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The All-You-Can-Eat Economy: How Never-Ending Economic Growth Affects Our Happiness and Our Chances for a Sustainable Future

Eric Wilson and Phalguni Mukhopadhyaya *

Department of Civil Engineering, University of Victoria, Victoria, BC V8P 5C2, Canada; ewwilson@uvic.ca
* Correspondence: phalguni@uvic.ca

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Abstract: This paper explores the relationship between energy consumption, economic growth, and life satisfaction and makes the case that economic growth as usual is no longer a desirable or sustainable policy goal. Historically, economic and social development go along with energy sector transformation and total energy use. As a country develops, its use of energy increases, resource consumption increases, population booms, life expectancy rises, and overall socio-economic outcomes are improved. One might deduce then, that life satisfaction is also tightly correlated to economic development and energy consumption, but is this the case? To answer this question, current academic literature and data on the relationship between energy consumption, GDP, and quality of life were explored. The review showed a weak relationship between GDP and quality of life, a saturation relationship between energy use and social returns (social returns increase with increasing energy use to a point), and a strong relationship between GDP and energy use. There have been high hopes that improvements in energy-efficient technology will reduce global aggregate resource consumption, however, there is a growing body of research to suggest the opposite is likely to occur due to "rebound effects". The major environmental issues of our time have been seen predominantly as issues to be solved through advancements in technology; however, it is the argument of this paper that they cannot be addressed from a purely technological standpoint. Of course, improving energy efficiency is an important factor, but we must not forget the equally important subject of human behavior and our addiction to continual economic growth. We must first address the human desire to consume resources in the pursuit of happiness and socio-economic status, and shift towards a mentality of sufficiency. Future research must demonstrate concrete examples of sustainable development and consumption, advance the discourse on how the individual can be part of the solution, and empower the implementation of sustainable government policy.

Keywords: planet; consumption; socio-economic; energy; sufficiency; sustainability; climate

1. Introduction

For many, it is hard to imagine a life without access to reliable energy. One only needs to experience the habitual flicking of a light switch during a power outage to realize it is inseparably integrated into our daily existence. Many of us have had the experience of preparing a home-cooked meal only to have the power go out with dinner half cooked in the oven. In vain desperation, you consider for a moment that you could use the microwave instead. It is evident that access to electricity is necessary for life in the western world. The phrase "necessary for life" might be best explained by considering a passage from Henry David Thoreau's *Walden*:

> *"By the words, necessary of life, I mean whatever, of all that man obtains by his own exertions, has been from the first, or from long use has become, so important to human life that few, if any, whether from savageness, or poverty, or philosophy, ever attempt to do without it [1]".*

For the western world, electricity falls into this category. At some point in our history, we developed the ability to harness the power of fire, steam, rivers, and the atom itself for the obtainment of our own comfort. Now, through "long use" electricity has become so important to our existence that the thought of doing without is enough to force us to pause, shudder, and, for a moment, become grateful for our circumstances (quite often only for a moment) before we are once again swept away by the business of a consumption-based life. Electricity has in no small part afforded us the opportunity to relieve our minds from the constant thought of survival. We do not have to worry ourselves with the tasks of gathering fuel and food, creating shelter, etc . . . We are free to dream, self-actualize, and focus our energy on developing vibrant economies, social lives, and enterprises.

Historically, the growth of energy consumption has fueled human development [2]. As a country develops, its use of energy increases, resource consumption increases, population booms, life expectancy rises, and overall socio-economic outcomes improve. It is well established that energy and resource consumption is tied very closely with economic activity [3], and that social performance is higher in countries with greater per capita resource use [4]. One might deduce then that life satisfaction is also correlated to economic development and energy consumption, but is this the case? To answer these questions, current academic literature and data on the relationship between energy consumption, GDP, and quality of life are explored. The western world industrialized during a time where many practices, such as long working hours [5], stagnant wages for increased labor [6,7], and child labor [7,8], would today be seen as grievous violations of human decency. During the Industrial Revolution the environmental implications of large-scale industrial expansion and the energy sector's transition towards the use of fossil fuels were not as well understood as they are today. Built on the backs of the working class, there is no question that the economy that emerged during the industrial revolution ushered in an era that drastically changed the quality of life for many parts of the western world in the years to come. With today's perceptions of human rights and our knowledge of the environmental impacts of pollution and carbon-emitting energy sources, countries industrializing in the 21st century must not repeat the same ethical and environmental mistakes of the past.

