Overview of Fossil Fuels and Green Energy: A Recommendation and Analysis of the Realisticality of the Current Proposed Energy Transition

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Introduction to the Proposed Energy Transition and Thesis:

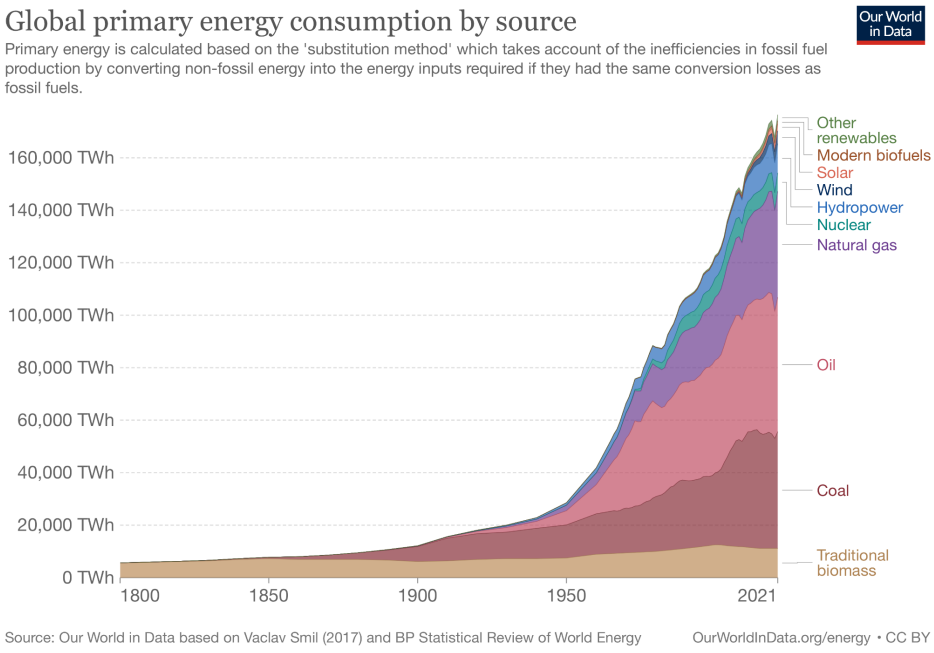
The proposed energy transition that has been proposed by the Biden Administration is as follows; “The Biden Administration plans to eliminate fossil fuels as a form of energy generation in the U.S. by 2035.” In this thesis, I will give an overview of fossil fuels and green energy, and give a recommendation and analysis of the realisticality of the proposed energy transition. As noted with the realisticality approach to this energy transition, there are major concerns about the largest proposed energy transition in history.

History of Fossil Fuel Consumption:

The coal that is found today, “may have began forming during the Carboniferous Period of the Earth,”(Seo, 2017). That is roughly “359.9 million years ago” to “298.8 million years ago,”(Manger, 2023). Earth and its elements applied massive amounts of heat and pressure to dead plants and animals so that our gasoline-guzzling cars can be driven. What a fascinating process this is. Dead plants and animals, mixed with enormous heat and pressure, creates the fuel that allows us to travel all around the world. Maybe we should all give thanks to the plants and animals that sacrificed their lives and were created into fossil fuels. Fast forward to the 1700s, “the first big energy transition was from wood to charcoal to coal, beginning in the iron industry in the early 1700s. By 1900, coal was the primary industrial fuel, taking over biomass to make up half the world’s fuel use,” (Gross, 2020). The world was using ancient coal, but it is one of the major contributions to the boom of our economy, production, and an increase in the quality of life. We were being fueled by an energy source that was 2X (times) more efficient than wood (legacystoves.com). This is great, but this was just the beginning of the efficiency of fossil fuels

and how they were drastically changing our lives for the better. In 1800, the global fossil fuel consumption for coal was 97 million terawatts, 0 terawatts for both gas and oil. In 2021, the global fossil fuel consumption for coal was 44,473 terawatt-hours, gas was at 40,375 terawatt-hours, and oil was at 51,170 terawatt-hours, (Ritchie et al., 2022). The growth and transition of the energy we use today are truly fascinating. It makes sense however, our world, the United States alone, would not be able to survive and keep up the production level we have by only burning wood as our main energy source. There is a direct correlation between energy consumption and the advancements in the U.S. from 1800 to 2021 such as westward expansion/railroad = coal (people.wou.edu), Industrial Revolution, "coal usage increased with the growth of steam power and coal-fired power plants, oil demand surged as gasoline vehicles took off," (Bhutada, 2022), first successful oil well is drilled in Pennsylvania, and mass consumption of petroleum for transportation and industry, (energyhistory.yale.edu).

