	-15.68%	15.79%	-7.33%	**-10.72%**
Haliburton Co.	HAL	-52.04%	65.51%	35.69%	-15.48%	0.52%	46.30%	-22.50%	-13.45%	58.90%	-9.65%	**28.92%**
Helmerich & Payne	HP	31.56%	-8.47%	2.35%	0.35%	17.27%	44.82%	41.94%	-51.71%	42.40%	-22.57%	**58.74%**
Hess Corporation	HES	-46.82%	12.79%	26.51%	-25.79%	-6.76%	56.72%	-11.06%	-34.33%	28.49%	-23.79%	**-52.94%**
Marathon Oil Corp.	MRO	-55.04%	14.11%	18.61%	30.21%	4.75%	15.13%	-19.86%	-55.50%	37.49%	-2.20%	**-54.18%**
National Oilwell Varco Inc.	NOV	-66.73%	80.40%	52.53%	1.10%	0.53%	16.36%	-8.57%	-48.89%	11.79%	-3.79%	**-45.59%**
Newfield Exploration Co	NFX	-62.52%	144.20%	49.51%	-47.68%	-29.02%	-8.03%	10.11%	20.06%	24.39%	-22.15%	**-40.17%**
Noble Energy Inc.	NBL	-38.10%	44.70%	20.86%	9.65%	7.79%	33.89%	-30.36%	-30.57%	15.58%	-23.44%	**-26.71%**
Occidental Petroleum	OXY	-22.08%	35.61%	20.59%	-4.49%	-18.24%	24.14%	-11.67%	-16.13%	5.40%	3.41%	**-0.26%**
ONEOK	OKE	-34.96%	53.06%	24.46%	56.28%	-1.37%	45.45%	-8.53%	-50.47%	132.81%	-6.90%	**172.77%**
Pioneer Natural Resources	PXD	-66.87%	197.71%	80.24%	3.06%	19.12%	72.69%	-19.13%	-15.77%	43.62%	-4.01%	**253.92%**
Range Resources Corp.	RRC	-33.04%	44.95%	-9.77%	37.71%	1.44%	34.19%	-36.60%	-53.96%	39.62%	-50.35%	**-66.78%**
Schlumberger Ltd.	SLB	-56.97%	53.77%	28.28%	-18.19%	1.45%	30.03%	-5.22%	-18.34%	20.36%	-19.73%	**-31.50%**
TechnipFMC	FTI	-55.73%	142.72%	53.72%	17.49%	-18.00%	21.90%	-10.29%	-38.07%	22.48%	-11.88%	**16.32%**
Valero Energy	VLO	-69.10%	-22.60%	38.03%	-8.95%	62.09%	61.71%	-1.79%	42.85%	-3.38%	34.53%	**43.67%**
Williams Cos.	WMB	-59.53%	45.58%	17.22%	33.58%	21.42%	17.81%	16.52%	-42.81%	21.17%	-2.09%	**4.32%**
Average		**-40.47%**	**49.14%**	**27.50%**	**7.09%**	**4.98%**	**34.25%**	**-6.99%**	**-25.35%**	**32.66%**	**-8.66%**	**43.75%**

Figure 1: Table above was created using data extracted from Bloomberg Terminal on S&P 500 Energy Stocks

Ultimately there was some predictions that could be made with the returns on the oil and gas-based stocks. The first was that regardless of the type of stock, 2008 was going to have highly negative returns. When the Financial Crisis occurred in late 2007 and early 2008, it affected every market that the NYSE covered. The entirety of the S&P 500 would eventually fall 57% at its lowest point from its

highest point on October 9, 2007, taking until 2013 to fully recover. (The Wall Street Journal, 2017). The oil and gas industry fell right in line with this prediction, falling a total of 40.47% during 2008.

