

Alternate to Alternative Energy

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# Alternate to Alternative Energy

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### **Executive Summary**

With the world depleting its natural fossil fuel resources, and with fossil fuel emissions causing global warming and the acceleration of climate change, a new and more efficient avenue for energy must be further researched, advanced, and mass commercialized. This new avenue is known as alternative energy; in other words, the generation of energy that does not harm the environment, nor does it deplete the Earth's natural resources. There are four different types of alternative energy resources that the report analyzes: Solar Energy, Wind Energy, Hydroelectric Energy and Nuclear Energy. This report analyzes the financial capability of each of these sources in the macro- and micro-economic scale. Solar energy is the most cost-effective source a household could own; however, regarding low- to moderate-income individuals, it is simply too expensive, as they cost around \$22,000 for a 12 kilowatt/hour system. Wind power has grown across the world and has shown good advancement. New offshore wind turbine techniques and more efficient turbines have allowed for the growth of wind energy. However, their initial installation prices are very expensive, as a 2 MW wind turbine costs \$3.5 million to install.

Hydroelectric energy is continuing to grow at a rapid pace due to its cost-effectiveness and high energy efficiency. With hydroelectric facilities growing, future mass energy production could rely on hydroelectricity. The final source is nuclear energy. With nuclear energy being an emission-free source, the interest in nuclear energy is also growing. Right now, 20 percent of U.S. power originates from nuclear energy.

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The report also analyzes the different approaches the U.S. government is making to create more affordable utility rates, with organizations such as the Weatherization Assistance Program (WAP). Finally, the report discusses the problems involving the slow conversion into alternative energy by the government and fossil fuel corporations. If the major economic powers were to switch, then the utility rates would decrease, allowing for easier affordability for low- to moderate-income individuals.

## **Background Information**

As part of the Florida Prosperity Partnership NAF Future Ready Lab internship program, interns Enrique Huerta and Deandra James were given the opportunity to research any topic involving financial capability. The topic of choice was the micro- and macro-economics of alternative energy. The researchers were given six weeks to gather information, develop a report, develop a PowerPoint presentation, and to present their findings at the End of Summer symposium. The researchers made this choice due to their own curiosity involving the slow advancement of alternative energy and the lack of alternative energy sources surrounding the Central Florida area.

## **Methodology**

The research team gathered information, evidence, and statistics over the course of six weeks under the NAF Future Ready Lab internship program. During this time, the team was able to get into contact with Ph.D. student Adrian Figueroa, who is currently studying Earth Systems Science: Natural Resource Science and Management from Florida International University. The team was also able to contact Nadja Rivera, who

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was able to connect them with a variety of articles and students. The team also contacted Barry Altland in order to gain greater insight on the ownership of a solar energy system. For the rest of the report, the information and statistics obtained were from secure and well-backed online resources such as, Energy.gov and Energysage.com. Once the team received all this information, an outline was structured in which the multiple alternative energy resources would be elaborated upon. A problem was discovered along with a possible solution provided by the research team.

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### **Introduction**

Gawdat Bahdat, a professor of Political Science from the National Defense University, once said, "The use of alternative energy is inevitable as fossil fuels are finite." The global energy sector has been showing signs of evolution and advancement. The environmental and health warnings throughout the world have been showing signs of imminent danger and risk. With 80 percent of the world reliant on fossil fuels, a new form of energy must be taken into consideration. Alternative energy is the key solution to these problems, but what is alternative energy? Alternative energy is the energy generated from resources that do not deplete nor hurt the environment. However, not only are these resources environmentally friendly, but economically friendly as well. This report will go into great depth at the different types of major alternative energy resources available, their economic value, popularity, restrictions on their advancement, and the solutions capable of fixing them.

### **1.0 The Rise and Development of Alternative Energy**

Throughout history, the pursuit of common and accessible energy has been the powerhouse behind the empires and nation-states of yesteryear and today. However, despite common thought, alternative energy did play a part along with the fossil fuel behemoths of that time. From the practical use of heating objects using solar power to the harvested energy of flowing water, alternative energy has been prevalent in history and today. Now with the technology sector growing at an exponential rate, the age of innovation and research has taken an even greater focus on Alternative Energy and its

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usefulness. For soon, the reality of our world governed by Alternative Energy is a plausible possibility.