See the figure below for the "Global Primary Energy Consumption by Source," from 1800 to 2021.



In the 1800s, the world started moving from wood to coal and one of the main factors for this transition was westward expansion and the building of the railroad. “As railroads moved west away from the east coast and its abundant forests, they could no longer rely on wood to fuel their steam locomotives,” (people.wou.edu). The reason coal was used to power the steam locomotives was because of its vast amount and efficiency. The American Industrial Revolution “brought a significant shift in energy sources with the usage of coal, mainly for steam engines, but increasingly for power plants,” (transportgeography.org). The Industrial Revolution was a time of industrial and economic boom for the United States. Cities were growing, buildings were being built at a rapid pace, and technologies advanced immaculately. One important part of this growth comes down to; what energy source was powering this rapid growth and was leading the industrial revolution at a time that the world had yet to experience. Well with the increase of coal-fired plants in the Industrial Revolution, coal increased. It’s incredible that in the same century, the world shifted from wood as the leading energy consumed, to coal. To preface, energy transitions can take a very long time. For instance,” wood alone accounted for about 90% of U.S. energy consumption in 1850,” (gml.noaa.gov). According to eia.gov, wood accounted for 2.0 Quadrillion BTU in the U.S., and the total energy consumption for the U.S. was roughly 9.1 Quadrillion BTU, (eia.gov, 2012). This means that as of 1900, wood accounted for 21.97% of the total energy consumption in the United States. This finding will be used at a later time but this is significant because, within 50 years, there was a 68.98% energy transition. This is a decrease in wood energy consumption by 1.3796% a year.

One of America's most prominent fossil fuels is oil. The reason oil is one of America's most prominent fossil fuels is because of the automobile industry. The gasoline-powered cars we drive today consume oil in order to run, and as a whole, they consume a lot of it. As of 2013, "If you do just 10,000 miles per year at 30mpg, you'll use 333.3 gallons in a year," (Ingram, 2013), and according to nhtsa.gov, there were "212.2 million licensed drivers in the United States," (crashstats.nhtsa.dot.gov, 2013). Thus, in 2013, there were approximately 70,726,260,000 gallons of oil consumed in the U.S. (212.2 million licensed drivers * 333.3 gallons consumed per driver). To put how much oil was consumed in the U.S. in 2013, I have made a practical analogy. I'm sure we have all watched the Olympics. 1 billion gallons equals 1,534 Olympic swimming pools, (andy.utah.gov). Thus, 70.726260 gallons of oil would fill up 108,494.08 Olympic-sized swimming pools. This increase in oil production and energy consumption is thanks to the car industry, but oil is used for many other things besides cars such as; "to heat buildings, and to produce electricity," (eia.gov). Edwin Drake is credited with the start of the oil industry in America as he successfully drilled a well in 1859. This well yielded 25 barrels per day, and 10 years later in 1869, 4,125,000 barrels were produced.

Fast forwarding to the future, as of 2021, the U.S. total energy consumption was 97.91 quadrillion BTUs, (eia.gov, 2022). The boom of petroleum is credited to the transportation and industry sectors. According to eia.gov, in 2021, the energy consumption for petroleum in the transportation sector was 67.2% and in the industry sector, petroleum consumption was 26.9%, (eia.gov). In 2021, these two sectors accounted for 94.1% of the petroleum consumption in sectors of the U.S. In today's world, the main energies we consume are petroleum/oil and natural gas. "In 2021, the United States consumed about 30.28 trillion cubic feet (Tcf) of natural gas,"

(eia.gov, 2022). Simplified, this is a very large amount of natural gas that the U.S. alone consumed in 2021.

To recap the history of fossil fuels, in the 1700s, wood was the prominent form of fuel. From wood, we transitioned to coal, and since then, we have transitioned to oil/petroleum and natural gas as far as fossil fuels. The main events that contribute to the growth in the history of fossil fuels and the growth in energy consumption are westward expansion/railroad which contributes to the growth in coal, the industrial revolution, coal usage increasing with the growth of steam power and coal-fired power plants, oil demand surging as gasoline took off, the first successful oil well being drilled in Pennsylvania, and the mass consumption of petroleum for transportation and industry.