2. Socio-Economic Development, Economic Growth, and Energy Use

The correlation between energy consumption and the welfare of a country is a well-discussed topic [2]. There is a general agreement in the literature that a certain amount of energy consumption is a fundamental requirement for the economic progress and social development of a country [2]. Economic growth is a primary policy goal of most governments, with an expectation that the economy should grow by between 2% and 3% per year [3]. For the majority of human history, the size of the global economy safely existed within the boundaries of the biosphere [3]. However, due to the rapid increase in the human population, industrialization, and the emergence of an energy sector dependent on fossil fuels, this is no longer the case. In the last 100 years, the population has increased from about 1.5 billion to 7.8 billion. During the same time (due to economic progress and technological advancements) the average global GDP increased from $4.01 T in 1900 [9] to $85.9 T in 2018 [10] (values given in 2020 USD), an increase of 21.4 times.

To illustrate the relationship between energy consumption and economic development, consider the example of the People's Republic of China. Since 1955, China has undergone an economic transformation. This is evident in the exponential change in the national GDP in that same time period, as shown in Figure 1. Below (it is compared to that of the USA for reference). Assuming energy use and economic growth are tightly coupled, one might expect that the energy demands of China significantly increased during this time frame, and indeed they did. In 1973, China's total energy consumption was 363 Mtoe (megatonnes of oil equivalent [11]). In 2009, they surpassed the USA as the largest consumer of energy in the world. By 2015, China's energy consumption grew to 2.0 Gtoe

(gigatonnes of oil equivalent) [11]. Further illustrating the relationship between energy consumption and GDP, we see decreases in both the GDP and the energy consumption of the United States during the 2008 housing market crash. Since 1973, the US economy has grown with little change to overall energy consumption, possibly due to the practice of exporting manufacturing processes overseas. This creates a "virtual decoupling" between energy consumption and GDP. Virtual decoupling between energy use and economic growth occurs when a high-income country outsources industrial production to lower income countries, thereby relying on foreign energy use to satisfy their own consumption of goods and services [2]. It is also interesting to note that in 1979 trade relations between the US and China were re-established, giving rise to a rapid growth of trade between the two nations: from $4 billion in 1979 to over $600 billion in 2017 [12].

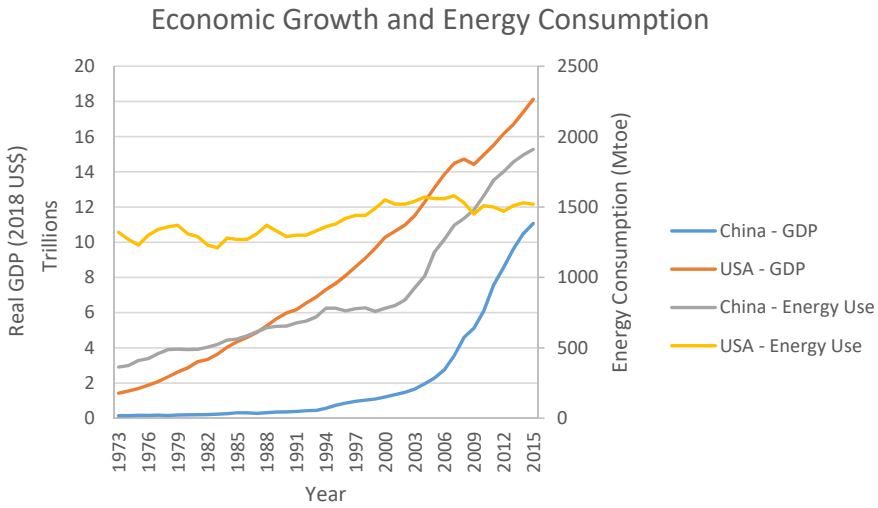

Figure 1. National GDP for China and the USA [13]. Mtoe—Megatonnes of oil equivalent.

2.1. Economic Growth as Usual Is not Sustainable

The pursuit of never-ending economic growth results in economies that are degenerative- exploiting the planet upon which human well-being fundamentally depends [14]. Our consumption-based economy creates a complicated paradox where economic development and environmental sustainability are at odds. We desire to bring the less fortunate out of darkness and into our standard of living, but if seven billion people were to live in the same way as we do in the global north, we would outstrip the Earth's ability to support humanity, requiring up to six earths to provide the resources to sustain this standard of living [15]. As countries, we aim to reduce our pollution emissions then export our manufacturing overseas, passing our emission problems to others [2].

The Environmental Kuznets Curve hypothesis (EKC) proposes an inverted-U-shaped relationship between pollutants and per capita income. That is to say that environmental pressure quickly increases at the early stages of economic development and improves in later stages and slows down relative to GDP growth at higher income levels [16]. The practice of outsourcing energy consumption (and pollutant emissions) could, at least on the surface, seem to support the EKC hypothesis. However, there is no agreement in the literature about the income level at which environmental degradation begins to improve. There are increasing grounds to be cautious about the EKC hypothesis and related policies [16]. There is ongoing debate about the validity of the EKC hypothesis [17,18]. The EKC hypothesis may be validated in the transition to cleaner energy sources [17]. However, it is also noted that there may be a behavioral component at play [17], suggesting a confounding factor. It is possible that validation of the EKC hypothesis occurs in situations where rising GDP occurs in tandem with changing societal mindsets around environmental issues and is not solely linked GDP growth as the hypothesis postulates.

