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Is it Too Late for Growth?

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Abstract

The planet is on a path to catastrophic warming which calls for structural changes in the operation of Global North economies, not merely a transformation of energy sources, the core of "green growth" approaches. Our research on inequality and working time shows that these are powerful drivers of carbon emissions that can be the center of a progressive agenda supplementing energy transition. Our work also shows that disproportionality in emissions sources presents a policy opportunity. We challenge Pollin's view that only growth-centric approaches are politically viable, and argue that progressive politics has moved from growth-centricity to needs- and people-centered policies. In our response, we argue that the recent rise of the Green New Deal is a strong piece of evidence for our position.

JEL Classification: Q5, Q54, Q56

Keywords

climate change, carbon emissions, sustainability, degrowth, inequality, working hours, decoupling

Introduction: The Urgency of Climate Response

Climate social science is dealing with a fast-moving target. Recent data on temperatures, sea-level rise, extreme weather events, and migration suggest that climate destabilization is accelerating. Globally the last four years have been the hottest on record, with a rapid escalation of temperatures, and the first half of 2018 suggests it will be the fourth hottest (Climate Central 2018). In 2018 average daily temperatures in the Arctic registered up to 20°C higher than normal, and up to 35°C higher in Siberia, which has led some climate scientists to reconsider even their most pessimistic scenarios (Watts 2018). Irreversible, catastrophic climate derangement is a real possibility.

Despite these grim developments, and the good intentions of the Paris Agreement, anthropogenic carbon emissions have continued their upward trajectory. From 2014 to 2016, global emissions were almost flat. But as global GDP growth picked up to over 3 percent in 2017, emissions grew by 1.4 percent, reaching their highest ever level (International Energy Agency 2018). Atmospheric concentration of carbon dioxide is still increasing, reaching 412 ppm in May of 2018, and continuing a five-year steady upward trend (CO_2.Earth 2018). While renewables increased by more than 6 percent in 2017 (International Energy Agency 2018), they still represent a small fraction of total energy

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production. Furthermore, cross-national research suggests that so far, renewable energy has only minimally displaced fossil-fuel energy (York 2012, Thombs 2018a). The 2017 rise in carbon emissions dealt a severe blow to hopes that they had finally peaked. Reaching peak emissions soon is crucial to all scenarios for controlling climate destabilization. A distinguished group of climate scientists recently concluded that "without a rapid and clear break in the historical trends of I_{FF} [the carbon intensity of the world economy] or GDP the opportunity to follow cost-effective 2° mitigation pathways in the near-term… has passed" (Friedlingstein et al. 2014).

There is increasing scientific consensus that the 2° target, which has been a political, rather than a scientific choice, is not safe. A decade ago, Hansen et al. (2008) warned that tipping points leading to irreversible, out-of-control climatic change are a danger above 350 ppm, which represents a warming target of 1°C. Now, the more conservative IPCC process has moved in this direction, with its 2018 report on differences between 1.5°C and 2°C, which clearly indicates the dangers of the higher target. An early leaked draft called for "rapid and far-reaching changes" and concluded that there was a high probability that the 1.5°C target is beyond our capabilities, although a later version appears to have softened the latter claim (Doyle 2018).

Carbon budgets represent another way to think about the problem. Introduced in the 5th Assessment Report of the IPCC in 2014, the carbon budget is a measure of how much carbon-based energy is available to be burned for a given temperature target. There is debate about how large the carbon budget currently is, and by extension the number of years we can continue to use fossil fuels and still stay within various temperature limits. A recent influential study by Millar et al. (2017) finds that for a 66 percent chance of remaining, within 1.5°C, we have twenty years of fossil fuel use remaining while the Mercator Institute (directed by Ottmar Edenhofer, co-chair of IPCC Working Group III on Mitigation) has estimated that we may have already used up the entire budget for a 1.5°C rise (https://www.mcc-berlin.net/en/research/co2-budget.html).

