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Alternative Energy: Vested Interest in the Power of Power

Joshua Pham

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Professor Zdravka Todorova

Department of Economics, Wright State University

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Joshua Pham

Wright State University

Abstract

Through the late 20th and early 21st centuries, the future of alternative energy within the United States has been uncertain and constantly shifting. However, as the 21st century has progressed, the path for alternative energy has began to solidify and certain patterns have emerged. This article addresses the dynamics displayed through a hybrid institutional-ecological/green framework to draw insights about the underlying causes for the paths these industries have taken.

Alternative Energy: Viable Solutions or Greenwashing

A key issue that plagues modern society, especially as the 21st century progresses, is climate change. With the increase of greenhouse gasses in Earth's atmosphere, solar radiation becomes trapped, resulting in increasing temperatures. This phenomenon and its resulting effects traditionally fall under the jurisdiction of environmental sciences. However, its widespread effects require heavily interdisciplinary analyses to understand the true consequences. Such analyses have become increasingly common as the issue of climate changes has become more prevalent in mainstream concerns. It is necessary to note the framework utilized for such studies, however, due to how this affects conclusions and insights resulting from differences in the very foundations of the analyses, such as the method of valuation.

For this purpose, this paper utilizes and institutional framework. This necessitates a sacrifice of some level of empirical analysis, relative to more mainstream Neoclassical analyses; however, this is made up for with its breadth and nuance. This means shifting away from price-centric models, which is not necessarily a negative, as many have critiqued them, namely Clarence Ayres who posited that there it is impossible to know nor measure wants, utility. Even by using price as an indicator of utility, there is no true measure of utility and the two are only conflated by theory.

Therefore, approaching this issue using an institutional lens provides the ability to unite the spheres of ecology, society, and economy. Ultimately this allows for an analysis that captures the embeddedness[1] of each of these spheres, rather than isolating them. Thus, this paper seeks to

[1] This term is used despite its critiques by individuals such as Hodgson, on the basis of its extremely broad and vague definition (2016). Here it will specifically refer to the interconnectedness of the spheres of ecology, society, and economy, as seen in Appendix A.

observe and create a comprehensive, cohesive assessment of the factors and effects of carbon emissions and climate change.

Carbon Emissions and Climate Change

This analysis begins in one of the most visible fields pertinent to the issue, the environment. First, however, clarification of economic framework for this study must be established. As is common within economics, there are a plethora of schools of thought which display inter- and intra-differences in methods and concepts. Three schools of though outlined by Cato, which specifically focus on environmental issues, are environmental economics, ecological economics, and green economics (2011). To simplify the relationship between these three schools of thought, they can be seen generally on a spectrum, ranging from most mainstream to most heterodox, respectively.

Environmental and ecological economics are largely dichotomous, utilizing similar concepts and tools, however, they primarily diverge regarding topics such as sustainability. Environmental economics largely takes on a neoclassical approach, relying on typical cost-benefit analyses and markets (Cato, 2011). This differs from ecological economics' shift away from neoclassical toward political economy. This introduces the schism deriving from how each school defines sustainability. Environmental economics takes on a stance of weak sustainability, through which manufactured capital can replace natural capital (Cato, 2011). This indicates technological advances brought upon by the economy can result in the production of goods and services that can completely replace what natural resources have been lost through an alternative substitute (Cato, 2011). This sharply contrasts the ecological economics approach of strong sustainability, where natural capital cannot be replaced by such manufactured capital (Cato, 2011). This is primarily rooted in the broader idea of ecology vs environment. In this, the

environment represents only one facet of the biosphere, neglecting the synergistic, interconnected factors of ecology. A basic example of this would be the ability to replace wood with plastics in manufactured goods. However, this does not mean the other functions of trees, such as shelter for animals, soil retention, and carbon sequestering can be replaced by such a simple substitution. It is all but impossible to fully understand the entirety of the roles each type of natural capital fulfills, and thus, it would be nothing short of hubris to claim the ability to create perfect substitutes for all of the capital's functions. Expanding upon this is the ecological economics finite view, compared to environmental economics' expansion-based view. As environmental economics sees technology as the driving factor for development, continual growth is attainable through the constant creation of capital. This is directly opposed by ecological economics' finite view, where the Earth is a closed system. Drawing upon concepts from other disciplines, as economics has since its inception, ecological economics relies on thermodynamics to convey its ideas. This utilizes a framework within the equivalent of the law of the conservation of energy and matter. This is particularly apparent in the use of entropy as an ecological concept. This differs from other economic uses of entropy, such as Hodgson's synthesis of entropy with evolution as a means to study production (2016). In this ecological context, entropy is visualized as a monodirectional flow of an hourglass (Cato, 2011). As natural capital is consumed and transformed, it shifts from low entropy to high entropy; thus, when it becomes high entropy it manifests as waste (Cato, 2011). This waste is unable to be recycled, or returned to a low entropy state, without the use of high levels of energy, resulting in the creation of further waste (Cato, 2011). This further solidifies the divergence of thought between the two schools, environmental economics and ecological economics, due to the difference in understanding of finiteness of resources.