## **2.0 Alternative Energy Interest**

As mentioned previously, the pursuit of sufficient and efficient energy has been and still is the pursuit of all nations. However, with the current main energy source being fossil fuels, a variety of problems have been presented. Economic, environmental, and health issues have all presented themselves as a result of the heavy use of Fossil Fuels, a problem of which major attention and focus is deserved. As a result, interest in alternative Energy has emerged as a rising global trend, leading to a potentially brighter future for the world.

### **2.1. The Economic Aspect**

Economically, fossil fuels are at a large disadvantage to alternative energy resources. Fossil fuels are nonrenewable resources, meaning that the world uses it faster than it can be naturally produced. According to Mike Eckhart, Managing Director for Citigroup Bank, "Fossil Fuels are resource-oriented... and the cost of resources goes up the more you use." Therefore, in relation to supply and demand, as the supply decreases, the price increases if there is still demand. With fossil fuels currently being the most cost-effective option, demand will remain at a high throughout the world.

On the contrary to the economics of fossil fuels, alternative energy resources and materials have the capability of decreasing their own costs. When analyzing the

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relationship between quantity and price--otherwise known as the experience curve--for alternative energy products, a distinguishable trend is that as the manufacturing of renewable energy products increase, the prices for them decrease. Due to the abundant resources necessary for the construction of alternative energy products, the economics involving it becomes more stable and predictable compared to Fossil Fuels, therefore providing a variety of benefits in the finances of individuals, corporations, and governments. This also includes the benefit of a reduced and steadier utility rate, in terms of a governmental grid. In terms of low- to moderate-income individuals, or in other words those whose income is less than 80 percent than the local median, it can prove to be more costly. This information will come later in the report.

## **2.2. The Environmental/Health Aspect**

As a consequence of the use of Fossil Fuels, certain greenhouse gasses are emitted into the atmosphere. Gasses such as Carbon Dioxide are produced and sent into the atmosphere, where it begins to accumulate. As a result, the heat reflected off the Earth essentially begins to trap itself even further, causing global warming. Consequently, this leads to various negative outcomes in sensitive ecosystems. Consequences such as the polar caps melting, rising sea levels, and damages to marine and land-based life. The increase in global temperature has evidently caused a greater intensity of storms, according to the Center for Climate and Energy Solutions (CCES), models have projected a 45-87 percent increase in the frequency of Category 4 and 5 hurricanes.

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Adding to the already tough situation, the emissions produced, especially in the heavily industrialized areas of the world, have shown an increase in health risks and problems. According to the World Health Organization (WHO), 29 percent of deaths are caused by lung cancer, 24 percent of deaths are from strokes, 25 percent are from ischemic heart disease, and a variety of other bodily failures. All of these deaths are in relation to the increasing amount of ambient air pollution, in which blood vessels and respiratory systems are being clogged and polluted. Since alternative energy provides a solution to polluted air because of its zero-to-minimal emission status, a growing interest has begun to accelerate slowly, especially in the fields of solar power, wind power, and hydroelectric power.

### **3.0. Solar Power**

Solar power is a rapidly growing energy resource with the attractive benefits of increased electrical efficiency and zero-emission status. In fact, a variety of initiatives and corporations have emerged to further the technological advancement of solar energy and the reduction of its prices. It has even come to the point where solar energy is cheaper than fossil fuels in over 80 percent of the world. Locally, the Florida Solar Energy Center, a research unit of the University of Central Florida, has gained many steps in the research of photovoltaic cells. This includes the research of zero-emission housing, where households rely 100 percent on their own alternative energy resources, most notably solar. For 2019, the federal government also instituted a 30 percent Federal Solar Tax Credit for individuals who use solar energy for household power. However, the tax credit is set to decrease to 26 percent for the 2020 tax year. This is all