The issues of climate change and resource consumption have been largely seen as engineering problems, but in reality, they are as much technological issues as they are social issues. An interesting fact about natural resource use is that we tend to consume more as our process efficiency improves, not less. This is an unnerving thought as there has been a focused effort on reducing energy consumption through efficiency measures. Recently, the United Nations and International Energy Agency (IEA) stated that energy-efficient technologies will play a major role in the goal to reduce global energy consumption by 30% [19]. However, there is a well-established phenomenon known as Jevon's paradox (or rebound effect) that shows an increase in overall energy consumption following an energy efficiency improvement [20], not a decrease. Increasing energy efficiency may not a reliable means of reducing energy consumption in isolation. Human behavior has to be considered.

In 1849, the British economist and philosopher John Stuart Mill expressed his concern for the environmental consequences of economic growth in 1848, stating: "I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it" [21]. Our current economic model is driven by an insatiable need to consume energy and resources to satisfy our economic aspirations. This is an inherently unsustainable mentality. If left unchecked, the compulsion to consume will lead to economic collapse as global resources are depleted and biospheric boundaries are exceeded. Johan Rockstrom suggests nine planetary boundaries that jointly define a safe operating space within which current planetary conditions must be maintained: climate change, biodiversity loss, nitrogen and phosphorus cycles, stratospheric ozone depletion, ocean acidification, global freshwater use, atmospheric aerosol loading, and chemical pollution [22]. Of those nine planetary boundaries, four are currently transgressed [15].

The consumption mentality incorporates an inherent duality between pursuing sustainable development while insisting on economic growth. The linkage between continued economic growth and improvements in energy efficiency can only act as a temporary offset towards higher consumption [23]. This duality has left policy-makers impotent when it comes to energy-saving policies. When the development path requires a choice between economic growth and environmental sustainability, the former is often favored. Energy savings from efficiency gains are being undermined by various rebound effects and the efficiency gains themselves are fueling unsustainable economic growth.

2.2. Economic Growth as Usual Is not Desirable

Economic growth is only desirable if it (1) occurs within planetary boundaries and (2) improves quality of life. The target of continual economic growth is outdated and based in the mindset of the 1950s [14]. It has resulted in economies that are degenerating, depleting, and exploiting the natural environment that humanity fundamentally depends on while enriching the super-rich at the expense of everyone else [14]. There are many critiques of the use of GDP as a measure of economic welfare. Simon Kuznets, the economist and statistician who helped create the standardized measure of GNP (the precursor to GDP) had deep reservations about the national accounts he helped to create [24]. He attempted to warn the nation of the limitations of the new system by stating that the welfare of the nation could "scarcely be inferred from a measurement of national income" [24]. GDP is simply a measure of market activity. It makes no distinction between what is desirable or undesirable. It also only looks at the segment of the economy that is involved with monetary transactions and pays no attention to the economic role of households and communities [24]. Worse yet, GDP sees social decline as "growth" [24]. For example, since Purdue Pharma released OxyContin in the 1990s, it has contributed $31 billion to GDP [25]. During that same time, North America has slipped into an opioid crisis: the first wave of which began with prescription opioids in 1999, and has since killed nearly 450,000 people [26]. In addition to the money made by selling incredibly addictive opioids, GDP also sees this social decline as growth by another name. Money changes hands as people check into rehab, require hospitalization for overdoses, plan for the deaths of their loved ones, deal with the fallout of broken homes, and manage every other manner of social degeneration; as long as money is changing hands, GDP chalks it up as a win on the economic score board. Environmental decline also shows up

multiple times on the balance sheet as a win [24]. For example, environmental decline caused by the oil and gas industry shows up as economic gains during extraction, refinement, and consumption, and then again when the nation spends billions of dollars repairing catastrophic damage caused by climate-change-related disasters or an oil spill. As a result, GDP masks the breakdown of social structures and the natural habitat that human well-being (and economic activity itself) depends on [24].

The World Happiness Report uses data taken from the Gallup World Poll, a set of nationally representative surveys undertaken in more than 160 countries to score a country's overall life satisfaction. It is based on the metric of the "Cantril Ladder" (CL), asking respondents to rate their life from 0 to 10, with 0 representing the worst possible life, and 10 representing the best possible life for them in particular [27]. In the United States, despite consistent increases in GDP, overall life satisfaction has decreased in the years between 2005 and 2016, as shown in Figure 2. In contrast, life satisfaction has increased in China along with GDP. Per capita GDPs in the United States and China were $57,927 and $8148, respectively in 2016 (in current US dollars) [10]. This suggests that life satisfaction may increase with per-capita GDP only to a point. Richard Layard argues that beyond a per capita income of about $20,000 a year, additional money does not appear to contribute to additional happiness [28].