Real-World Applications of Fossil Fuels/Effects and Replacements:

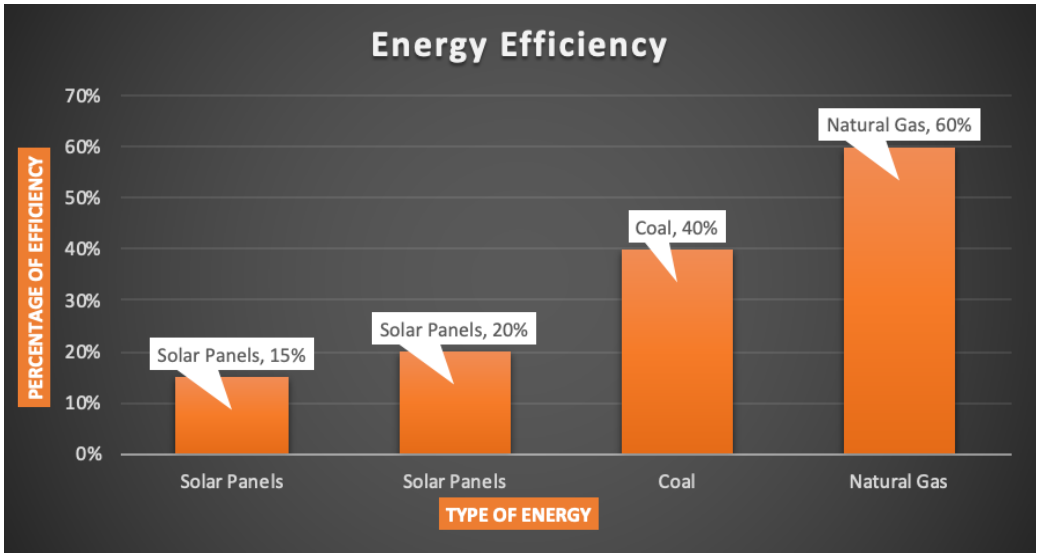
As mentioned above, fossil fuels are used for a variety of purposes. Whether this be to heat a home, fuel a car, or power a city, fossil fuels are a critical part of our world and our day-to-day lives. If we didn't have fossil fuels, we would not be able to be as energy independent and efficient as we are today. We would have to way for the wood and coal to heat our home at a slower rate. A lot of homes as gas stoves which work a lot better than electric stoves or stoves fueled by other energy sources. It's safe to say that fossil fuels have made our lives more efficient and better with respect to the benefits it provides such as transportation and quickly heating a home. However, if we didn't have fossil fuels but had "cleaner" energy sources such as nuclear energy, solar energy, or wind energy being most of our energy consumption, the CO2 emissions would diminish and the health of our world would increase. This leads to the possible

replacements for fossil fuels, which our world actually uses already. For the purpose of green energy and replacing fossil fuels, I'm going to solely look at the United States.

First, I would like to define CO2 emissions. According to ec.europa.eu, Carbon Dioxide emissions are defined as, "emissions stemming from the burning of fossil fuels and the manufacture of cement; they include carbon dioxide produced during consumption of solid, liquid, and gas fuels as well as gas flaring," (ec.europa.eu). CO2 emissions have a negative effect on the planet for example, "disrupting weather patterns," and "causing global temperatures to increase and other climate changes," (Boiler, 2022). CO2 emissions create problems for our atmosphere and weather at an increasingly exponential rate and people today are seeing these effects. Real-life example, I remember the Summer of 2022 being hotter than one I have experienced in the past. The Washington Post states, "Per NOAA's data, 2022 has been the sixth-warmest year on record from January through August, with a global average temperature 1.55 degrees higher than the 20th-century average," (Rosenthal et al., 2022). These are some great effects of fossil fuels which are harmful to our planet. With the negative effects of Fossil Fuels, one route we can go for the health of our planet is replacements. "The five primary alternatives to fossil fuels are renewable energy, nuclear power, hydrogen, biomass, and geothermal energy," (robeco.com). These types of energy are also known as green energy. I will get into green energy later, but for now, I want to introduce and establish green energy as a replacement for fossil fuels and note that green energy is a lot less harmful to the planet, therefore being a safe energy.

World of Solely Fossil Fuels (Pros and Cons):

There would be benefits and detriments of a world running only on fossil fuels. A pro of the world only using fossil fuels is the efficiency that our world would experience. When compared to the efficiency of solar panels, this is was la.solargroup.com has to say about the efficiency of fossil fuels, "The effectiveness of solar panels can be between 15% to 20%, whereas coal could reach 40% efficiency and natural gas can reach 60 percent efficiency," (la-solargroup.com). In order to understand the significant pro that using only fossil fuels would cause, it is important to understand what energy efficiency is. According to the Department of Energy, "energy efficiency is the use of less energy to perform the same task or produce the same result. Energy-efficient homes and buildings use less energy to heat, cool, and run appliances and electronics, and energy-efficient manufacturing facilities use less energy to produce goods," (www.energy.gov). Some of the benefits of energy efficiency that the Department of Energy lays out is, "energy efficiency saves money, increases the resilience and reliability of the electric grid, and provides environmental, community, and health benefits," (www.energy.gov). With coal and natural gas having 40% and 60% efficiency respectively if the U.S. used solely fossil fuels to power it, we would be able to obtain much more efficiency overall and we would be receiving a greater amount of the benefits. For example, we would save much more money and reliability of the power and energy we use.