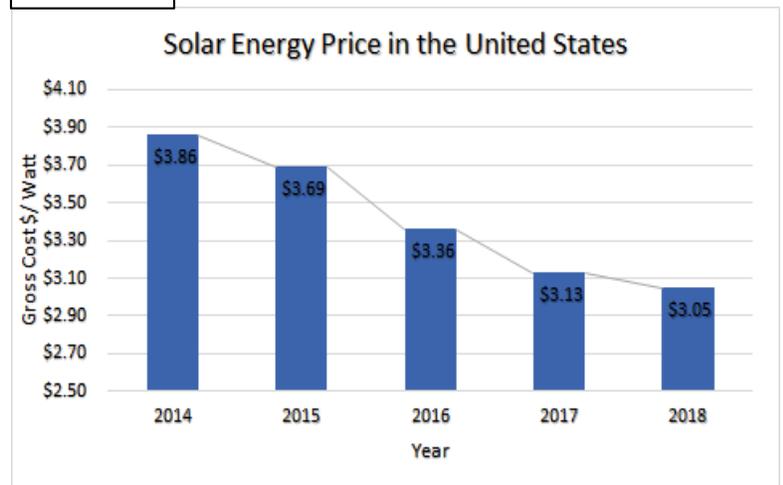
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part of a solar subsidy initiative by the United States government to spur solar development and rapid commercialization.

There has been some backlash to these subsidies, calling them unfair to the fossil fuel sector. However, United States subsidies have had a trend of excelling in the industries that they assist, that being the Internet industry, the Interstate Highway industry, the Fossil Fuel industry, etc. In fact, the subsidies and growing consumer attention in the United States have allowed solar energy prices to decrease

substantially. The past four years have shown a decrease of 21 percent in gross costs per watt. The reduced cost has improved the competitiveness of solar energy in the utility market. In fact, according to Barry Altland, a solar panel system user, the price for his utility bill has decreased dramatically. The solar panel system allows the consumer to gather their own electricity, therefore not reliant to the main electrical grid as much.

Figure 1



Solar panel systems have increased in popularity exponentially across the United States, especially in Florida. Thanks to Chapter 163.04 of the 2018 Florida Statutes, which prohibited housing organizations such as the Homeowners Association (HOA) from denying homeowners the ability to install solar panel systems. With this barrier gone, middle-class homeowners have begun to look more into the state and pricing of solar energy. According to Energysage.com, the average Floridian solar panel system is

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12.5 kilowatts. Taking this into consideration, a table was developed to show the relationship between the system's size and cost.

Figure 2

<b>System size</b>	<b>Florida cost of solar panels (with Federal Solar Tax Credit)</b>
<b>3 kW</b>	\$5,733
<b>6 kW</b>	\$11,466
<b>10 kW</b>	\$19,110
<b>12 kW</b>	\$22,932

The figure shows the average value of a Floridian solar system, with the Federal Solar Tax Credit. As one could tell, the pricing is expensive and therefore requires a loan if not accessible by cash. A variety of solar loans are available, by either the Solar company or local bank. These loans typically have an interest rate of around 5.5 percent to 10.5 percent but can be collateralized against one's home for a cheaper rate. One setback, however, is that solar panels rely on the heat and radiation of the sun in order to create energy, meaning a change in the weather can impact the amount of energy the solar panels can produce. To counter this, most solar systems create excess energy and send it to the central grid company in the form of credits. These credits could then be exchanged for power from the central grid in times of minimal solar power, according to the solar system owner, Barry Altland.