The other prediction that was made when creating this data was that there was going to be a hit to the stock prices for 2014 and 2015 when the price of oil collapsed. The price of oil had been steadily over $100 for three years, beginning in 2011, allowing for oil and gas companies to prosper as they expanded operations and increasingly partook in larger, more risky ventures. However, beginning in late July 2014 and until March 2015, the price of West Texas intermediate crude oil (WTI), the most commonly used benchmark for oil prices, dropped an overwhelmingly 60% (Cornell, 2015). As a result, everyone in the oil and gas industry was severely hit by this, especially those that needed higher oil prices to maintain the activities that they were invested in. As can be seen by the data, the returns were indeed negative for 2014 and 2015 at -6.99% and -25.35%, respectively. While they both followed the predictions, it was surprising that 2014 took a much smaller hit when the drop of prices occurred for five months as opposed to three months in 2015. The preceding three years were all positive as to be expected by the high oil prices, although the returns for 2011 and 2012 were definitely lower than expected when comparing to the significant returns in 2010.

The overall returns for the last ten years were definitely higher than expected. With the market averaging a return of 7% Y/Y, the last thing expected was energy, which has been more volatile over the last few years. However, with the oil and gas industries recovery after the recession and some good years with oil

prices, the overall return for the last ten years comes out at 43.75%. Investing in an index made up of energy companies similar to the example provided would have definitely been beneficial to university endowments. With that said, there are some potential limitations to this assumption that will be discussed in a later section.

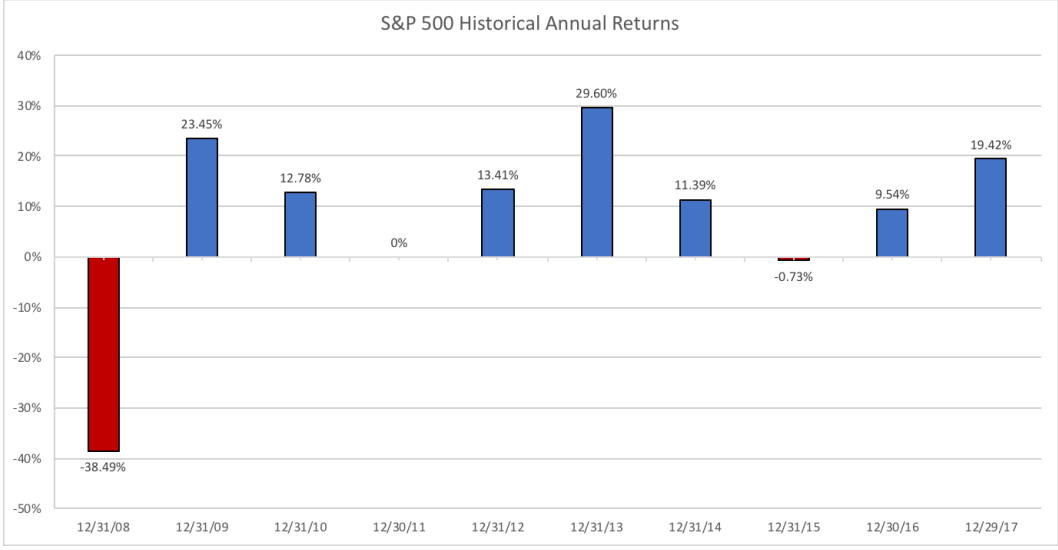

Figure 2: Information was extracted from Bloomberg L.P. for S&P 500 returns

While a 43.75% return is good on its own, to better understand how the oil and gas industry did in terms of returns, it needed to be compared to the overall economy and market. Looking at Figure 2, it shows the overall returns for the S&P 500 for the last 10 years in its entirety. The decision to use the overall returns for the S&P 500 was that this would be an indicator of how all industries were performing during each year of the market. In turn, it would give a better understanding on how the economy was doing and how the oil and gas industry was doing benchmarked off of the economy. There are particularly two different things to note from the data of the overall S&P 500 and the oil and gas returns. The first is that when the oil and gas stocks have positive returns, they are exceptional returns. As can be seen in Figure 3 below, of all the years in which the oil and gas

stocks had a net positive return, it outperformed the S&P 500 every year but 2012.