Source: made from Excel using data from

https://la-solargroup.com/efficiency-of-solar-panels-compared-to-fossil-fuels/.

Now moving on to a major con of our world using fossil fuels solely, as I mentioned before, the health of our planet would face increasing harm and detriment. These detriments include extreme weather and the heating of the planet. It is safe to say that if our world only used fossil fuels, the global warming and effects of it, would increase at a more rapid rate than it already is. “If we want to stop climate change (and avoid devastating extreme weather, sea level rise wiping out communities, global conflict and instability, etc.), we have to stop burning fossil fuels,” (greenpeace.org, 2019). I like this statement for my goal of focusing on a major con if we were to only burn fossil fuels, and have no other way of energy consumption. Our world does not want global warming or seas taking out cities, so it is a good idea for our country to use fossil fuels and other means of energy use such as solar and wind. In conclusion, it would be unsafe for our world to only use fossil fuels, and for fossil fuels being efficient, it is important that we use fossil fuels and green energy in order to power our world.

It is important to take the last quote used and settle a notion that I believe is unrealistic and causes me to wonder what people really mean. This notion will be focused on heavier when talking about the proposed energy transition, but I wanted to take the moment to introduce it right now. In the quote used in the last paragraph, “If we want to stop climate change (and avoid devastating extreme weather, sea level rise wiping out communities, global conflict and instability, etc.), we have to stop burning fossil fuels,” (greenpeace.org, 2019), the phrase in question is; “we have to stop burning fossil fuels.” According to eia.gov, the U.S.’s fossil fuel energy consumption totaled to 60.2%, and its renewable energy consumption totaled to 21.5%.

Theoretically, no fossil fuels would limit all of the CO2 emissions it causes, however, when it is more than half of our energy, it's impractical to stop it completely. This makes me raise the question, when people say stop using fossil fuels, are they realistically meaning, let's use less fossil fuels? Or something to the matter of, what would it look like if we found a good balance between fossil fuels and green energy where our CO2 emissions are less, but we aren't sacrificing energy efficiency? I think the direction needs to be turned from "stop using," to how do we find a good balance?

History of Green Energy:

Let's start in 1800 when the first battery was created. The man who created with creating the first battery is Alessandro Volta. The battery was said to be "simplistic in its design," (inspirecleanenergy.com, 2017), but it was able to conduct a successful electric current. We use batteries to power a multitude of things that we use on a daily basis. Batteries are what run our electric cars which contribute to the decrease in the burning of fossil fuels, ultimately relieving the world of CO2 emissions by a little. With this said, batteries play an important role in renewable energy because "the main way to store renewable energy is in batteries," (Matuszak, 2022). The invention of batteries over 200 years ago will play a crucial role in the proposed energy transition of cutting out all net CO2 emissions and going completely green. In 1838, "Welsh scientist William Robert Grove was the first to develop hydrogen fuel cell technology," (inspirecleanenergy.com, 2022). Hydrogen fuel cell technology is less heard of compared to fossil fuels such as petroleum and gasoline, and even green energy like solar or wind energy. However, "hydrogen fuel cells are generally between 40% to 60% energy efficient, according to the U.S. Department of Energy. This range compares to the typical internal combustion engine of

a car, which is about 25% energy efficient," (plugpower.com). It brings about the question of, why is hydrogen fuel cell technology not utilized more since it is more efficient than a combustible engine. It turns out that hydrogen fuel cells produce energy for a lot of items we use daily such as electronic devices and vehicles. Hydrogen-fuel cars entered the market and tried to lead the renewable-fueled car industry that Tesla currently leads with their electric vehicles. However, "the vast majority of car companies have turned away from hydrogen because of the high density of energy consumed in its production, as well as poor funding and backing from governments, which is stopping the hydrogen revolution from expanding ever more," (cardealermagazine.co.uk, 2022). It seems that Hydrogen fuel cell technology is efficient but has not been perfected to where it is industrialized, which is why it is rarely talked about. In 1887, Charles F. Brush created the "first automatic wind turbine to generate electricity," (Diaz, 2019). Wind turbines, despite the energy source to produce electricity which is wind, being free, aren't completely free to build and manufacture. Following will be a cost analysis of a wind turbine including manufacturing one, installing it, and the cost to actually run this machine. This cost analysis will give insight into the cost of creating a machine capable of using renewable energy to produce electricity such as solar, wind, and hydrothermal. According to waetherguardwind.com, the cost of a turbine is "$2.6 - $4 million per average-sized commercial wind turbine." There is a maintenance expense that costs about "$42,000 - $48,000 per year," (Blewett, 2021). With this being noted, the start-up costs for a renewable energy source can be high. However, the cost of wind, sun, and water is relatively free. With water and hydro dams, there may be regulations and additional costs to consider. The point is, the energy source used to power wind turbines and solar panels are wind and sun, both things that are free. Unlike fossil fuels, when creating these energy systems, very minimal costs are required to produce electricity