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### 4.0. Wind Power

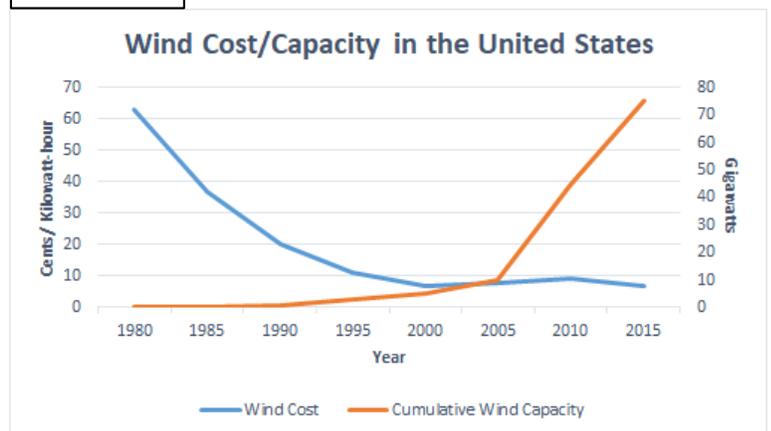
In addition to solar power, wind power has also taken in a large interest by the public for alternative energy. Their zero-emission status in a world where cutting back on emissions is key that makes wind power a very attractive source. Unfortunately, wind turbines are responsible for thousands of bird deaths every year, making them locally environmentally unfriendly. However, the sheer damage caused by fossil fuel emissions is much higher than the concentrated area that makes up a wind farm, for millions of animals are negatively impacted by the environmental change caused by fossil fuels. In regard to the economical aspect, kilowatt-hour costs have decreased tremendously

across the United States. With data obtained from the Department of Energy, the price of unsubsidized wind power has reached seven cents as of 2015. As of 2018, the price of wind power has reached between two and four cents per kilowatt-hour. In fact, the

cost of land-based wind has dropped by 41 percent since 2008.

Not only has the price of wind power decreased dramatically, but the power capacity for wind power has increased even more. According to the Department of Energy, energy capacity is three times greater in 2015 than what it was in 2005. This is due to developers deploying larger turbines. These turbines, along with their lighter and longer blades, have helped drive down costs and improve performance. The country of

Figure 3



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Denmark receives 40 percent of its electricity from wind energy, showing the potential success of wind power.

Wind power has also recently developed into another sub-section, that being the less common offshore wind turbine. These turbines provide more sustainable and consistent energy due to the ocean's constant wind. These turbines also provide benefits for marine ecosystems, as they restrict access to certain waters and therefore increase artificial habitats. In fact, the United Kingdom invested 127 million pounds into the development of offshore wind turbines. This is part of their initiative to achieve at least 30 gigawatts of offshore wind farms installed by 2050. Unfortunately, offshore wind turbines are more expensive due to their larger maintenance expense and complicated energy transfer systems back to shore.

In terms of the practicality of wind turbines for homes, it cannot be used effectively to provide power. Therefore, household wind turbines are mostly used as supplementary power devices. This means that the wind turbines contribute to the power the house receives, therefore reducing the power received from the central grid. This, in turn, causes the utility rates to decrease. Regarding urban windmills, the practicality for them is also minimal. The speed of wind within urban centers decreases drastically, therefore making urban wind turbines inefficient. Even though wind turbines do not provide consistent power by themselves, if intertwined as a supplementary within the main power grid, their use can reduce utility rates and cut emissions.

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## **5.0 Hydroelectric Energy**

There has also been a growing interest in Hydroelectric energy and its efficiency. In fact, 10 percent of the electricity that the United States uses originates from hydroelectric sources. Additionally, hydropower can convert 90 percent of the available energy into electricity, compared to fossil fuel's 50 percent. This makes them one of the most efficient forms of alternative energy sources, according to the Wisconsin Valley Improvement Company. Unfortunately, in terms of environmental problems, the reservoirs and dams created would affect the local ecosystems by causing the downstream water level to dry out. Also, the large reservoirs created would wipe out the local wildlife habitats. However, the marine life within the reservoir would flourish, while also allowing for a variety of recreational activities.

For hydroelectric plants to produce enough power, large scale projects must be put into place. The Hoover Dam is one of the nation's largest hydroelectric power stations, providing enough power to serve 1.3 million people in the states of Nevada, Arizona, and California. (Bureau of Reclamation) The United States generates the third-highest amount of power from hydroelectric power stations, at just above 292 billion kilowatts per year. China leads the industry with a whopping 856 billion kilowatts. As a result of these successful projects, foreign initiatives involving hydroelectric plants have also grown. For example, the European nation of Norway produces more than 99 percent of its electricity with hydropower.