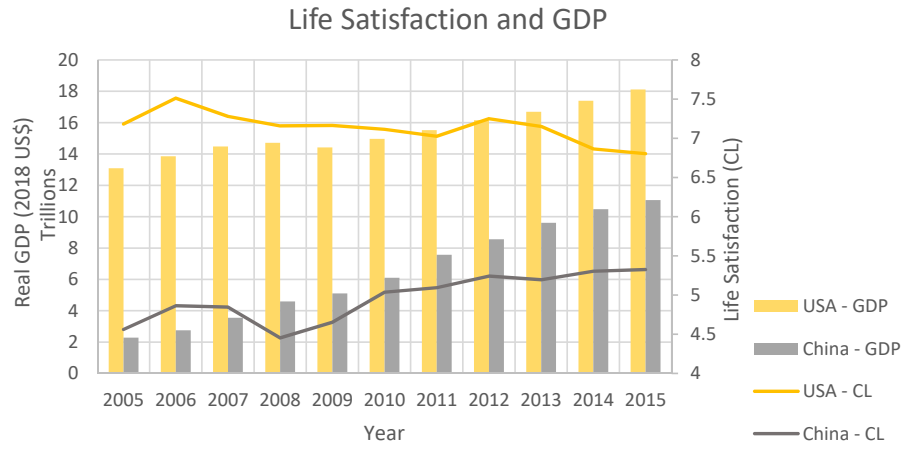

Figure 2. Life Satisfaction and GDP in the United States and China [13,27]. CL—Cantril Ladder.

Some countries exhibit similar trends to China, while others exhibit trends more like the United States. This suggests that the relationship between GDP to quality of life is weak. The focus on GDP neglects the importance of other factors in the overall well-being of a population. Similarly to China, India's per capita GDP has increased significantly over the last 10 years, however, it can be seen in Figure 3. that overall life satisfaction has decreased.

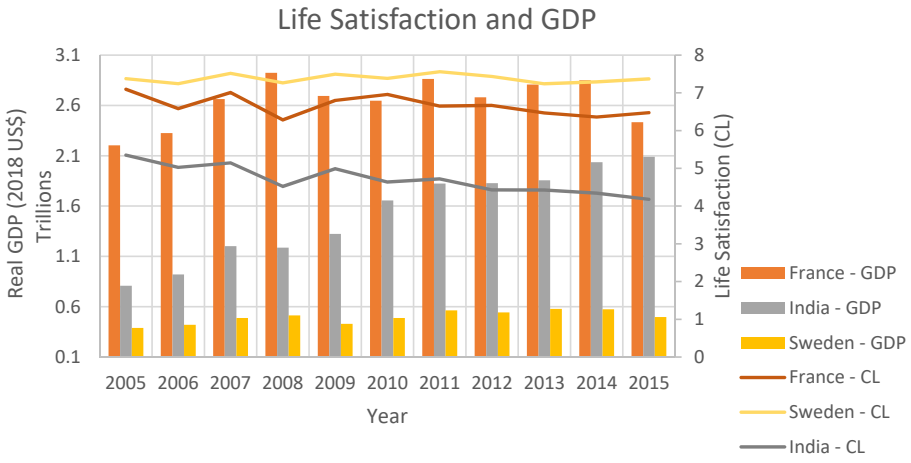

Figure 3. Life Satisfaction and GDP of Various Countries [13,27].

It is increasingly being recognized that GDP was never designed as a measure of economic welfare and GDP growth is no longer an appropriate national policy goal [29]. Resource consumption is merely a means to increase economic development with the assumption that development will lead to increased human "well-being". However, well-being is not determined solely by the consumption of goods and services, but also on health, education, family, friends, social networks, leisure time, self-actualization, and healthy ecosystems, none of which are directly measured by GDP [30]. There is a growing body of research to show that evaluating these alternative indicators in total economic progress typically finds that well-being is not improving in global north countries and is in fact declining despite continual increases in GDP [30]. An alternative to GDP as an indicator of progress is the genuine progress indicator (GPI), which is based on the GDP, however, includes several components that GDP does not. GPI is a measure of economic welfare generated by economic activity. It starts with personal consumption expenditures (similar to GDP) but adjusts them using 24 different components, including income distribution, environmental costs, crime, pollution, benefits of volunteer work, and household work, among others [29]. It separates economic activities that diminish welfare from those that enhance it, however, it does not measure the sustainability of economic activity. Although not perfect, GPI is a far better welfare indicator than GDP [29].