Even accepting the optimistic twenty-year horizon for the carbon budget, the implications for wealthy countries are clear: rapid, deep decarbonization is required. The meager remaining budget should go to poor countries, who have done relatively little to cause climate destabilization and will suffer disproportionately from it. And what if the lower estimate—that there is no safe amount of fossil fuel to burn left—is correct? Or what if we have less risk tolerance than the 66 percent chance of remaining below 1.5°C, and want an 80 percent or 90 percent chance of meeting the temperature target? Budgetary math implies that the relatively painless paths that were available earlier are now precluded. Therefore, some climate scientists have argued that an honest reckoning, even for the 2°C target, requires acknowledging that continued GDP growth is not sustainable (Anderson and Bows 2012). While this view is not yet a consensus among the climate science community, we suspect that it will increasingly gain adherents in the coming years.

Consensus Approaches

Without question, energy sector transformation is at the heart of addressing climate destabilization. Kevin Anderson (2012: 25) of the Tyndall Centre for Climate Change in the UK has argued that even under optimistic deforestation scenarios, for a 50 percent chance of hitting the inadequate 2°C target, global energy-related carbon emissions need to hit zero between 2035 and 2045, which implies 10–20 percent annual declines.

Energy-sector decarbonization is the heart of Robert Pollin's work (2015). He focuses on the growth of renewables and enhanced energy efficiency. In addition (as Pollin also discusses), a carbon tax will be necessary. To have a major impact it will have to be high—work by Ackerman and Stanton (2012) suggests that the social cost of carbon may be as high as $900 per ton of carbon dioxide, and that safe emissions pathways require taxing carbon at between $150 to $500 per ton. In the United States, recent trends in power generation, plus the revival of consumer auto demand and the shift back to SUVs, have resulted in transportation becoming the largest sectoral source of greenhouse gases. Thus, energy system transformation must include the decarbonization of mobility. As the global climate conversation has increasingly recognized, changes in land use are also required. These include not only an end to deforestation but also afforestation and forest preservation. Agriculture must also be transformed. Two key measures will be to reverse the current upward global trend in meat consumption and carbon sequestration in soils.

These changes (energy system + agricultural transformation) are both relatively uncontroversial and widely recognized. But are they sufficient? Put differently, can the magnitude of required emissions reductions be achieved while leaving the basic structures of the economy unchanged? Or does the scale of the challenge facing us require more systemic change as Anderson and others have argued?

There is little doubt that climate scientists and social scientists can produce models that project desired emissions and temperature targets. Many (including Pollin) have done this. However, virtually all IPCC scenarios rely on large-scale negative emissions later in the century, the equivalent of pulling a rabbit out of a hat, given the state of negative emissions technology. Achieving actual results in the real world has been much more difficult than the modeling exercises acknowledge. The political will and operational power for required emissions reductions has been absent. We believe one reason is that most approaches have focused almost solely on technological change (via changing energy sources and efficiency), rather than other double- or multiple-dividend approaches which can boost emissions reductions. Furthermore, GDP growth has "wiped out" a good deal of the progress that has been made in reducing the energy intensity of GDP, a topic we return to below. For that reason, we propose that instead of BAU + (energy system + agricultural transformation) approach, we abandon the growth-at-all-costs mentality that has dominated policy-making and focus on additional emissions-reducing policies.

Much of our research has centered on three areas that might help. Two entail structural changes in the operation of the economy that both reduce emissions and yield a range of other benefits. These are a reduction in the extent of top-of-distribution income concentration, and shorter working hours. The third approach stems from the fact that the sources of emissions are highly concentrated, or disproportionate (by industry, nation, company, facility, and household), and identifies power plants as another heretofore largely unrecognized source of disproportionality. Action on these three fronts (inequality, disproportionality, and hours of work) can have major impacts on emissions reductions to complement technological change in energy and agriculture. We discuss the three in turn.

Inequality

The North-South dimension of inequality is well recognized in the climate conversation: the Global North is the largest legacy producer of greenhouse gases, and the Global South will experience the most severe impacts from climate destabilization. Another important aspect of inequality is ecologically unequal exchange, which is the environmentally damaging removal of energy and other natural resource assets from and the externalization of environmentally damaging production and disposal activities to less developed countries. Research in this tradition indicates that asymmetrical trade relationships and global production network characteristics contribute to the growth of energy use and production-based carbon emissions within developing nations (Yu, Feng, and Hubacek 2014; Givens 2018; Huang 2018; Jorgenson 2012).