Green economics differs from the two prior schools due to its radical foundations, firmly rooted in political economics. Unlike ecological economics, which sits as a halfway point between environmental economics and green economics, the neoclassical tools and valuations are wholly rejected. This is derived from the fundamental shift of economic goals from maximizing utility and welfare to a focus on wellbeing. This utilizes the concept of holism, which promotes the interconnected view of the spheres of the economy, polity, and environment (Cato, 2011). This once more brings about the concept of embeddedness discussed prior, which is unsurprising given its pervasiveness in heterodox economics. This commonality of embeddedness provides the foundation for the framework used in this analysis, acting as a nexus for the various economic schools of thought whose concepts and tools will be utilized in conjunction with each other to provide a more wholesome view of the issue at hand.

With the establishment of the foundation for the analysis, the issue can now be broken down and dissected using the proper tools. For the sake of conciseness, this paper will narrow the issue of climate change to the confines of the United States during the 20th and 21st centuries. Though many other countries in the world have carbon emissions rivaling the United States, these countries are typically large, developing countries and their emissions are primarily industry based, making the pollution per capita far smaller than the United States'. Therefore, the United States is a prime candidate of study, as their emissions levels per capita can be used as the upper limit benchmark an extrapolated onto other countries to estimate their possible emissions at an equal developmental level as the United States. The next step of analysis requires the sources of greenhouse gas emissions to be divided and examined.

Sources of Greenhouse Gas Emissions

In 2017, greenhouse gas emissions by sector, were 29% for transportation, 28% for electricity, 22% for industry, 12% for commercial/residential, and 9% for agriculture (See Appendix B) (EPA, 2017). Thus, transportation and electricity combined make up more than half of the greenhouse gas emissions for the United States. These share a commonality of fossil fuel usage for energy production, which largely accounts for their respective harmful emissions.

Electricity

With the necessity of electricity's permeation throughout all walks of modern life, particularly for the United States, it is no wonder it is the second most emissions heavy sector in America. The primary forms of electricity production rely on fossil fuels, nuclear energy, solar power, and wind power.

Fossil Fuels

The primary fossil fuels for electricity production in the United States are coal and natural gas. Given America's long-standing coal mining industry and eventual shift to fracking, in an attempt to combat foreign control of oil, the incentives behind the use of these energy sources is quite obvious. Given the extremely high fixed costs for entering this industry, monopolies and oligopolies inevitably emerge and gain hegemony through the lucrativeness of this business. Therefore, the combination of sunk costs via the investment into fixed costs and high propensity for profit create strong vested interests for the firms within the industry. Such vested interests are rooted within the Veblenian dichotomy. This can be analyzed twofold, as Veblen applied his dichotomy concepts to varying levels. On the most macro level, this can be divided between instrumental and ceremonial. In this, instrumental factors are the functional aspects while the ceremonial are fripperies. This is not to say, however, the ceremonial does not

hold purpose, but rather, their use is more convoluted. Technology functions as a medium of change within this framework, typically originating within the instrumental and eventually transforming to the ceremonial.

Brazelton, Sturgeon, and Weinel's story of "The Ancient and Honorable Order of Flintworkers" provides an allegorical view of this interaction within the Veblenian dichotomy (see Appendix C) (1993). This, therefore, can be extrapolated to show the key connection for vested interest within the fossil fuel industry. The clearest case study that exemplifies this is that of gasoline. Prior to the creation of the internal combustion engine, the refinement of oil was purely a method of obtaining kerosene. This meant the other byproducts of the process were disposed of as a useless byproduct. With the introduction of new technology, these alternative fuels became increasingly valuable, slowly beginning the shift from instrumental to ceremonial. Thus, the functionality of these firms begins to wane over time with the introduction of new technology. Before they are replaced, however, they use their hegemonic power to create barriers and secure their position. This manifests in the firms' lobbying, resulting in further prevention of alternative, more efficient technologies that would fill the same niche while increasing total wellbeing. Drawing parallels between the case study of gasoline and the allegory of the flintworkers, the primary parties can be paired where the oil companies are coupled with The Ancient and Honorable Order of Flintworkers and alternative (green) energy is coupled with the young man with the bronze knife. Thus, the first pairing represents the ceremonial faction with vested interest in holding on to their position of power; while the second pairing represents the instrumental faction, which tries to increase total wellbeing through the introduction of technology.[2] Here, the use of myth, legend, and traditions functions as the primary tools utilized

[2] It is important to note here that the introduction of new technology is not always a positive, the way portrayed here. Instead, it is presented in this way as it most easily represents the dynamic occurring. Thus, this

by the ceremonial faction to maintain their hegemony. The way the use of these tools manifest between the allegory and case study differ based upon the social setting each occurs within. For the allegory, The Ancient and Honorable Order of Flintworkers hold positions of governmental, religious, academic, and business power, which enable them to utilize their authority over institutional matters, reaching the point of invoking their god's will to justify their actions and authority. In regard to the case study of oligopolistic oil firms, they clearly lack the religious sway seen among the flintworkers, however, their mass wealth gives them the ability to utilize government lobbying and marketing, as touched upon previously. This works to threefold effect, at the highest level resulting in legal policy that favors the oil firms and disadvantages the substitute technologies, allocation of governmental funds that mirror this same sentiment, and a firm push for consumer preferences toward consumption of goods and services that benefit the oil firms.