and keep these systems going. Producing electricity from fossil fuels constantly requires money in order to produce it because the energy sources are not free like crude and natural gas. It takes money to refine the resources and transport them to where they can provide energy for people.

Moving along, geothermal energy is another source of renewable energy. Geothermal energy is "a type of renewable energy taken from the Earth's core. It comes from heat generated during the original formation of the planet and the radioactive decay of materials. This thermal energy is stored in rocks and fluids in the centre of the earth," (www.twi-global.com). Geothermal in today's world is not as common as other types of renewable energies. For example, the estimated U.S. energy consumption in 2021 for geothermal was only 0.206 quads. "Geothermal energy can be used in different ways depending on the resource and technology chosen - heating and cooling buildings through geothermal heat pumps, generating electricity through geothermal power plants, and heating structures through direct-use applications," (energy.gov, 2018). One question that comes to mind is, why is this type of renewable energy consumed so little, and is it possible or worth it to grow this type of renewable energy in efforts to go completely green? In 1935, "the Hoover Dam became the world's largest hydroelectric power plant," (inspirecleanenergy.com, 2017). 75% of Iceland's electricity comes from hydropower so it is theoretically possible for a country to run majorly on hydropower. However, Iceland is a smaller country with more dense areas where this water can be used for power. For the United States, this would be impractical because of the land area of our country and all of the different areas where electricity is needed. In 1942, the first nuclear reactor named Chicago Pile-1 was created. This started the atomic age and since then, many more nuclear reactors have been built, one of the most noticeable being Chernobyl. Chernobyl was a tragic event and in all actuality, nuclear is clean and safe for the environment. As long as the waste is handled properly

and the reactor overall is safe, nuclear is a good source of energy to use. We (the United States) should look into nuclear energy more and see how we can make it safe and more of use. The year of 1954 brought the first solar cell which is one of the major categories of renewable energy. The sun comes up every day, however, it is important to note that on a cloudy day, the amount of electricity created from solar energy will be limited or close to none. In 1977 the Department of Energy was established and in 1990, "Congress passed act to stimulate development of hydrogen power," (www3.uwsp.edu). Hydrogen power is something that isn't talked about often but is another form of renewable energy that could be used to help the overall state of the planet. In 2008, Tesla started to cause chaos in the gasoline vehicle industry when they launched their Roadster which helped contribute to 21.5% of U.S. energy consumption being green energy as of 2022, (inspirecleanenergy.com, 2017) (eia.gov, 2022). Following is a "Green Energy Timeline Infographic," based on the previous information.

A GREEN ENERGY TIMELINE

1800 ..... 

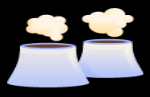
In 1800, scientist Alessandro Volta created the battery. (Inspirecleanenergy.com, 2017)

1838 ..... 

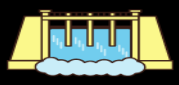
In 1838, "Welsh scientist William Robert Grove was the first to develop hydrogen cell technology." (Inspirecleanenergy. com, 2017)

1887 ..... 

In 1887, Charles F. Brush created the "first automatic wind turbine to generate electricity." (Diaz, 2019)

1911 ..... 

The first commercial Geothermal Plant was built in Larderello, Italy. (Inspirecleanenergy.com, 2017).

1935 ..... 

"The Hoover Dam became the world's largest hydroelectric power plant." (Inspirecleanenergy.com, 2017)

1942 ..... 

"Nicknamed 'Chicago Pile-1,' the world's first nuclear reactor kicked off the Atomic Age..." (Lerner)

1954 ..... 

"The scientists at New Jersey's Bell Labs were able to create the first practical solar cell that could convert the power of the sun into electrical energy." (Inspirecleanenergy.com, 2017)

1977 ..... 

In 1977, the Department of Energy was established. (Inspirecleanenergy.com, 2017)

1990 ..... 