It is less recognized that domestic inequality is also implicated in environmental outcomes, a relationship first identified by James Boyce (1994). New work by us and others finds that domestic income and wealth inequality are positively associated with carbon emissions (Eisenstein 2017). These associations are observed within more economically developed nations, such as the United States (Jorgenson, Longhofer, and Grant 2016; Jorgenson, Schor, and Huang 2017; Jorgenson et al. 2018; Jorgenson, Dietz, and Kelly 2018; Knight, Schor, and Jorgenson 2017), the transition economies of post-Soviet nations (Jorgenson, Schor, and Giedraitis 2017), and in developing nations as well (Hubacek et al. 2017). In contrast to studies measuring inequality using only Gini coefficients, we find that the concentration of income and wealth at the top of the distribution (either at the 10 percent, 5 percent, or 1 percent level) is what especially matters for emissions. Multiple factors likely account for this relationship. Higher-income and wealthier households consume more goods and services as they engage in Veblenian status-consumption (Veblen 1934) or consumption competition (Schor 1998). These dynamics lead households farther down the distribution to increase their spending to keep up with these visible lifestyles, which in recent decades have entailed consumption of energy-intensive luxuries. The wealthy are also owners of polluting firms and energy-producing enterprises. To protect these assets, they are more likely to use their economic resources to gain political power, which they use to dominate the policy environment. (Boyce 1994, 2007; Downey 2015). An additional pathway is that income inequality has been shown to have a positive association with working hours (Bowles and Park 2005), and working hours are drivers of energy consumption and carbon emissions, a point we return to below (Fitzgerald, Schor, and Jorgenson 2018; Knight, Rosa, and Schor 2013).

Of course, there are compelling non-climate-related arguments for reducing income and wealth concentration, such as basic fairness, and impacts on well-being and economic functioning (Hill and Jorgenson 2018). In the United States, where inequality has soared in recent decades, there is a robust social movement advocating reforms such as a $15 minimum wage, wealth taxation, and enhanced social welfare expenditures. Progressive cap-and-dividend schemes offer the most promise to combine inequality and climate impacts. More generally, integrating climate policy into a broader inequality agenda offers the opportunity to transcend the traditional middle-class bias of environmental policy and the relative isolation of environmentalism from progressive movements.

Disproportionality

A second underappreciated area of research relevant for climate policy is disproportionality. Much of the climate discourse has had a POGO quality (following the famous cartoon): we have met the enemy and he is us, a formulation which implicitly assigns responsibility equally. However, at many scales, climate emissions are highly concentrated. For example, the United States, the European Union, and China account for more than half the world's GHG emissions, and the bottom one hundred countries are responsible for only 3.5 percent (Friedrich, Ge, and Pickens 2017). Disproportionality also shows up across households. Chancel and Piketty (2015) estimate that the top 10 percent of the world's wealthiest households are responsible for 45 percent of global emissions. And consumption of particular commodities is also concentrated: in the United States, 20 percent of individuals account for half of diet-related emissions (Heller et al. 2018).

The work of Jorgenson and colleagues finds disproportionality across fossil fuel power plants around the globe (Jorgenson, Longhofer, and Grant 2016). They employ qualitative comparative analysis and multilevel modeling techniques to analyze the conjoint effects of global, political, and organizational conditions on fossil fueled plants' carbon emissions (Grant, Jorgenson, and Longhofer 2018). They find that the dirtiest 5 percent of plants are responsible for large shares of their sectors' total emissions. If these hyper-polluting plants continued generating the same amount of electricity but met particular intensity targets through enhanced efficiencies or through other means, the world's total electricity-based carbon emissions could be reduced by as much as 40 percent (Grant, Jorgenson and Longhofer 2013; Jorgenson, Longhofer, and Grant 2016; see also Robertson and Collins 2018). These hyper-polluters' emission rates are a function of four distinct causal recipes, which these researchers label coercive, quiescent, expropriative, and inertial configurations, and these same sets of conditions also increase plants' emission levels (Grant, Jorgenson, and Longhofer 2018). Coercive and quiescent configurations enhance plants' ability to externalize their carbon emissions by neutralizing and manipulating potential sources of resistance, whereas expropriative and inertial configurations inhibit plants' ability to curb emissions by subjecting them to opportunistic behavior and forces of inertia.

From a policy point of view, targeting this small fraction of hyper-polluters should be easier than general regulations which affect all plants. Similarly, efforts that force or induce high-emitting households to adjust, rather than all households, hold political promise as well.