In a study of 17 countries that make up 53% of the world's population 59% of global GDP, Kubiszewski et al. looked at GPI as an indicator of economic welfare. They found that while global GDP has tripled since 1950, economic welfare as measured by GPI peaked in 1978 (around the same time that global ecological footprint exceeded global bio capacity) and has been decreasing since [29]. In addition, life satisfaction has not improved significantly since 1975 [29]. Interestingly, they note that GPI and GDP are highly correlated up to a point of about $7000/capita, after which there appears to be a negative correlation. They go on to quote the "threshold hypothesis" proposed by Manfred Max-Neef, which states: "for every society there seems to be a period in which economic growth (as conventionally measured) brings about an improvement in the quality of life, but only up to a point–the threshold point-beyond which, if there is more economic growth, quality of life may begin to deteriorate" [31] (p. 117). Socially minded critics argue that even if economic growth could continue, it is no longer a desirable goal for wealthy nations to pursue because it is failing to improve people's lives [4].

2.3. Peak of Maximum Utility

As mentioned above, there is a general agreement in the literature that a certain amount of energy consumption is a fundamental requirement for the economic progress and social development of a country [2]. Access to electrical energy significantly improves quality of life. For example, lack of electricity hinders the ability of those in the developing world to carry out many of the tasks the western-world takes for granted such as cooking, cleaning, working, reading, etc. It also means that hundreds of billions of hours each year are spent collecting fuel for cooking and heating—a duty borne primarily by women and children [32]. Without electricity, these people do not have access to modern hospital services or refrigeration for food and medicine. Without electricity, they do not have access to proper sanitation services such as septic systems, or garbage disposal. It affects the ability of children to become educated (as the schools many of these students attend lack an electrical connection). This hampers their future prospects, which perpetuates the problem into the future due to the fact that economic growth has largely been a consequence of a shift towards industrialization and a knowledge-based economy [32]. In addition to this, 2.8 billion people—38% of the global population, and almost 50% of the population in developing countries—lack access to clean cooking. This leads to 2.8 million premature deaths per year, primarily women and children, directly related to the inhalation of toxic fumes produced from burning biomass for cooking, or kerosene for lighting. At the same time, the environmental ceiling has already been crossed for four of the seven measurable planetary boundaries. Generally the more social thresholds a country achieves, the more biophysical boundaries it transgresses [15].

Akizu-Gardoki et al. explored available literature to determine the required energy to meet a basic level of social development and found that 9.3 MWh per capita per year were required to maintain a Human Development Index (HDI) value above 0.7 and 33.7 MWh per capita per year in order to uplift the HDI above 0.9 [2]. In this literature review, they also found data that demonstrates energy consumption above 43.8 MWh per capita per year does not necessarily lead to a higher quality of life, and that a population needs 33.7 MWh per capita per year to maintain an HDI higher than 0.9 [2]. O'Neill et al. (2018) studied the impacts of resource use on social outcomes and found a logarithmic (saturation) relationship between resource use and social returns, suggesting diminishing marginal utility with higher resource use [15]. In fact, higher resource use has begun to exhibit negative marginal returns as climate change imposes huge environmental damages due to storms, rising sea levels, new diseases, and mass migrations from threatened areas [33]. To illustrate this phenomenon, consider the "all-you-can-eat-buffet".

At the buffet, the food is pre-gathered, pre-cooked, and laid-out as far-as-the-eye-can-see. A patron, let us call him "Phil", fills up his first plate of steak, bacon-wrapped-bacon, fried chicken, deep-fried prawns, and broccoli–beef. As he consumes, the usefulness of Phil's meal approaches a peak of maximum utility, as illustrated in Figure 4. At this point, by all means, Phil is sufficiently satiated. Yet, he gets up, grabs another plate and piles it high with a second course. Phil does not just eat until he is full, oh no, Phil eats until he cannot bend down to re-tie his shoes. After he has fully consumed the second plate of food he feels bloated and uncomfortable. He has consumed passed the point of maximum utility. Now the net utility of his meal decreases according to the economic principle of diminishing marginal utility [34]. However, there is always room for dessert...Phil stumbles over to the ice cream bar and continues to consume. If we plot the utility of Phil's dinner against the amount of food he consumes, it would look similar to the graph shown below.

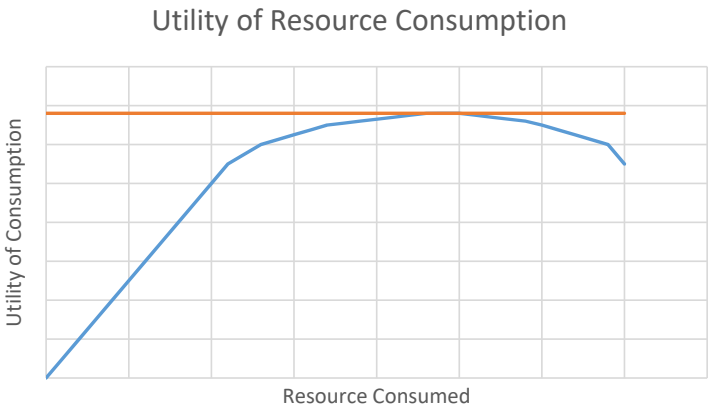

Figure 4. Phil's Utility of Consumption.