"Congress passes act to stimulate development of hydrogen power." (UniversityofWisconsin Stevents Point)

2008 ..... 

"Tesla Launches Roadster" which "disrupted the traditional gas-aholic car industry." (Inspirecleanenergy.com, 2017)

2022 ..... 

In 2022, the U.S.'s energy consumption of renewable energy was 21.5%. (eia.gov, 2022)

SOURCES

https://www.inspirecleanenergy.com/blog/clean-energy-101/earth-day-technology-timeline
https://www.siemensgamesa.com/explore/journal/2019/11/siemens-gamesa-inventors-day
https://news.uchicago.edu/explainer/first-nuclear-reactor-explained
https://www3.uwsp.edu/cnr-ap/KEEP/nres635/Pages/Unit1/Section-C-Renewable-Energy-Timeline.aspx
https://www.eia.gov/tools/faqs/faq.php?id=427&t=3

Real-World Applications of Green Energy:

Three major real-world applications of Green Energy are: “Opt for Solar Powered Lights,” Powering homes with solar and wind energy, and “Using Bioethanol to Power Cars,” (www.trvst.world, 2023). Lights (such as garden lights) are mostly powered by another form of electricity when they can be powered by solar energy. Although the initial costs of powering a home with solar energy are expensive (due to the cost to build and install solar panels), it saves a lot of money in the long run and helps the overall health of the planet. Wind energy is another clean energy source that can be used to power a home. Gasoline is a major part of the fossil fuel category and is consumed in enormous consumption due to gasoline vehicles. There is another form of energy that could power our cars that is clean called bioethanol. These are ways that green energy is used in today’s world.

World of Solely Green Energy:

A world of solely green energy would bring: no carbon emissions, high initial costs but lower operating costs, increased wellness of health, and the economy will take a hit for example, “America’s oil and natural gas industry supports 10.3 million jobs in the United States and nearly 8 percent of our nation’s Gross Domestic Product,” (api.org). No carbon emissions would significantly increase the health of our planet as CO2 emissions are harmful. It costs a lot of money to build machines that turn green energy into electricity (a figure will show this in more detail later). However, since the energy is free such as solar and wind energy, the long-term operating costs are lower. As the health of our planet would increase, human health would increase because harmful chemicals would be eliminated from the atmosphere. However, our economy heavily relies on fossil fuels with respect to the production and sale of fossil fuels

domestically and internationally. Completely eliminating fossil fuels would not just cause our economy and GDP to fall, it would eliminate jobs. An article on api.org states, “America’s oil and natural gas industry supports 10.3 million jobs in the United States and nearly 8 percent of our nation’s Gross Domestic Product,” (api.org). When the Keystone Pipeline shut down, roughly 20,000 jobs were lost. The effects of these jobs lost reached beyond the direct effects inflicted on these employees. People who didn’t work for Keystone were unable to find jobs, causing there to be detrimental effects beyond the Keystone bubble.

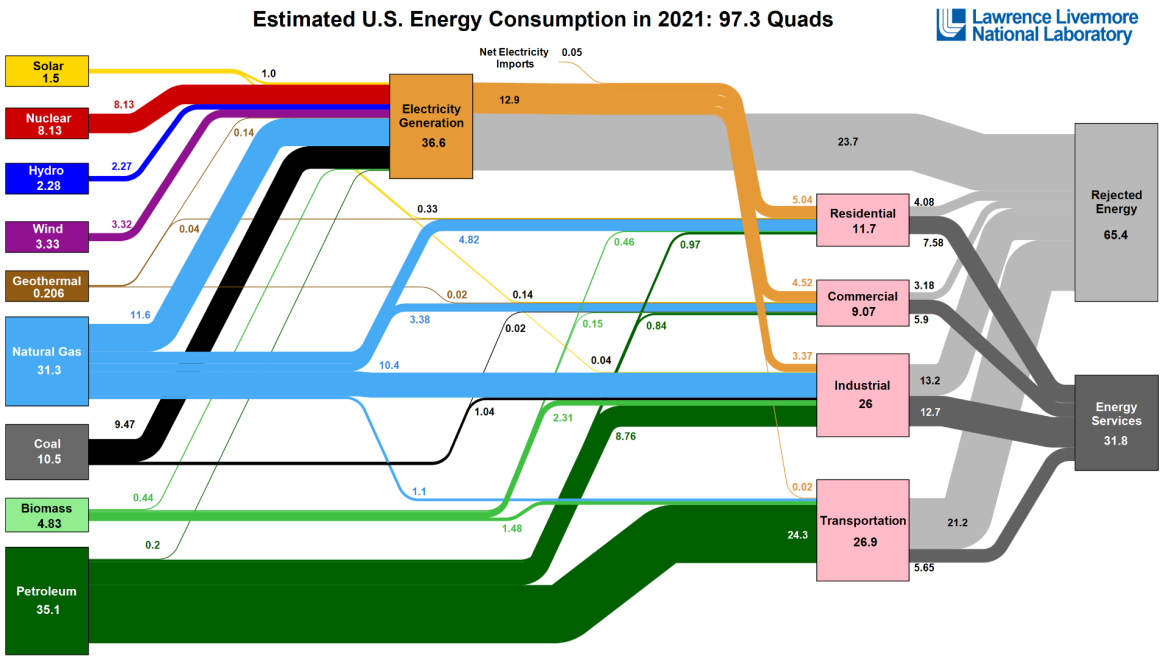
Pros and Cons of Fossil Fuels and Green Energy:

A few pros of fossil fuels are; Electricity, transportation, and high efficiency. With respect to fossil fuels and electricity, coal can be used to generate a lot of electricity in one place at a low cost. Fossil fuel transportation is relatively easy. Fossil fuels are able to generate a lot of energy that has various uses such as making a car able to go, or powering a city on a power grid ran by fossil fuels. A few cons of fossil fuels include Limited Supply, CO2 Emissions, and Destruction. Since fossil fuels are non-renewable energy sources, we have a limited supply of them. This means, that with a projected date of roughly 2080, we will run out of fossil fuels. Therefore, it is very important to incorporate green energy into our energy consumption which could even push back the complete run out of fossil fuels. Fossil fuels when burned emit CO2 gas which is harmful to the planet in the form of global warming (due to greenhouse gasses). Limiting CO2 emissions will better the health of the planet and slow down the rise in atmospheric temperature. Extracting fossil fuels from the ground can be destructive as land is destroyed by fracking and other methods.

A few pros of green energy are; public and planetary health will benefit, energy is renewable, and there are lower operating costs. Renewable energy does not emit CO2 and other harmful chemicals, therefore increasing the health of the planet and humans. As mentioned earlier, we are running out of fossil fuels so it is important to consume energy where the source is renewable. We have an unlimited supply of renewable energy; as long as the sun is shining and the wind is blowing. The initial cost to build green energy machines (solar panels/wind turbines) is expensive, however, the operating cost is a lot less to produce energy because the energy is free (i.e. sun, wind, and water). A few cons of green energy include; low efficiency, the "sun goes down," and there are high initial costs. Fossil fuels such as coal, are a lot more efficient than green energy such as solar panels. The sun goes down, the wind stops blowing, and the water stops flowing at times. This means at these times, energy from these sources is not being produced. As mentioned earlier, it is very expensive to build a wind turbine or solar panel.

Economic Impact:

The figure below is an Energy Cost Analysis of fossil fuels (coal, natural gas, and petroleum) and green energy (wind, geothermal, hydropower, nuclear, solar, and biomass). This chart has the 2021 Estimated Energy Consumption (Quads), the Cost to Produce, and the Cost of Electricity. The purpose of this chart is to highlight the initial costs of fossil fuels and green energy, and the operating costs (or costs of creating electricity with each energy source). The Estimated U.S. Energy Consumption in 2021 Flowchart is what the Energy Cost Analysis is based on as far as the estimated energy consumption. These figures are on the next page.



	ENERGY COST ANALYSIS						
Type	2021 Estimated Energy Consumption (Quads)	Cost to produce	Date	Source #	Cost of Electricity	Date	Source #
FOSSIL FUELS							
coal	10.5	$37.48 Per ton	2021	1	$1.98 Per Million Btu	2021	1
natural gas	31.3	$3 Per Cubic Foot	2016	2	$.065 Per KWh	2011	2
petroleum	35.1	$43 Per Barrel	2020	3	$10.08 Per Million Btu	2021	3
RENEWABLE ENERGY							
Wind	3.33	$1,300,000 Per Megawatt	2021	4	$0		
Geothermal	0.206	$18,000 to $30,000	2021	5	$0		
Hydropower	2.28	$2,135 Per Kilowatt Installed	2021	6	$0		
Nuclear	8.13	$7,675 to $12,500 Per Kilowatt	2022	7	$0		
Solar	1.5	$100,000 For a Small System	2023	8	$0		
Biomass	4.83	$3,000 - $4,000 Per kW	2016	9	$0		
TOTAL	97.176						