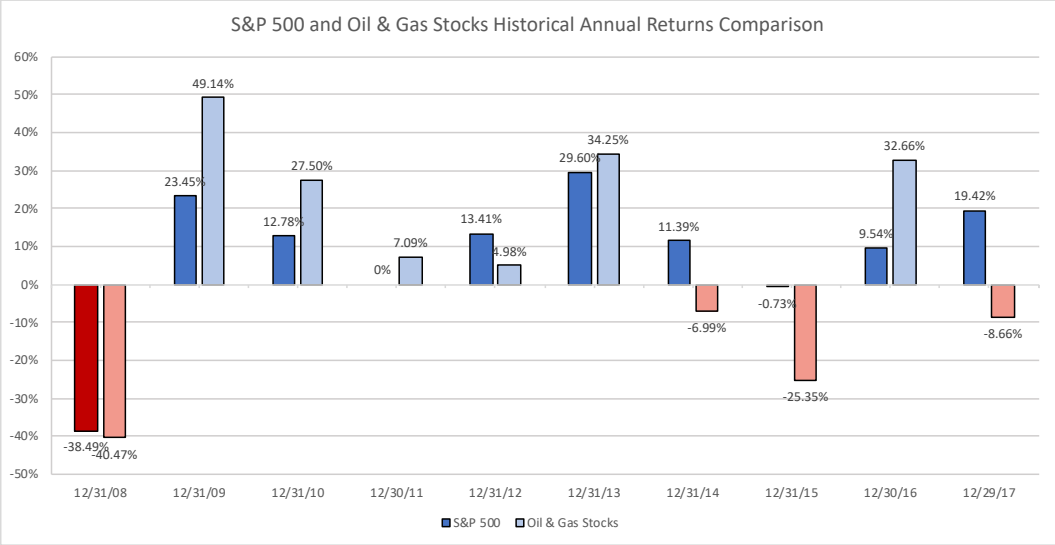

Figure 3: Information was extracted from Bloomberg L.P for S&P 500 and S&P 500 Energy Stocks

However, the second important data analysis to note is that in both years that the S&P 500 had negative returns, the oil and gas stocks had even higher negative returns as well as the oil and gas stocks having negative returns in both 2014 and 2017 when the S&P 500 had positive returns. Some of this can be explained with the points above where the price of oil collapsed, obviously impacting the oil and gas market in 2014 and 2015 more than the overall economy. However, these negative returns when compared to the overall market retaining mostly positive returns definitely effect the profitability of the oil and gas market. Shockingly, in the last 10 years, the S&P 500 has returned a surprising 82.07% as compared to the oil and gas simulated index only returning just over half of that at 43.75%.

Returns on Investment in the Stock Market on Alternative Energy

After collecting and reviewing the data on stock returns in the oil and gas industry, the next step was to look into how investments in alternative energy would return in the stock market. Determining what types of stocks went into this was a little bit harder to define as the alternative energy market is a looser ideology as opposed to the more established oil & gas markets. Like with oil and gas, the assumptions that universities would invest in some type of index or fund was used when determining the stocks that would be used. Ultimately, the Nasdaq Clean Edge Green Energy (CELS) Index was used to simulate this. The Nasdaq CELS Index is a modified market capitalization-weighted index that tracks the performance of companies that are primarily manufactures developers, distributors, or installers of clean-energy technologies. All stocks on the CELS Index have a minimum market cap of $150 million and the index was introduced in 2006 so there would be public stocks in it that went back the last 10 years (Clean Edge, 2017).

There is a total of 40 stocks within the CELS index. However, with a timeline established at 10 years, there were less samples dating back that long. This resulted in a total of 23 stocks with 10 years of returns to establish "the investment fund" represented in this experiment. As before, the annual historical returns for each of these stocks were found through Bloomberg and then composed into one grouping, which can be found below in Figure 4.