In this example, maximum utility is reached shortly after that first plate of food, yet Phil's consumption continues to his overall detriment. This is true for buffets, it is true for energy, and it is true of most resources.

The major issues of our time such as energy consumption, climate change, and poverty cannot be addressed from a purely technological standpoint. Of course, improving energy efficiency is an important factor, but we must not forget the equally important subject of human behavior and cultural context and the drive for an improved life. Where basic human needs are not yet satisfied, such as in areas without access to clean cooking and dependable electrical connections, economic growth will take priority over environmental benefits and energy savings. However, growth should be seen, as it is in all-natural systems, as a transition to maturity [23]. It is unnatural to demand the infinite expansion of an economy that exists within the bounds of a finite environment. In fact, if continual unchecked growth occurs within human anatomy, there is a term for it: cancer. Constant economic growth should not be the indicator of a healthy population.

3. Alternative Economic Goals

As Kate Raworth suggests, the 21st century calls for a far more ambitious economic goal than continual growth. The challenge should now be achieving the well-being of all people within the scientifically informed boundaries of the planet [14,35]. There are economic models that have affirmed that investing in renewable energies and energy efficiency (which are necessary to stabilize the climate) will be a positive source of net job creation and economic growth [36]. This is beneficial so long as it (1) exists within planetary boundaries and (2) improves quality of life. This represents a switch in mindset from seeing the environment as an externality to the economy, to understanding how the economy can thrive in balance with environmental boundaries [14]. The shift to a sustainable economy represents significant changes in group psychology and lifestyle. One of the primary arguments against a sustainable economy is that it leads to national economic recessions and unemployment due to the reduction of consumption and the corresponding impact on the economy [30]. Unfortunately, if the growth of the all-you-can-eat economy persists, we are headed to an economic recession brought on by an environmental collapse as we outstrip the Earth's ability to support humanity.

A more sustainable approach to energy and resource consumption would be to begin a transition towards a mature, steady-state, "sufficiency" economy. One that exists at the point of maximum utility of resource consumption (with the caveat that this level is within per capita planetary boundaries).

A steady-state economy is an economy where the main biophysical stocks and flows are stable, where resource consumption is equal to resource regeneration, and where material and energy flows are kept within ecological limits [4]. When the goal of achieving a social foundation for all people is combined with the goal of maintaining a steady-state economy inside environmental boundaries we can visualize this through Kate Raworth's concept of "doughnut economics" [14]-concentric circles with 11 social indicators making up an inner ring, and the nine ecological boundaries comprising an outer ring. The goal is to remain within the area between the two circles. A simplified version of this diagram is shown in Figure 5 below:

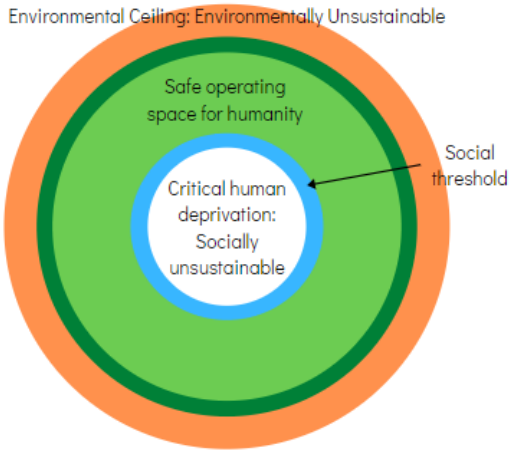

Figure 5. Safe Operating Space for Humanity [14].

Currently there are no countries that achieve a high quality of life for their citizens within ecological boundaries [4]. O'Neill makes an interesting observation: Countries with biophysically stable economies are more democratic and more equal, and their citizens are happier and healthier than those in growing or degrowing economies. However, the article does not find that a high level of social performance can be achieved at an environmentally sustainable level [4]. What is not explored is how a transition to renewable and more efficient energy sources may allow developing countries to consume more energy per capita (and achieve more of the social thresholds) while remaining inside ecological limits. In addition, as developed countries transition to renewable energy sources, it may be

possible to maintain a high standard of living while bringing environmental impacts to levels within planetary boundaries.