This leads to further explanation of the phenomena via the second layer of the Veblenian dichotomy, industry vs. business. This follows the same logic as the prior dichotomy; however, this is further specialized to analyze production and its related functions. Under this framework, industry mirrors the aspects of the instrumental and business mirrors the aspects of the ceremonial. Thus, industry is primarily concerned with production maximization as to maximize total societal wellbeing. Inversely, business is solely interested in the amassing of pecuniary value, often at the expense of productive efficiency. This leads to Veblen's concept of sabotage. McCormick quotes Veblen's definition of sabotage which is, "[a] conscientious withdrawal of efficiency" (2010). Applied to this case study, this does not necessarily mean a withholding of

monodirectional movement toward human betterment should not be assumed as a universal truth, but rather, as an explanation of the dynamics occurring within this specific scenario.

possible oil production[3], but rather, a stymying of internal funding of alternative fuels. Though investment into research and development of such fossil fuel alternatives would satisfy industrial goals of increasing total energy source output, this contradicts the business side by cutting into current profits related to the near monopolistic holdings on the energy market, yielding a considerable amount of power in influencing prices and thus profits. To simplify, in neoclassical terms this would have a similar appearance as a deadweight loss induced by market failures.[4] These insights regarding the case study of oil firms is not purely limited to this partition of fossil fuel manufacturers as they all share similar backgrounds and incentives; therefore, these observations can be extrapolated across the sector.

Transportation

Relying on energy production, much like the electricity sector, a similar set of options present themselves. Of these, fossil fuels have played a leading role, as is expected with the inevitably technology spillover between sectors and the development of institutions that permeate other sectors of the economy. This being said, however, there is an additionally large industry within this sector that has its own vested interests. This industry is comprised of vehicle manufacturers and, for the sake of this analysis, will be narrowed to land transportation.[5] From this point on this will be captured by the umbrella term of the automotive industry. Though the automotive industry's vested interest, or going concern[6], are not identical with that of the oil industry, they have been largely inextricably intertwined within the current era. This

[3] This route of analysis can be pursued however it does not fall within the scope of this study.
[4] This connects back to neoclassical economics; however, this does not utilize the same tools and analyses. This is purely a simplification of the concept to allow for clearer synthesis.
[5] Once more, the insights from this can be extrapolated out to the industry as a whole.
[6] Going concerns "include households, business enterprises, states, global institutions, and other organizations that are interested in continuity of their existence and social activities over time – viable association." (Todorova, 2014). Thus, going concern is a more favorable term within this context as it is more concise, due to its greater pertinence within the industry-business Veblenian dichotomy; this can be attributed to its connotation of continuation and self-reproduction of the business.

interconnectedness stems from the complimentary nature of the goods both industries provide, with each relying on the production and sale of the other. Therefore, this conjoins their going concerns through a mutual desire for continuation and longevity. Though alternative energy vehicles have been viable far longer than they have been produced, they were not pursued in favor of maintain the status quo with gasoline and diesel engines. This was a twofold decision, firstly to appease their oil producing partners with whom they formed close ties economically and socially, and secondly to avoid further investment into research and development that would reduce short-term pecuniary gains through an increase in fixed costs.

The combined efforts of the oil and automotive industries formed an unassailable bastion of institutional power and authority that remained unopposed for decades. As is inevitable with the existence of technology, even these apparently impervious positions are untenable in the long run. In this case, the ever-growing research into climate change, initially termed global warming, lead to the eventual mainstream acknowledgement of the issue and a push for changes in consumer preferences. The resulting dynamics of this shift in zeitgeist are not as simple as most suspect, as will be seen in the following sections.

Fossil Fuel Alternatives

With the large consumer shift towards environmentally friendly, or green, products and services, both the oil and auto industries began to see their long-term probabilities for survival greatly diminish. This necessitated a multileveled shift in strategy, moving away from promoting the current product toward rebranding their image and investing in green technologies. This falls in line with their going concerns of continuity and pecuniary profit maximization. More specifically, this highlights how these industries' going concerns are not necessarily inextricably tied to their industries, but rather, to the firms within it. Delving deeper into this, an individual

firm can essentially shift industry as its going concern is for the firm itself to survive, not necessarily the industry as a whole. The firm and industry's going concerns only overlap as long as the firm is within the industry or fundamentally tied to it, as seen with the interconnectedness of the oil and automotive industries. Therefore, if a firm chooses to shift industries as a means to ensure its survival, its going concerns shift with it, possibly losing their connection to the going concerns of the prior industry.

The issue introduced by the evolution of these firms is apparent in the continued hegemony of those holding authority through the ceremonial aspect of the Veblenian dichotomy. This means the introduction of the third party that would typically come to replace the preexisting intrenched institutions is instead absorbed, resulting in further replacement of industrial values with business ones. This translates to both stunted growth of the new industries during the transitional period and overinvestment into less efficient industries. These negative factors will be explored more in depth below.