Nasdaq CELS Index	Ticker	Y/Y Returns										10 year return
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Acuity Brands, Inc	AYI	-0.54%	-26.20%	20.65%	18.84%	39.36%	33.26%	44.89%	57.31%	41.18%	-35.74%	304.15%
Advanced Energy	AEIS	-23.93%	51.56%	-9.55%	-21.33%	28.69%	65.55%	3.67%	19.11%	93.94%	23.25%	415.88%
AVX Corporation	AVX	-15.72%	-29.12%	56.39%	5.00%	-11.07%	-10.26%	10.76%	8.27%	-11.91%	30.31%	7.76%
Ballard Power Systems	BLDP	-78.52%	67.26%	-20.63%	-28.00%	-43.45%	148.08%	30.69%	-21.21%	5.77%	167.27%	-16.16%
Canadian Solar	CSIQ	-77.05%	346.13%	-57.01%	-78.53%	27.82%	777.06%	-18.88%	19.72%	-57.94%	38.42%	-40.10%
Cree, Inc.	CREE	-13.61%	26.35%	117.45%	-47.80%	-28.00%	161.06%	-24.05%	-44.31%	-11.48%	6.07%	-7.51%
EnerSys	ENS	39.23%	-49.33%	103.47%	61.19%	-12.83%	31.54%	52.02%	-7.29%	-13.26%	41.67%	359.49%
First Solar, Inc.	FSLR	-49.25%	-0.90%	-2.74%	-74.06%	-8.60%	77.08%	-18.38%	47.98%	-51.37%	110.41%	-74.62%
Green Plains, Inc.	GPRE	0.00%	48.70%	-24.28%	-13.32%	-18.95%	145.01%	27.86%	-7.59%	21.62%	-39.50%	68.50%
Hexcel Corporation	HXL	-69.56%	75.64%	39.37%	33.83%	11.36%	65.76%	-7.16%	11.95%	10.74%	20.24%	154.75%
Integrated Device Technology, Inc.	IDTI	-44.49%	-43.69%	25.93%	20.92%	-2.59%	4.48%	59.84%	65.70%	4.88%	14.07%	53.49%
Itron, Inc.	ITRI	-33.58%	6.01%	-17.94%	-35.49%	24.55%	-7.00%	2.08%	-14.45%	73.71%	8.51%	-28.93%
JA Solar Holdings	JASO	-82.43%	30.47%	17.18%	-81.49%	-36.92%	108.46%	-8.46%	23.86%	-47.51%	46.94%	-94.28%
Maxwell Technologies	MXWL	-38.69%	251.87%	5.89%	-14.03%	-48.89%	-6.39%	17.37%	-21.71%	-28.29%	12.50%	-30.35%
Microsemi Corp	MSCC	-8.00%	-39.92%	11.03%	-6.60%	25.59%	19.18%	4.85%	28.55%	30.21%	22.63%	84.65%
ON Semiconductor	ON	-61.71%	159.41%	12.02%	-21.86%	-8.68%	16.88%	22.94%	-3.26%	30.20%	64.11%	135.83%
Ormat Technologies, Inc.	ORA	-18.93%	-12.68%	-10.53%	-22.19%	-31.28%	7.93%	57.22%	9.43%	-6.78%	0.28%	-41.21%
Pacific Ethanol	PEIX	-94.64%	61.36%	1.65%	-79.02%	-70.18%	7.35%	102.95%	-53.73%	98.74%	-52.11%	-99.47%
Plug Power, Inc.	PLUG	-74.18%	-30.39%	-47.75%	-45.01%	-75.49%	210.00%	93.55%	-29.67%	-43.13%	96.67%	-94.03%
Power Integrations	POWI	-42.26%	82.90%	10.45%	-17.43%	1.36%	66.08%	-7.31%	-6.01%	39.52%	8.40%	113.62%
Sunpower Corporation	SPWR	-73.00%	-33.07%	-45.82%	-51.44%	-9.79%	414.41%	-8.96%	14.02%	-77.97%	27.53%	-93.57%
Universal Display	OLED	-54.28%	30.79%	147.98%	19.71%	-30.17%	34.11%	-19.24%	96.18%	3.42%	206.66%	735.30%
Veeco Instruments	VECO	-62.04%	421.14%	30.02%	-51.58%	41.78%	11.60%	5.99%	-41.06%	41.78%	-49.06%	-11.09%
Average		**-42.49%**	**60.62%**	**15.79%**	**-23.03%**	**-10.28%**	**103.53%**	**18.45%**	**6.60%**	**6.35%**	**33.46%**	**169.45%**