4. Future Work

It is clear that the overconsumption of resources is undermining human and planetary well-being. The current economic model of continual growth at the expense of the environment or our well-being is no longer serving humanity and has become a cancer. Previous work has done an excellent job in defining the safe and just space in which humanity must operate, now the question remains: how do we achieve this in practice? A recent article published in nature communications synthesized the discourse on reforming or changing economic systems and distilled it into recommendations for further research. To paraphrase the authors of this paper, future work must be targeted towards (1) research to advance basic academic understanding, (2) research on societal change for citizens and communities, and (3) research on governance [37]. Future research must demonstrate concrete examples of sustainable development and consumption, advance the discourse on how individuals and communities can be part of the solution, and empower the implementation of sustainable government policy. The myriad of issues that stem from the overconsumption of resources is both technological and social—as such, solutions must exist at the intersection of technology and society. Technological advancements such as improvements in efficiency and transitions to renewable energy sources will be an important part of the solution. However, in the absence of a firm understanding of human behavior and in the presence of a dominant culture of consumption, this may lead to a rebound due to Jevon's paradox (although there is still some debate on the presence of an economy-wide rebound effect [38]). A collective shift towards sustainability is first needed in the western psyche before improvements in efficiency will provide long-term reductions in aggregate resource consumption. These issues are complex, have numerous stakeholders with conflicting values and needs, and have both social and technological implications. By definition, these problems are "wicked". Wicked problems demand a very different approach to produce solutions. Richard Buchanan quotes Horst Rittel in his description of wicked problems, stating that wicked problems are a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision-makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" [39] (p. 15). As Rittel and Webber explained: "The information needed to *understand* the problem depends upon one's idea for solving it" [40] (p. 161). Rittel and Webber later go on to describe that for wicked problems "one cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve" [40] (p. 162). There is a missing component in the current literature: an understanding of human behavior, culture, and mindsets as related to resource consumption and climate change. In order for solutions to take hold and produce positive long-term effects, future work must be done to identify and change the institutional, cultural, and individual barriers that are preventing the shift away from current economic models and trends of consumption. This is where social innovation processes such as systems thinking and design thinking excel.

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References

1. Thoreau, H.D. Walden. In *The American Tradition in Literature*; The McGraw-Hill Companies, Inc.: New York, NY, USA, 2009; pp. 702–767.
2. Akizu-Gardoki, O.; Bueno, G.; Wiedmann, T.; Lopez-Guede, J.M.; Arto, I.; Hernandez, P.; Moran, D. Decoupling between human development and energy consumption within footprint accounts. *J. Clean. Prod.* **2018**, *202*, 1145–1157. [CrossRef]
3. O'Neill, D.W. Measuring Progress Towards a Socially Sustainable Steady State Economy. Ph.D. Thesis, University of Leeds, Leeds, UK, 2012.
4. O'Neill, D.W. The proximity of nations to a socially sustainable steady-state economy. *J. Clean. Prod.* **2015**, *108*, 1213–1231. [CrossRef]
5. Hopkins, E. Working Hours and Conditions during the Industrial Revolution: A Re-Appraisal. *Econ. Hist. Rev.* **1982**, *35*, 52–66. [CrossRef]
6. Allen, R.C. Engels' pause: Technical change, capital accumulation, and inequality in the british industrial revolution. *Explor. Econ. Hist.* **2009**, *46*, 418–435. [CrossRef]
7. Griffin, E. Diets, Hunger, and Living Standards During the British Industrial Revolution. *Past Present* **2018**, *239*, 71–111. [CrossRef]
8. Humpheries, J. Childhood and child labour in the British industrial revolution. *Econ. Hist. Rev.* **2013**, *66*, 396–418.
9. Our World In Data. World GDP over the Last Two Millenia. Available online: https://ourworldindata.org/grapher/world-gdp-over-the-last-two-millennia?time=1900..$\delimiter"026E30F$ (accessed on 6 June 2020).
10. The World Bank. GDP (Current US$). Available online: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD (accessed on 24 June 2020).
11. IEA Energy Atlas. Energy Balance. Available online: http://energyatlas.iea.org/#!/tellmap/-1002896040/1 (accessed on 24 June 2020).
12. Library of Congress. Reasearch Guides. Available online: https://guides.loc.gov/us-trade-with-china#:~{}:text=The%20U.S.%20trade%20with%20China,over%20%24600%20billion%20in%202017 (accessed on 24 June 2020).
13. The World Bank. GDP (Current US$). Available online: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2016&locations=CN-US&start=1961&view=chart (accessed on 23 March 2018).
14. Raworth, K. Why it's time for doughnut economics. *IPPR Progress. Rev.* **2017**, 216–222. [CrossRef]
15. O'Neill, D.; Fanning, A.L.; Lamb, W.F.; Steinberger, J.K. A good life for all within planetary boundaries. *Nat. Sustain.* **2018**, 88–95. [CrossRef]
16. Dinda, S. Environmental Kuznets Curve Hypothesis: A Survey. *Ecol. Econ.* **2004**, *49*, 431–455. [CrossRef]
17. Dogan, E.; Inglesi-Lotz, R. The impact of economic structure to the environmental Kuznets curve (EKC) hypothesis: Evidence from European countries. *Environ. Sci. Pollut. Res.* **2020**, *27*, 12717–12724. [CrossRef]
18. Usman, O.; Terhemba Iorember, P.; Olanipekun, I.O. Revisiting the environmental Kuznets curve (EKC) hypothesis in India: The effects of energy consumption and democracy. *Environ. Sci. Pollut. Res.* **2019**, *26*, 13390–13400. [CrossRef] [PubMed]
19. Saunders, H. *Why Energy Efficiency May Not Decrease Energy Consumption*; The Breakthrough Instituite: Oakland, CA, USA, 2010.
20. Freire-Gonzalez, J.; Puig-Ventosa, I. Energy Efficiency Policies and the Jevons Paradox. *Int. J. Energy Econ. Policy* **2015**, *5*, 69–79.
21. Stewart Mills, J. *Principles of Political Economy with Some of Their Applications to Social Philosophy*; John W. Parker: London, UK, 1849.
22. Rockstrom, J. A safe operating space for humanity. *Nature* **2009**, *461*, 472–475. [CrossRef] [PubMed]
23. Nørgård, J.S. Avoiding Rebound through a Steady-state Economy. In *Energy Efficincy and Sustainable Consumption*; Palgrave Macmillan: Hampshire, UK, 2009; pp. 204–221.
24. Cobb, C.; Halstead, T.; Rowe, J. If the GDP Is Up Why Is America Down? *The Atlantic*. Available online: https://www.theatlantic.com/past/docs/politics/ecbig/gdp.htm (accessed on 24 June 2020).
25. Ryan, H.; Glover, S. You Want a Desciption of Hell? OxyContin's 12-Hour Problem. Available online: https://www.latimes.com/projects/oxycontin-part1/ (accessed on 24 June 2020).