Electric

As discussed prior, pertaining to the electricity producing sector, there are various viable energy sources for producing power. Sans fossil fuels, the other forms of electricity production using nuclear energy, solar power, and wind power are all considered environmentally friendly, green energy. Each of these have their benefits and drawbacks, however, with their environmental costs manifesting in different ways. According to 2008 data, the CO_2 footprints of these different forms of energy production, in grams of CO_2 per kilowatt-hour, were 1050 for coal, 443 for gas, 288 for nuclear, 32 for solar, and 10 for wind (Gore, 2009).[7]

[7]Reported here are the upper limits of the reported range, see Appendix D for full figure with ranges.

Cleaner Coal

The first alternative option is not truly an alternative at all, which is the shift of coal to "clean coal." This relates back to the evolution of fossil fuel firms through their attempt to not only shift industries but also reform their image (Smith, 2009). The two primary ways coal producing firms have chosen to reform their image is through the shift from low grade to high grade coal, as well as the utilization of coal scrubbing (Smith, 2009).

Shifting Coal Types. Coal is graded based on its quality, pertaining to its efficiency and cleanliness when burned. Low-grade coal is filled with impurities which result in higher levels of pollution as these are not burned off. Additionally, these result in lower temperatures. Inversely high-grade coal contains less impurities and burns at higher temperatures. This provides a simple solution, yet restricts the supply of coal, given only high-grade coal is preferable. This can result in negative outcomes such as the cost of high-grade coal outweighing the benefits for users of coal, resulting in it failing to be widely adopted. This is remedied, however, through the introduction of cleaning the coal using K-Fuel (Smith, 2009). This is the process created by the company Evergreen Energy that pressurizes and heats the coal to remove impurities and convert low-grade coal to high-grade (Smith, 2009).

Scrubbing Coal. While reducing impurities and increasing the efficiency of coal by shifting from low-grade to high-grade reduces the pollution associated with the use of coal, many of the primary greenhouse gases associated with the use of coal remain (Smith, 2009). There are various ways scrubbing can be accomplished, given it has developed an industry of its own, yet they typically function off of mechanical or chemical processes to neutralize and remove the greenhouse gasses created by the burning of coal.

The issue that remains, however, is the still massive carbon footprint left when coal is continued to be utilized. Cleaning coal only shifts the carbon footprint of coal from 1,050 grams

of CO_2 per kilowatt-hour to 966 grams of CO_2 per kilowatt-hour (Gore, 2009). This remains substantially higher than the remaining alternatives, over three times the amount produced by nuclear (Gore, 2009).

Nuclear Power

Nuclear energy reached the forefront of alternative energy in the late 20th century, yet it has already begun a rapid decline by the time of the 21st century. This typically attributed to the perceived danger of nuclear power, due to major disasters such as the Three Mile Island incident, nuclear meltdown at Chernobyl[8], and Fukushima Daiichi disaster, as well as the possibility of weaponization of nuclear power by foreign countries.[9]

The true reasoning behind nuclear energy's falling out of favor, however, is primarily tied to its costs. The initial costs to manufacturer nuclear power plants is exorbitant given the safety precautions required exceeding other forms of energy. Additionally, the disposal of the nuclear waste, once the radioactive material has been depleted, is both expensive and environmentally hazardous.

Furthering these costs, the water consumption of nuclear power is significantly higher than the next largest, coal, with a range of 445-870 gallons per megawatt-hour and 330-550 gallons per megawatt-hour, respectively (see Appendix E) (Gore, 2009).

[8] Such beliefs are captured by the availability heuristic, given their massive impacts. Thus, they heavily impact individuals' opinions on nuclear power, regardless of the actual probabilities such events would typically occur.
[9] Though such possibilities of weaponization are a foreign threat much more than domestic, the prevalence of certain energy sources are largely determined by global viability of the method, given the high fixed costs for initial research and development.

Solar Power

One of the alternative forms of energy that has made massive leaps and bounds in development and mainstream adoption is solar energy. This in itself can be subdivided in two primary categories, concentrated solar thermal (CST) and photovoltaic (PV), each of which has its individual strengths and weaknesses.

CST. CST is a liquid based energy sources, similar to nuclear or fossil fuel, in its use of heat to convert the liquids to vapor which powers generators (Gore, 2009). Though CST benefits from requiring only the passive heat from the sun, it suffers from the need for large quantities of water, much like the prior methods. This additionally suffers from its efficiency being directly related to location. By requiring large areas of land that receive substantial amounts of sunlight, they often must be located in areas far from where their energy is most needed. This results in a bottle neck due to infrastructural inefficiencies in the existing power grids.

PV. Unlike CST, PV doesn't rely on the sun to heat water but instead directly converts sunlight into energy. This is done by utilizing the photons in solar radiation to free electrons within the PV cell, resulting in the electrons exiting the PV cell as electricity (Gore, 2009). PV's primary efficiency benefit is that it does not require economies of scale in the same manner as CST. This translates to a more viable, wider adoption of PV solar energy, as it can be scaled down for individual consumers. Unfortunately, much like CST, PV suffers from higher costs in comparison to traditional fossil fuels. This is offset, however, by a cost reduction curve which weakly mirrors Moore's Law, which indicates "regularly produced sharp reduction every 18 to 24 months in the cost of computer chips." (Gore, 2009). This is due to constant refinements in production through innovation. Such cost reductions do no occur with CST, however, due to

CST's heavier reliance on production inputs used to create the CST solar farms rather than increases in technological efficiency (Gore, 2009).