Figure 4: Information extracted from Bloomberg L.P. for stocks pertaining to the Nasdaq CELS Index

The results went completely against the hypothesis that was predicted. Expectations were that the alternative energy stocks would at least have similar returns as the oil & gas stocks, if not worse. However, that ended up not being the case at all. The 23 stocks that have been in the CELS index for 10 years have returned an average of 169.45% on their investment. Even if the averages are included for when a new stock is added to the CELS Index, the average return on investment still is approximately 72%. Some of the yearly returns could be expected for the alternative energy. Like the oil & gas investments, there was going to be a negative return in 2008. It ended up being a very similar loss to that of the oil &

gas investments. As well, it was not surprising at all to find that there were negative returns in 2011 and 2012. This was during the time that oil and gas were over $100 a barrel and so investment was going more into oil and gas as opposed to alternative energy. However, what was very shocking was that at year end 2013, about seven months before the oil price collapse would begin, the returns would be an aggressive 103.53%. The fact that there wasn't a single negative return in the alternative energy "investment index" after 2011 definitely supports the higher returns. With it doubling in size and then just increasing it from there, it is able to return at a much higher rate than the oil & gas that has taken some negative hits due to industrial factors.

After seeing the vastly higher returns on alternative energy than expected, more information was needed to explore why alternative energy returned the way it did. One factor that has seemed to play in the alternative energy returns favor is the decrease in costs for implementing in alternative energy. For example, the cost of building large utility-scale solar panels has decreased by about 50% in just five years (Worland, 2017). The decrease in costs allow for increased capacity as well as being able to shift that money elsewhere to increase productivity. Another factor is that there is more alternative energy being produced now as compared to ever before. According to the Worldwatch Institute, one-third of new electricity generation added to the U.S. grid over the next three years is expected to be renewable energy. Within the next year alone, wind energy is expected to increase by 45% (Block, 2018). Other factors like a decrease in coal production have opened the doors to renewable energy. All of these have played into the returns increasing

over time, ultimately allowing alternative energy to have such a higher than predicted return.

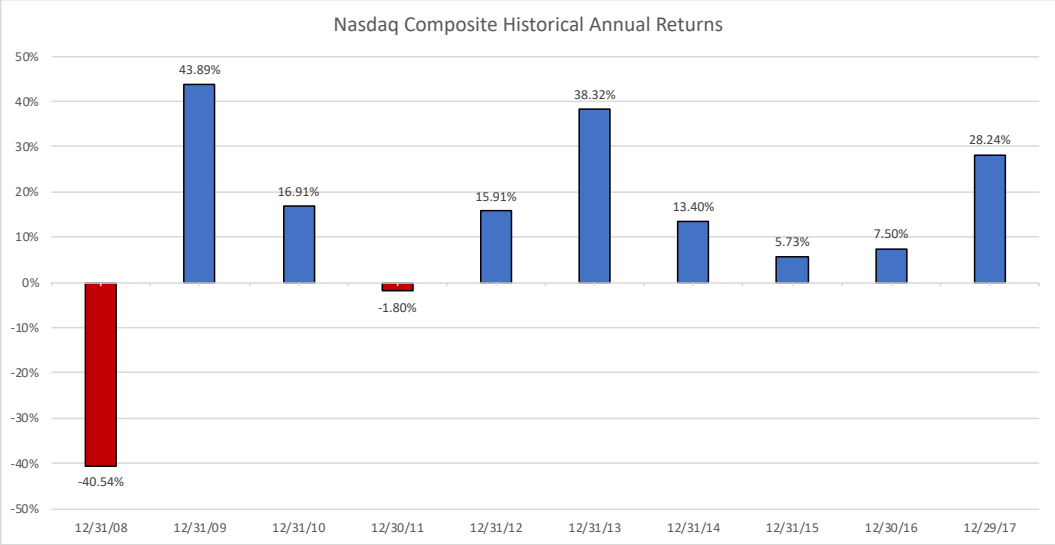

Figure 5: Information Extracted from Bloomberg L.P. for the Nasdaq Composite Returns