Areas receiving hydroelectric power do receive lower utility rates due to a lack of price fluctuations, unlike fossil fuels, where their prices fluctuate frequently. Therefore, hydroelectric power tends to be more cost-effective in terms of utility rates compared to

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their fossil fuel counterparts. With the United States containing 250,000 rivers, the potential for a mainly hydroelectric-reliant country is possible. Hydropower currently has a maximum budget of \$41 million and has been requested to decrease for the 2020 national budget.

## 6.0 Nuclear Energy

Nuclear energy is the most popular alternative energy resource in the United States. Having first been used to produce power in 1956, the United States Nuclear Regulatory Commission now regulates 99 commercial nuclear reactors. These reactors together generate 20 percent of the United States total electricity, making them the most used alternative energy resource. A nuclear reactor essentially takes the heat given off by nuclear fission to create steam that then generates power by spinning multiple turbines. Due to nuclear fission producing no carbon emissions, this form of alternative energy does not further add to global warming.

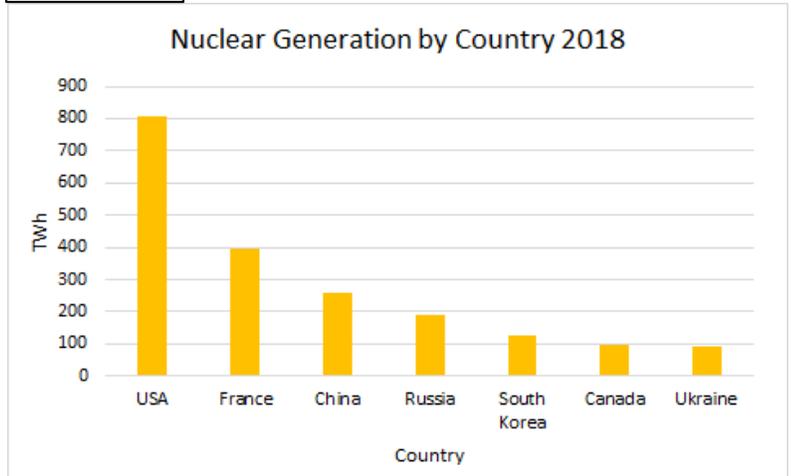
However, conventional nuclear power plants produce nuclear waste, a byproduct of Uranium 235, the fuel used for nuclear reactors. The waste contains radioactive isotopes of americium, technetium, iodine, and plutonium. The plutonium produced is then used and refined for nuclear weapon use. As a solution to this dangerous waste, the element Thorium 232 was proposed to take over for Uranium 235 due to its much safer and abundant nature. (Forbes.com) Unfortunately, the element is very expensive to be refined and therefore makes it economically ineffective on the macro-economic scale. Also, quite ironically, even though the element is safer and less radioactive, the

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United States government has given little support due to its inability to produce plutonium.

The United States leads the nuclear power industry by a major margin; however, China does have 108 proposed nuclear power plant projects that are projected to be completed by 2050. (Forbes.com) The figures in the table are given by the

Figure 4



World Nuclear Association (WNA). The United States Congress recently passed a bill that directs the Department of Energy's secretary to take steps in ensuring the operation of at least two advanced nuclear reactors by the end of 2025. (S&P Global) The advanced reactors use a variety of coolants such as molten salt, high-temperature gas, water, and liquid metal. This essentially allows for the safer operation of nuclear reactors as well as better efficiency in response to rapid demand.

## 7.0 Effect on Low-to-Moderate Income Individuals

According to the Department of Energy, nearly 50 million households are defined as low- to moderate-income (LMI) individuals. Only five percent of all solar installations in the United States are by LMI individuals, displaying a lack of progress with alternative energy within that sector. A variety of factors contribute to this lack of alternative energy adoption with LMI individuals, such as low credit scores and the ability to pay off the financing. As a result, programs such as the Clean Energy for Low Income

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Communities Accelerator (CELICA) have been instituted, with the aim to lower energy bills by working with the U.S. Department of Energy (DOE) and state and local governments.