Wind Power

Much like solar power, wind power is heavily locationally dependent in regard to efficiency. Wind power is technically a subsect of solar energy, due to the direct effects of the sun's heat on airflow (Gore, 2009). However, they are semantically different as the methods used to harness the suns power significantly vary. Wind power and solar power have grown similarly throughout the 2000s, however, their growth patterns have begun to diverge. With wind power's similarity to CST solar power, pertaining to the infrastructural shortcomings, it has been heavily localized to areas where consistent winds occur. This has been paired with increasing maintenance costs and disposal, as the blades are not recyclable (Martin, 2020). As the blades are made to be extremely durable, breaking them down is not viable. Martin quotes Bob Cappadona in saying, "The wind turbine blade will be there, ultimately, forever," (2020).

Biofuel

The final energy alternative to fossil fuel left to be discussed here is biofuel. This can be broken down into four generations, each substantially differing in makeup and efficiency.[10] Discussion of biofuel under the framework created for this analysis contains a specific dynamic as interindustry interactions causes further alignments of vested interest and policy outcomes. This specifically refers to the entrenchment of first-generation biofuels, regardless of their relative inefficiencies and shortcomings, due to the vested interests of farmers. With the United

[10] A deeper analysis of these biofuels can be explored in Decoupling or Derailment: Environmental Sustainability Through Biofuel (Pham, 2017).

States largely starting as an agrarian society, the farmer has been the backbone of the country for innumerable decades. Despite industrialization, the agricultural industry has been fully woven into the ceremonial aspect as it has been tied to the very essence of the American identity. Through this, the agricultural industry holds sway over policy through tradition, something easily identified through the mass subsidies of agricultural goods. Thus, with the introduction of ethanol fuel, farmers were elated by the mass increase in demand for corn. This provided farmers with a boon of profits, incentivizing their support for this first-generation biofuel. The drawback to society, however, was the shift in usage of arable land. With production that once was allocated to food being repurposed for fuel, the price of corn increased. This ultimately translates to a misallocation of resources to fulfill business concerns rather than industrial concerns. This is worsened by the opposition to alternatives, namely the subsequent generations of biofuel. The harm this imposes is further magnified when observing the additional effects of later generations of biofuel, such as replenishing of soil and sequestering of CO_2 (Smith, 2009; Gore, 2009; Dutta, Daverey, & Lin, 2014).

These dynamics further highlight the continued ongoing of institutional evolution and the consistent social and productive inefficiencies linked to the ceremonial actions taken, based on vested interest.

Conclusion

The dynamics observed through the Veblenian dichotomy can be consistently observed throughout time. The effects of these dynamics are more clearly observed when an institutional framework is synthesized with an ecological/green framework, utilizing tools from both schools to properly understand the impacts that occur within all three embedded spheres of life. Under this context, the gradual evolution of energy alternatives to fossil fuel can more easily be

observed and the effects of the adoption of these technologies can be more clearly understood. Vested interest will continually hinder social, economic, and environmental efficiency within these energy related sectors, however, by drawing insights from how this occurs, combating these efficiencies becomes possible. Though this article cannot provide an in-depth enough analysis to fully weigh the costs and benefits related to each of these alternatives, it lays the foundation for a fuller assessment.