Like before, it was best to compare the alternative energy's returns to how the overall economy and market was doing. Figure 5 shows the returns for the Nasdaq Composite over the course of the same ten-year span. While the S&P 500 was used for oil and gas, the Nasdaq composite was used to get an overall understanding of the market and compare it to stocks made up more similar in size the stocks used from the Nasdaq CELS Index. Because the Nasdaq is still one of the main three indices followed, it should be able to give an understanding on how the overall economy was affected in this time frame. The comparisons when looking at the Nasdaq and alternative energy stocks are surprisingly more similar when comparing returns as opposed to the expectations established by the S&P 500 and oil & gas stocks. To note in Figure 6, the returns from 2011-2013 are really the only years with a substantial difference in returns. As stated earlier, 2011 and 2012 were influenced by the high oil prices and thus prevented investment in alternatives.

2012 was the only year in which alternative energy posted a negative return when the market as a whole was positive. Anything that was lost in 2012 was then made up by the drastic increase in returns in 2013, therefore, leveling out the alternative energy market with the Nasdaq composite. All in all, the Nasdaq composite returned 160.28% in 10 years while the alternative energy investments returned 169.45%.

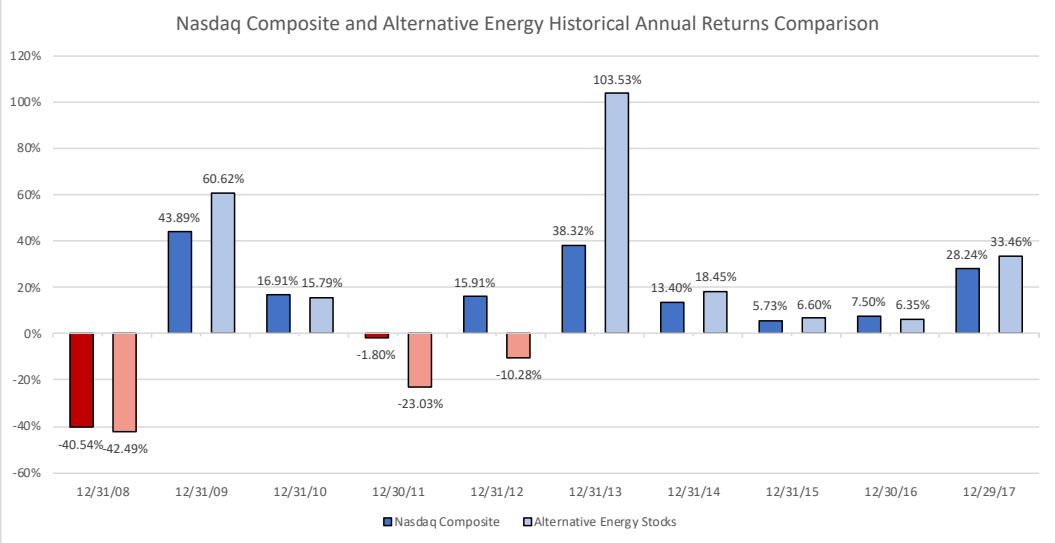

Figure 6: Information extracted from Bloomberg L.P. for returns on the Nasdaq Composite and for the Nasdaq CELS Index

Part IV: Discussion of Findings

After collecting and analyzing the data, the results surprisingly did not favor the original hypothesis that that universities switching their endowments from fossil fuels to renewables will see lower returns by this decision. While the returns for the oil and gas stocks were still significant, returning an average of 43.75% over the course of the 10 years, it wasn't to nearly the same standard as that the alternative energy that returned almost 4x what it's fossil fuel counterparts returned with a shocking 169.45% increase since the beginning of 2008. While this is significant,

and this data is telling that the hypothesis should be rejected, it is not to say that every university should switch their endowment to renewable energy and that should be the new norm. There are definitely areas of this research that could account for the findings that were different than expected.