Due to the expensive prices of household alternative energy devices such as solar panel systems, low-income communities have a hard time affording them, and therefore have a hard time reducing their utility bills. In response, the Weatherization Assistance Program (WAP) has used its congressional funds to help households increase their energy efficiency. Currently, they use their funds to pay utility bills in general for LMI households. However, a new proposal has emerged in which the WAP could use those funds for solar investments. This could be a sustainable solution for helping families lower their energy bills while moving toward greater energy independence. (Lowincomesolar.org) This program would allow for LMI households to achieve lower utility bills, and therefore greater freedom to use the available funds for other expenditures.

## **8.0 Alternative Energy Projects**

In response to the rising economic and environmental problems throughout the world, various nations have been instituting more alternative energy projects. For example, the United Arab Emirates (UAE) has a project known as the Sweihan Project. This 1,177 MW solar power project will be the world's largest solar project. Using joint funds from eight commercial banks, the solar farm will be expected to produce power for 195,000 households. This is all part of their solar initiative so that the UAE can provide self-sustainable energy in case of oil prices skyrocketing. In fact, the UAE was

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able to reduce the price of solar to 6 cents per kilowatt-hour, making it cheaper than fossil fuels.

An even more utopian example can be seen with the Canary Island of El Hierro. This small Spanish island has been able to completely switch to renewable energy by using solar, wind, and hydroelectric technologies. The island was able to create an interconnected grid of renewable energy sources in order to power the island, essentially reducing 19,000 tons of Carbon Dioxide emissions. (Endesa.com) Due to the island's location, the wind turbines receive consistent wind; however, in times where there is little wind, solar panels and hydroelectric facilities take over. This interconnected alternative energy process allowed El Hierro to achieve 100 percent reliance on renewable energy.

In more local terms, the Florida Municipal Power Agency (FMPA), in conjunction with 12 Floridian municipal electric utility companies, announced plans for a large-scale solar energy project. 900,000 solar panels will be installed on three sites in Osceola and Orange Counties. In total, 1200 acres of land will be filled with solar panels, producing 223.5 MW of power. This investment will power up to 45,000 Floridian homes and reduce the utility prices for them, due to the economic stability of solar systems. Florida Power & Light (FPL) also announced plans to install more than 30 million solar panels by 2030, enough to power much of the state. Along with Tampa's initiatives towards offshore wind farms and Florida's five nuclear power stations, the future for Florida seems to be pointing towards alternative energy.

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## **9.0 Why Has Alternative Energy Not Taken Off Even More?**

There are many politics involved in the managing of funds supporting renewable energies. Due to most energy coming from fossil fuels, the corporate fossil fuel refiners are looking for ways to retain their profits. With the growing initiative towards renewable energy, fossil fuel behemoths are looking for any way possible to retain their profits and shareholder value. Companies such as ExxonMobil, Chevron, and Royal Dutch Shell have been stalling legislative acts towards the restrictions of fossil fuel emissions. Fossil Fuel companies have been reluctant to change their business model due to the losses they would be receiving (Union of Concerned Scientists). Alternative energy would require investments with less risk, due to the stable nature of alternative energy economics. Therefore, the reduced risk means reduced earnings, which then means reduced profits, which causes the skepticism of shareholders to increase support.

With the potential of losing shareholder value, the economic price is too much to bear for large fossil fuel companies. Therefore, they have been fighting legislation that could harm their profits. The influence that the fossil fuel industry has on the national economy is vast, so if the industry was to fall without another industry rising to the occasion, the entire U.S. economy could lose value. Therefore, the slow conversion into alternative energy is a very difficult and lengthy process for these companies. However, as history has shown, if companies are not prepared to evolve along with the times, then they face bankruptcy. For example, the whaling industry was the fifth-largest industry but failed to evolve as the lighting industry evolved. This caused the industry to disappear altogether. The Fisher Brothers, who built carriages, evolved with the times and invested more into the auto industry, eventually becoming a branch of General

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Motors. History has shown that if a company does not keep up with the global trend, then it would ultimately fail.