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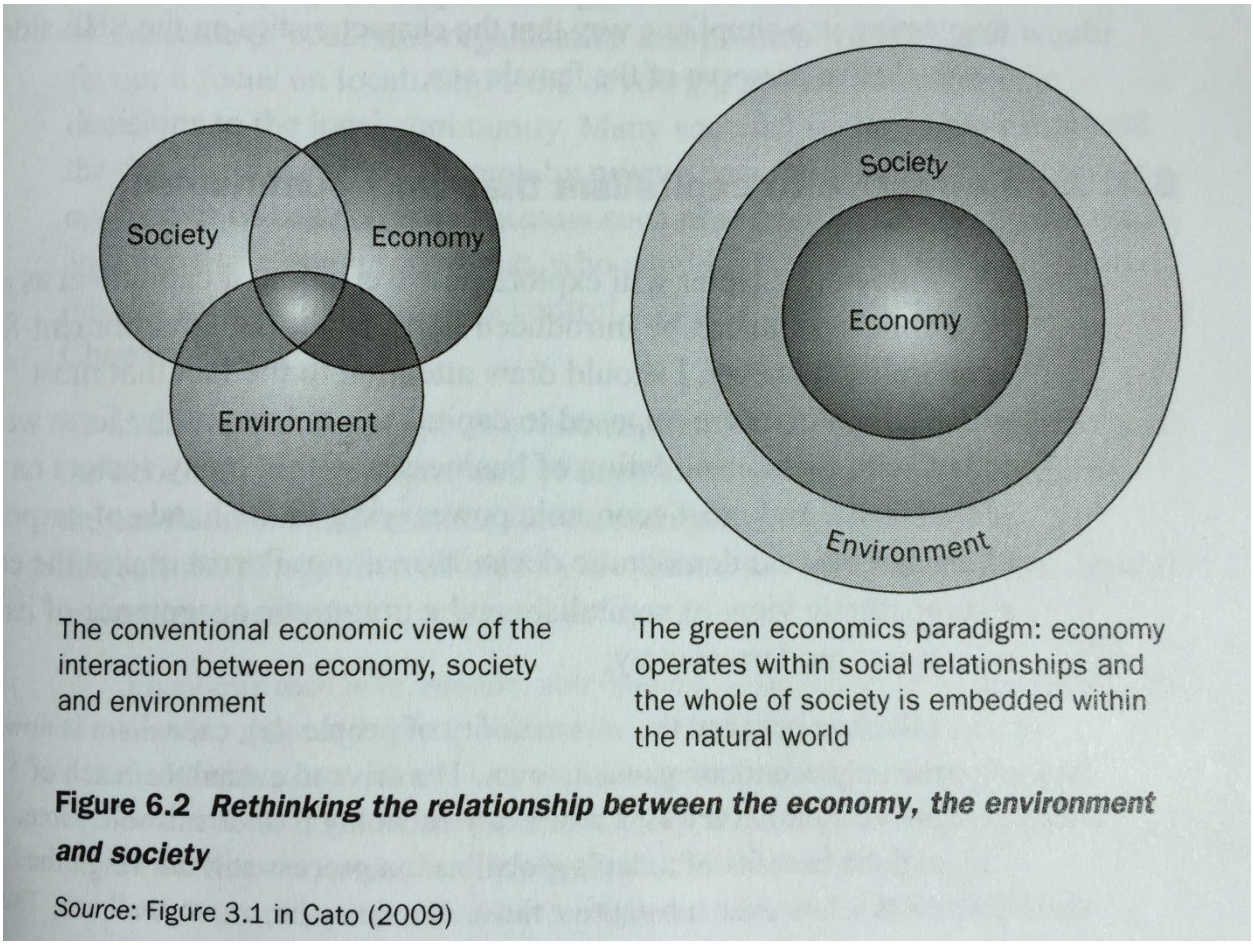
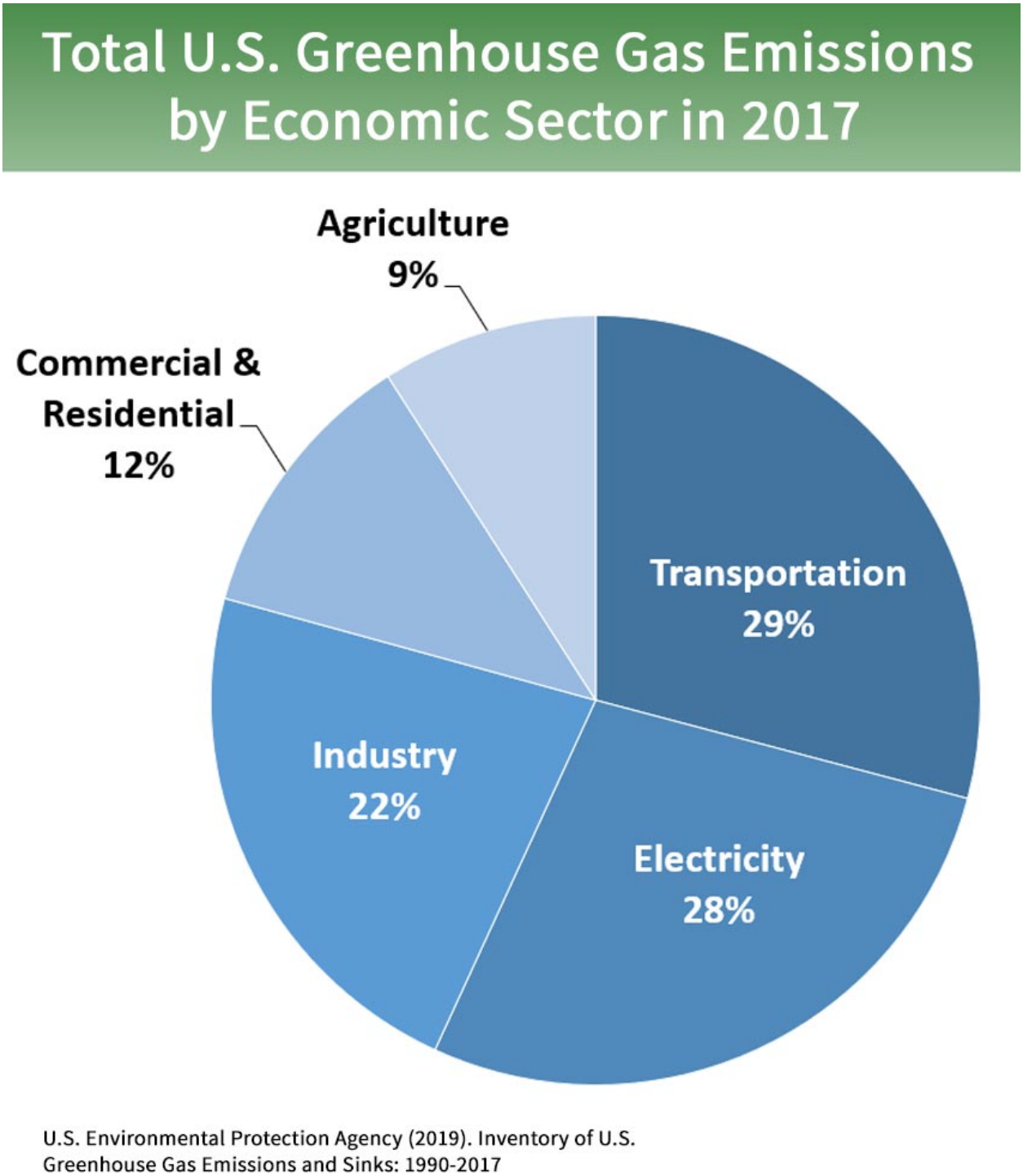
Appendix A