The first is that when looking at both the oil & gas investment portfolio as well as the alternative energy investment portfolio, the stocks that were in them had to be determined. Due to the fact that there wasn't public access to actual endowments investments, it was impossible to get the perfect picture for what each portfolio makeup is for each category. After doing a large amount of research and reading through literature that made up the literary review, it was determined that the best index to use with the energy companies was the S&P 500. This is because when looking at the oil and gas industry, it is a very established market with large players in it. Therefore, these "leaders" are going to be some of the main public companies that are invested in because they are large enough for continued growth and improvement. While there are definitely smaller companies that could be invested in, companies like ExxonMobil, Concho Resources, and Pioneer Natural Resources will be strong investment opportunities.

However, for renewable energy, that isn't going to be the same investment strategy. Most renewable energy companies that are going to be invested in aren't going to have the $5.3 billion market cap that is required for placement on the S&P 500 (Amadeo, 2018). Of the solar energy companies that were made up in the Nasdaq CELS Index, only two of them could have met the minimum for the market cap in the S&P 500. That is why the decision to go with the smaller market cap size

of the Nasdaq CELS Index was beneficial. There are definitely going to be smaller, more growth-based stocks in the alternative energy sector as opposed to the type found for oil and gas.

Going off of this information, when comparing the average return for the S&P 500 and the Nasdaq Composite, some ideas can be established on why the conclusions were drawn. The overall return for the S&P 500 over the course of the 10-year period was 82.07%. The return for the Nasdaq Composite over the same 10-year period came out to 160.28%. The Nasdaq Composite had double the returns that the S&P 500 had during this time period. This is a major indicator that companies that are made up of the Nasdaq Composite ultimately did better handling and recovering from the recession and then thriving under the bull market that followed in comparison to the S&P 500. A reason that this could be the case is that Nasdaq companies are generally more technology based than the much broader S&P 500 companies. In turn, the former index could be doing better than the latter because technology companies have done better in the market the last ten years. Ultimately both the size and composition of the companies are partially to explain the large difference in returns.

As well, because all of the data was pulled individually and created based on a simulation on how universities would invest their endowments, there were a few limitations created in this experiment. The first limitation is that it is unlikely that universities would be investing their money in the heart of the financial crisis. The reason for doing the 10-year timeline was to be able to gauge how an endowment would make it through the recession, as well as the recovery of the

recession, and the bull market that followed. It was supposed to give an idea of what occurred during long-term investment periods. The data could definitely have changed somewhat if the timeline was changed.

The second limitation that occurs with this experiment is that while in this experiment, the returns were compared as if there was a one-time amount invested and then at the end, the larger amount was deemed the better investment. However, unlike in this experiment where there was a one-time amount invested, in the real world, money can be invested and pulled at any given time. This will ultimately affect the returns for any given endowment based on when they are putting more money in and taking more money out. If they put it in and pull it out at the right time, they are going to have higher returns than this baseline. However, if money gets put in and pulled at the wrong time, the returns will be lower than the baseline.

The third limitation to consider in this study is that a number of renewable energy companies that were used in this simulation are eligible for government subsidies, which would not be the case for oil and gas companies. Because of this, some of the renewable energy companies are able to bolster their financial statements because the government is putting money into them and supporting them. In turn, they may see higher stock prices and returns, even though they aren't doing as well in their earnings as some oil and gas companies. This may skew the data for long term sustainability, however, it was nearly impossible to control for this as the source of funding, as subsidies can come from the local, state, or federal level, and how much it impacts the companies returns are tremendously difficult to determine.

The best way to advance this study would be to get access to a handful of larger university endowments and dissect exactly what they are invested in on the energy front and figure out the returns. This will allow more accurate information to help determine an exact strategy. As well, exploring deeper into the returns on private equity could be helpful to get a better understanding on what private equity firms produce better returns and progress endowments further. Ultimately, while this is a good starter to get an idea on university endowment investments, the next best thing is getting more concrete numbers.

Part V: Implications

After analyzing the data, this could definitely establish that the push from societal forces to invest in renewable energy isn't necessarily a bad push. While many people are busy citing that the reasons for this push are that fossil fuels are negatively affecting the environment, causing global warming and hardships for the future, the legitimacy of it could come behind the profitability of this switch. While there are many unanswered questions in renewable energy, with their own set of implications such as potential environmental issues from the mining of minerals for renewable energy batteries, if there is a profitability aspect that will continue to push forward in the same way that oil & gas has for over a century it could lead to a positive future in this industry.