## **10.0 The Potential Solutions**

In terms of increasing the rate of change involving fossil fuel companies converting into alternative energy companies, an incentive must be provided. A proposal is that the federal government could institute certain tax breaks regarding the production of alternative energy. Nearly the same way individuals must pay taxes, corporations must do the same. Corporations fill out IRS Form 1120 in order to report their taxes. As of 2018, oil and gas companies receive tax deductions for the tangible and intangible assets that they have. Tangible, meaning that the assets can be resold, and intangible, meaning assets are used up. Therefore, fossil fuel companies face a forgiving tax code and can therefore maintain high profits.

The federal government should reduce these tax breaks and institute more forgiving tax breaks to alternative energy equipment and assets, encouraging the manufacturing of alternative energy products and the equipment behind them. A 20 percent tax deduction into alternative energy equipment and the removal/reduction of fossil fuel tax breaks could force the hand of these fossil fuel corporate giants. The federal government should also reduce fossil fuel subsidies in order to raise the price of fossil fuels, therefore, providing another incentive for the conversion into cheaper alternative energy. Research from the Global Commission on the Economy and Climate finds that bold conversion into alternative energy could deliver at least \$26 trillion in economic benefits. With the tax incentive possibly harming some of the fossil fuel

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companies, their eventual conversion into alternative energy companies could pay off more in the long-term than in the short-term.

Another proposal is that there could be change in the views on alternative energy by the government. Currently, the 2020 budget for the Department of Energy is \$31.7 billion according to the 2020 Budget Justification Page. In terms of Nation Security, the budget proposes \$23.7 billion into that sector of the Department of Energy. However, nowhere in the fact sheet does this sector involve national security with alternative energy sources. In terms of petroleum, the United States imports 29 percent of gross petroleum imports from the Organization of Petroleum Exporting Countries (OPEC). The U.S. also imports 16 percent from Persian Gulf Countries. Most notable are the countries of Libya, Iran, Iraq, Venezuela, Saudi Arabia, etc. These countries have historically carried much conflict within the region, causing fossil fuel rates to fluctuate drastically

As a result, this causes the United States to become more vulnerable in the energy market as the increased prices causes the buying of fossil fuels to slow down. This, in turn, slows down the economy and reduces economic efficiency, leaving the United States a bit more susceptible to economic sabotage. Even though we have enough fossil fuels to self-sustain our nation, the reliance on them would reduce our exports drastically, therefore, reducing our national Gross Domestic Product (GDP). The weakening of our economy could fall to the point where the rising nation of China would equally match us economically. Due to their rapid initiatives towards alternative energy, the multi-billion-dollar market is expanding and increasing their GDP, especially due to their exports of photovoltaic cells (PV) for solar energy systems. Therefore, if the

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mindset on alternative energy changes into that of national security, then the extra funding and brain power would allow for the rapid expansion of that industry. Therefore, allowing the United States to achieve the \$26 trillion economic opportunity as mentioned previously.

### **11.0 Conclusion**

Though there is no doubt that the global conversion to alternative energy exists and will happen, it is the length of that process that worries people. As described throughout the report, a variety a major alternative energy resources are available for mass commercialization and globalization. However, with current fossil fuel subsidies and lack of incentives, the conversion to alternative energy is slow. Despite this, with the solutions proposed, there is a possible way to accelerate the process and prevent the environmental and economic consequences that lay in our current path. In terms of low- to moderate-income individuals, programs such as the Weatherization Assistance Program (WAP) have been instituted to help these individuals convert to solar energy systems. By using the funds handed off by the federal government, this program is using the money to install solar panel system for individuals with low income. These panels would effectively increase the efficiency of the home by causing the household to rely on its own power, rather than from the central grid. This, therefore, reduces their utility rates, allowing for a greater availability of funds to be used on other useful expenditures.

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