Relationship Between the Economy, Environment, and Society (Cato, 2011, p.89)

Appendix B



Total U.S. Greenhouse Gas Emissions for 2017 Divided by Economic Sector (EPA, 2019)

Appendix C

"There is a folk tale of an ancient jungle community that may help us understand these gales of creative destruction. According to this legend, a long, long time ago there was a community in Mother-jungle which our anthropologists call the Kingdom of Moo. There lived a homogenous people with a just code of laws, pleasant social customs, and a virtuous economic system.

Further, the cultural borders of Moo were strong and well defended. By order of the Great God Chubu, each man stood to his place on those borders and no one yearned for the flesh-pots of the rich neighboring Kingdom of Lem.

One night a young man of Moo built a fire against a claybank. The next morning in the ashes of his fire he found a stone – wonderful beyond description. We call it bronze. When warm it was soft and could be molded and sharpened into implements such as no man had ever imagined. When it cooled those implements quite magically became hard and tough.

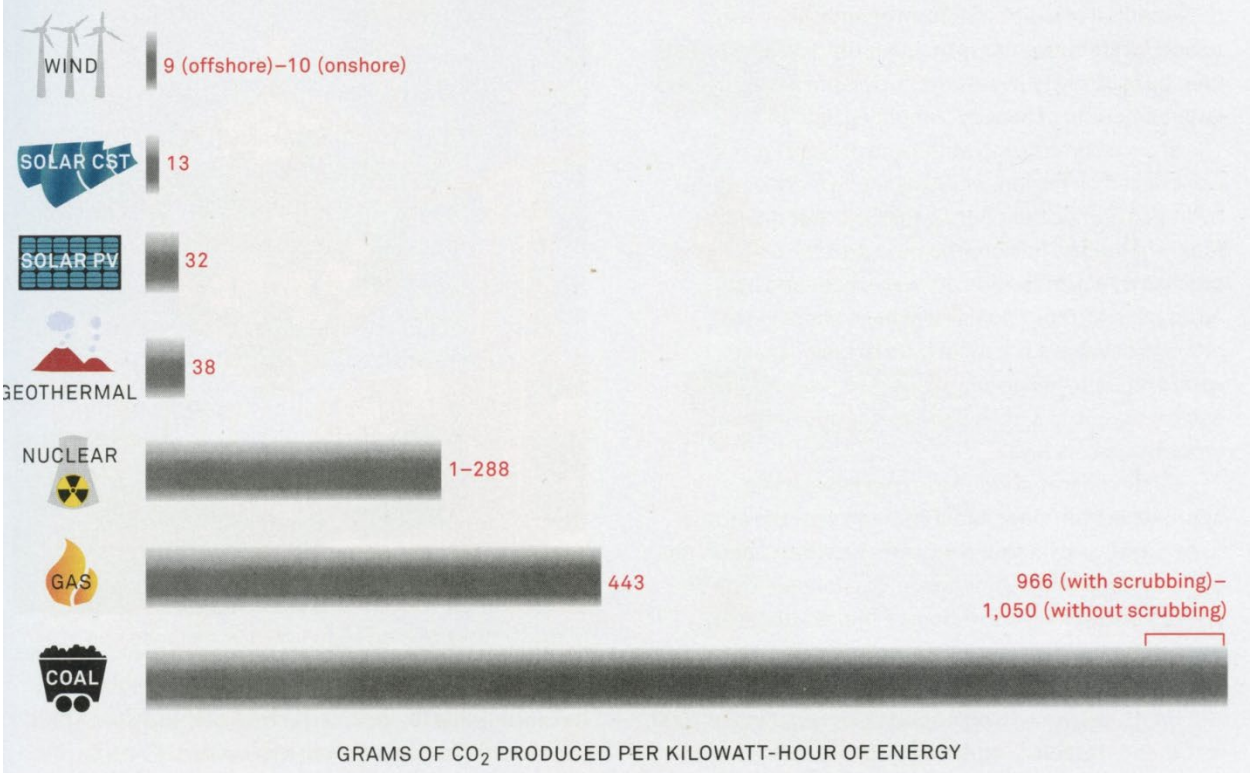
The young man made himself a bronze skinning knife and brought it back to the Great Council of the Kingdom of Moo. He said, "See what I have done. With this we can shatter the border of Lem. We can conquer the whole jungle. We can produce our food and clothing and shelter with one-tenth the number of wives it has required heretofore."