While there may be the opportunity for high returns within the alternative energy market as seen by the experiment performed, one thing to realize is that alternative energy is much more likely to consist of growth stocks as opposed to oil & gas stocks. Because of this, they are likely to be more volatile, as well as produce

less dividend payouts, which weren't accounted for in the experiment, than fossil fuel stocks which are more likely to consist of value stocks. Due to the fact that fossil fuel stocks are more likely to be value stocks, there are going to retain their stock value at a much more constant rate and, therefore, can be much more sustainable as the market continues to move and adjust around renewable energy.

The hope of this experiment was to aid investment groups and investors who are influential on university endowments as well as other endowments that could use this information. The societal forces that have pressed this question will likely get stronger as more energy is needed, and better technology is created that will help to advance alternative energies such and wind and solar power. By doing this experiment, it can show that these managers and other investors should cautiously transition into the renewable energy market.

The advice from this study would be that there should definitely be a transition. With 169.45% returns over 10 years, if it remains sustainable, it will be an exceptional growth opportunity. However, investment portfolios should remain balanced. It should entail both areas of investment. Oil and gas are not going anywhere soon as the cost of oil slowly climbs back up and likely stabilizes, it will allow for more growth and adjustment in that sector as well. On top of that, oil and gas are heavily integrated in the economy. Therefore, they are going to remain sustainable for as long as the economy wants them to. To maximize growth within endowments and other investment groups it is best to maintain a balance, adjusting it to embrace the industries that are doing better at a given time.

Part VI: Conclusion

With the overarching fact that fossil fuels are a finite energy source as well as an increasing future population and the constant arguments that fossil fuels are hurting the environment and the world, there will likely be an argument from here on out that there needs to be a switch to alternative energy. Since universities are an entry point into new ideas and ideological transitions, it stands that they will be used to try to push this argument. One of the main ways in which this can be done is by switching endowment investments in fossil fuels over to investments in renewables. By choosing to research this topic, this thesis was able analyze the reasoning behind this transition as well as how this was going to affect universities from an investment return aspect with their endowments and if it would, in turn, hurt them. The reasoning for choosing this topic was that there was interest in the constant fossil fuel vs renewable debate and that it would be a way in which to see how it effects an area that large number of students are surrounded by. Based on prior knowledge of the subject, the original hypothesis was that by molding to the societal pressures to switch to alternative energy investment, universities who made the switch would have returns that were worse than those who remained in oil and gas investments.

Looking through the literature on the topic, there was information that looked at the different inputs that were being made on what type of energy should be used within the United States. This gave a number of different reasons, from the idea that the US should be sticking with the more engrained oil and gas, to the arguments made by the opposing side that it hurts the environmentally as well as

other arguments such as that it was hindering innovation. This helped establish the argument, but it was the literature around the types of investments made in endowments that helped establish the topics next points and helped to figure out the type of data that needed to be collected to complete the thesis. The third literature piece was used to analyze the hypothesis to determine if it was plausible. Based on some information, as well as a similar study to this thesis done by an Arizona State University professor, the hypothesis seemed plausible.

After collecting the data needed to understand the hypothesis and then analyzing it, it was surprising to discover the returns on renewable energy were actually far better than it was for oil and gas. This defeated the initial argument that it would be against the best interests of the universities to switch the endowments over. The results could definitely be strengthened or weakened based on more endowment specific information on what universities actually invest in. But as it stands, alternative energy investment won't hurt it.

Currently the hypothesis is not supported and there could definitely be a transition that allows for higher endowment returns with alternative energy. The best way to move forward and progress this study would be to find public stocks that both fossil fuel-based endowments and renewable based endowments invest in and look at those returns. As well, finding out the private equity firms that they invest in and finding out how their returns are in the private sector will strengthen the overall argument being made. The future will definitely transition to renewable energy as technology advances it and makes it as cost and energy efficient as oil

and gas but until it has, and their stocks become more value-driven, it will be a discussion that will keep being had.

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