26. Centers for Disease Control and Prevention. Understanding the Epidemic. Retrieved from Center for Disease Control and Prevention. Available online: https://www.cdc.gov/drugoverdose/epidemic/index.html (accessed on 24 June 2020).
27. Ortiz-Ospina, E.; Roser, M. Happiness and Life Satisfaction. Available online: https://ourworldindata.org/happiness-and-life-satisfaction (accessed on 4 October 2018).
28. Layard, R. *Happiness: Lessons from a New Science*; Allen Lane: London, UK, 2005.
29. Kubiszewski, I.; Costanza, R.; Franco, C.; Lawn, P.; Talberth, J.; Jackson, T.; Aylmer, C. Beyond GDP: Measuring and achieving global genuine progress. *Ecol. Econ.* **2012**, *93*, 57–68. [CrossRef]
30. Herring, H.; Sorrell, S. *Energy Efficiency and Sustainable Consumption*; Hampshire: London, UK, 2009.
31. Max-Neef, M. Economic Growth and Qualith of Life: A threshold hypothesis. *Ecol. Econ.* **1995**, *15*, 115–118. [CrossRef]
32. International Energy Agency. *World Energy Outlook*; OECD Publishing, Paris/IEA: Paris, France, 2017.
33. Ayers, R.U.; Van den Bergh, J.C.; Lindenberger, D.; Warr, B. The underestimated contribution of energy to economic growth. *Struct. Chang. Econ. Dyn.* **2013**, *27*, 79–88. [CrossRef]
34. EconomicsConcepts.com. Law of Diminishing Marginal Utility. Available online: http://economicsconcepts.com/law_diminishing_marginal_utility.htm (accessed on 12 March 2018).
35. Dearing, J.A.; Wang, R.; Zhang, K.; Dyke, J.G.; Haberl, H.; Hossain, S.; Langdon, P.G.; Lenton, T.M.; Raworth, K.; Brown, S.; et al. Safe and just operating spaces for regional social-ecological systems. *Glob. Environ. Chang.* **2014**, *28*, 227–238. [CrossRef]
36. Pollin, R. Expanding Job Opportunities through Clean Energy Investments. In *R. Pollin, Greening the Global Economy*; The MIT Press: Cambridge, MA, USA, 2015; pp. 75–91. [CrossRef]
37. Weidmann, T.; Lenzen, M.; Keyßer, L.T.; Steinberger, J.K. Scientists warning on affluence. *Nat. Commun.* **2020**. [CrossRef]
38. Turner, K. "Rebound" effects from increased energy efficiency: A time to pause and reflect. *Energy J.* **2013**, 25–42. [CrossRef]
39. Buchanan, R. Wicked Problems in Design Thinking. *Des. Issues* **1992**, *8*, 5–21. [CrossRef]
40. Rittel, H.W.; Webber, M.M. Dilemmas in a General Theory of Planning*. *Policy Sci.* **1973**, *4*, 155–169. [CrossRef]