However, you see, there was in Moo a club, known as the Ancient and Honorable Order of Flintworkers. Its members owned all the good flint beds. Only they knew the ancient craft of chipping flint to spear point, arrow head, and skinning knife. Further, they were the important people in Moo. One was president of the First National Bank, one was secretary of the Chamber of Commerce, another was Grand Mogul of the Moovian Rotary Club, another, Business Agent of the International Brotherhood of Flintchippers. Still another was High Priest of the Temple of

Chubu, one was Patriarch of the Moovian Association of College Professors, and three were on the Board of Regents of the University of Moo. They did not like new-fangled notions!

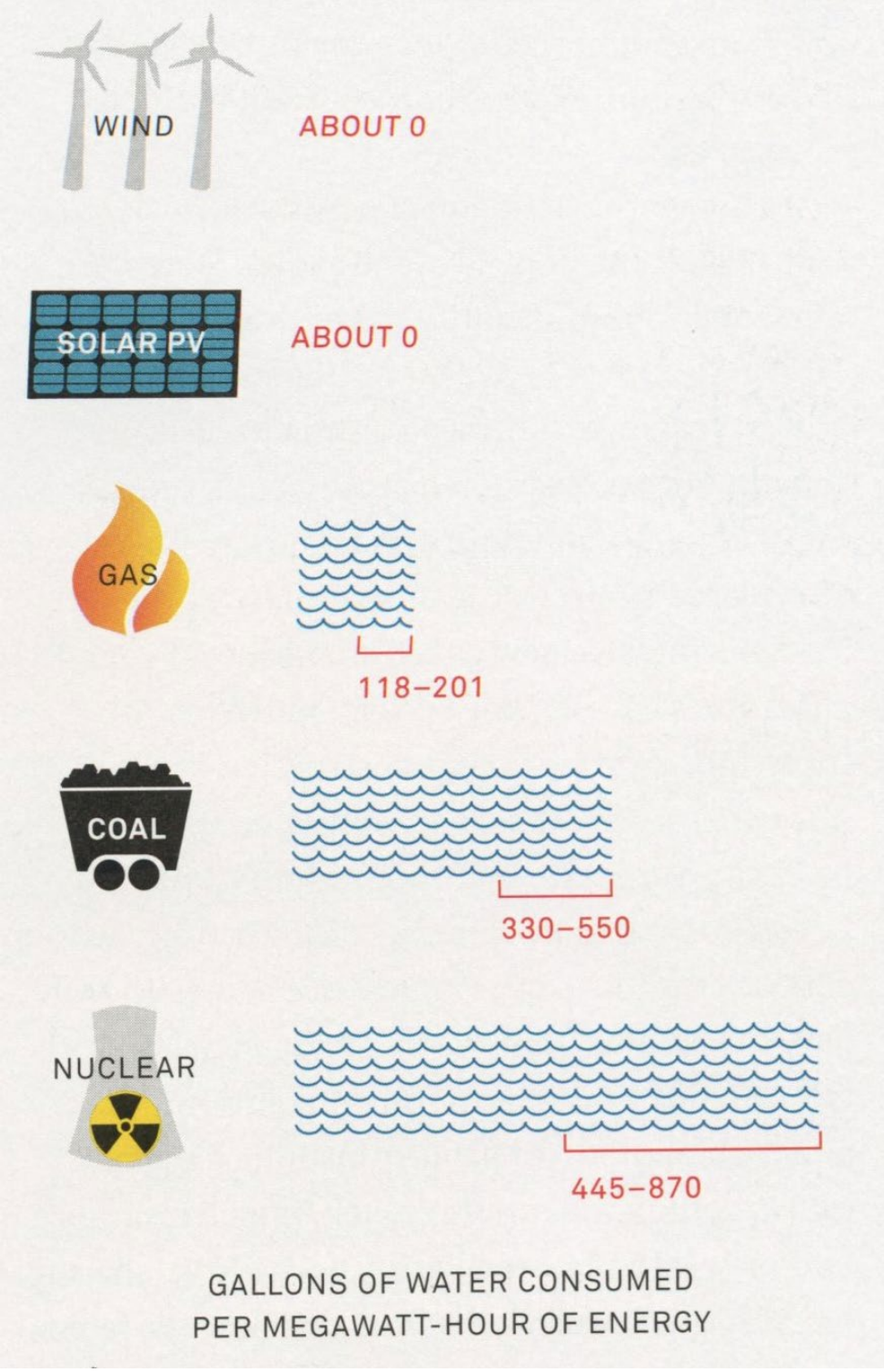
So the Unmoovian Activities Committee seized the young fellow, used the bronze skinning knife on him, and threw him into the sacred volcano to appease the wrath of Chubu. The ancient script records that the Great Court characterized that bronze knife as a Subversive Influence. How right they were! They should have thrown it into the volcano with its inventor." (Brazelton, Sturgeon, and Weinel, 1993).

Appendix D



CO_2 Footprints of Varying Power Sources (Gore, 2009)

Appendix E



Water Usage of Varying Power Sources (Gore, 2009)