Cost to Produce Sources

1 https://www.statista.com/statistics/183962/average-cost-of-coal-for-us-electricity-generation-from-2005/
2 http://naturalgassolution.org/natural-gas-affordable/
3 https://voltaoil.com/what-makes-up-retail-price-for-gasoline/
4 https://weatherguardwind.com/how-much-does-wind-turbine-cost-worth-it/
5 https://www.climatemaster.com/homeowner/news/geothermal-energy/geothermal-energy/2021-01-27-how-much-will-a-geothermal-heating-and-cooling-system-cost-for-my-home-in-2021
6 https://www.statista.com/statistics/799341/global-hydropower-installation-cost/
7 https://world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx
8 https://www.sunbasedata.com/how-much-does-it-cost-to-make-a-solar-panel-in-2021
9 https://www.energy.gov/sites/default/files/2018/11/f57/robi-biomass.pdf

Cost of Electricity Sources

1 https://www.statista.com/statistics/183992/average-costs-of-fossil-fuels-for-us-electricity-generation-from-2005/
2 https://www.brookings.edu/opinions/the-real-costs-of-u-s-energy/
3 https://www.statista.com/statistics/183992/average-costs-of-fossil-fuels-for-us-electricity-generation-from-2005/

One economic benefit of fossil fuels is, “at the start of this year, the oil and gas industry was responsible was responsible for 12.3 million American jobs,” (energy.gov). The fossil fuels industry supplies a huge amount of jobs to Americans and is an integral part of the job world. A couple more economic benefits of fossil fuels are; from 2012-2025, the fossil fuel industry is projected to bring in a federal/state tax revenue of about $1.6 trillion dollars and the domestic production of fossil fuels lowered the trade deficit by $305 billion lower than it would have been without it. It is very clear to see the economic impact fossil fuels bring to the American economy, therefore, they should not be gotten rid of completely.

Proposed Energy Transition (Analysis):

To recap, what is the proposed energy transition for the United States? The proposed energy transition for the United States is to go completely green (switch completely from fossil fuels to green energy) by 2035. This is 12 years away. Before getting into the recommendation of this proposed energy transition, it is important to note that in the 1800s, it took about 50 years to drop our wood energy consumption by about 30%. The proposed energy transition is suggesting that we will go from about 79% fossil fuel consumption as of 2021 (eia.gov, 2022), to 0% in 12 years. On the surface, this proposed energy transition sounds unrealistic. There are 6 major drawbacks of a complete green energy transition. These are economics, misconception, unreliability, efficiency, too much initial cost, and unemployment.

1. Economy - People are heavily invested in oil & gas and may be liable to a financial hit if gotten rid of.
2. Misconception - There is a misconception that going completely “green,” will eliminate pollution and waste into our air.
3. Unreliable - Bad weather or the sun not shining/the wind not blowing will limit how much electricity can be generated.
4. Efficiency - Fossil fuels are much more energy efficient. Fossil fuels are able to produce much more energy at its cost than green energy.

5. Too much initial cost - We could get investors to help with the transition however, it would cost roughly $62 trillion to go completely green.
6. Unemployment - Over 10 million jobs would be lost. That decreases the cash flow going into the economy.

These drawbacks would be detrimental to our economy and government and need to be taken seriously. We would need an energy transition plan that combats these drawbacks and helps eliminate the negative effects that would be caused.

Conclusion (Recommendation):

In conclusion, I think the plan to incorporate more green energy into our country is good, but overall the plan is not a good one. I don't see the realisticality of us making the largest energy transition ever, in 12 years. One reason is that we are currently in $31 trillion debt, we don't need to add $62 trillion to that number. I'm for green energy as it is good for the health of our planet, however, I am also for a successful economy with not as much debt. If we increase the nation's debt, we would be increasing inflation and we could have higher taxes which I along with all of America do not want. A list of main reasons this plan needs to be demolished and reworked are listed below:

- Unrealistic
- Needs more time to fully develop
- The economy and employment can't handle this detriment
- Too much debt
- Makes oil and gas companies look bad because the media makes them seem like they aren't willing to make this transition, when in fact this plan is unrealistic and they see that.

My recommendation is for the administration to meet with experts, fossil fuel companies (executives), and the Secretary of Energy to come up with a new plan. The following must be included in the new plan:

- Start time when our debt is below $20 trillion.
- The new goal year is 2050.
- Incentives for fossil fuel companies and their shareholders.
- A proper plan to transition our booming economy which is partially thanks to fossil fuels.

It is a good idea to incorporate more green energy consumption into our country, however, we need a good and realistic action plan of how to get there so that people get on board and that we can achieve this goal. It's important to note that for the United States, I believe it will be impossible to completely eliminate fossil fuel consumption.

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