Working Hour Reductions

Working time reduction is another example of a double- or multiple-dividend climate policy. While attention to working hours has waned as wages have stagnated and inequality has risen, in an earlier era, economists, trade unionists, and others recognized the benefits of shorter hours (Schor 1992). Shorter hours of work have historically been enacted as a remedy for unemployment, for example during the Great Depression, and in Western Europe after the 1980 recession. While the employment consequences of shorter hours are complex and vary with the type of hours reductions, large hours reductions are more conducive to employment expansion. Furthermore, worksharing has a strong track record as a viable means of employment preservation during downturns. Working time reduction has also historically been a major factor in maintaining high employment when labor-saving technical change occurs. As artificial intelligence eliminates the need for many jobs, it may prove to be a vital policy response. Shorter working hours can also contribute to reduced stress, better physical and mental health, and higher quality of life (Schor 2010).

Our research shows that shorter hours of work can be an important part of the effort to reduce emissions. In a series of studies we have found that there is a large and significant relationship between annual hours of work and emissions in wealthy countries (Knight, Rosa and Schor 2013; Fitzgerald, Jorgenson, and Clark 2015). Fitzgerald, Jorgenson, and Clark (2015) estimate that for every 1 percent decline in hours, energy consumption in wealthy nations is reduced by 0.4 percent. This relationship is even larger across US states (Fitzgerald, Schor, and Jorgenson 2018), where we find that a 1 percent decline in weekly hours results in emissions reductions ranging from 0.55 percent to 0.67 percent, depending on the particular model. There are two pathways through which hours and emissions are likely related. The first and larger one is what we call the scale effect: countries that take more productivity growth in the form of shorter hours expand output less than they might. Casual observation reveals that the few countries that have managed to achieve significant emissions reductions, such as Germany, have done so with low rates of GDP growth. The second pathway is the composition effect, which measures how time availability affects the composition of household activities and consumption, following the classic insights of Gary Becker and Steffan Linder. The intuition is that time-stressed households engage in more carbon-intensive activities. In the cross-national studies, this effect is much smaller, and in some models non-significant, however, in the United States cross-state models it is similar in magnitude to the scale effect.

This body of work suggests that policies to reduce working hours can be important tools for lowering emissions, while also boosting employment and improving workers' health and well-being (Schor 2013). If working time reduction is tied to productivity growth it can be achieved without reducing workers' incomes, but as an alternative to higher wages. This avoids the well-known problem of loss aversion, as well the preference endogeneity which develops when incomes rise, a phenomenon Schor has described as the "work-and-spend cycle" (Schor 1992). In the United States, working hours have risen substantially for the most highly educated workers (Jacobs and Gerson 2005), who are also disproportionate carbon emitters. Focused policies that target this group, who have historically been most interested in trading time for money, could reduce both income inequality and emissions. (We are currently investigating the interactions between these two variables.)

The Debate About Growth

The discussion of working hours brings us to the question of economic growth. Can we afford decades more expansion of economic activity at a time when current levels are putting us on a pathway to runaway climate change? Is it reasonable to continue to aim for growth when we have failed for nearly three decades to reduce emissions? While modelers are still producing 1.5°C scenarios which assume continued growth, even the IPCC has become pessimistic on this question with its latest 2018 report. Remaining in a moderately safe climatic zone may either already be impossible or is the equivalent of threading a needle. That informs our position on growth. In theory we advocate an agnostic attitude, or what Jeroen van den Bergh has termed a-growth (van den Bergh and Kallis 2012). A-growth abandons the presumption of growth and regards it as a means rather than an end.

It may be worth noting that standard economic theory is also agnostic about growth. The optimal rate of growth depends on workers' preferences for goods and leisure. If workers want to take their productivity growth in the form of shorter hours, the labor market will equilibrate with fewer hours supplied. Mainstream economists are on shaky analytic grounds for their unquestioning attitude to growth. Even in Marxist economics, while there is a firm-level growth imperative, there is less rationale for growth in the aggregate. Indeed, some capitalist countries have had low or near-zero growth for extended periods of time. Aggregate rates of growth should also be considered in light of population trends. Currently half the global population (48 percent) lives in countries with sub-replacement fertility, including all of the European Union, the United States, China, Russia, Brazil, and Japan (https://en.wikipedia.org/wiki/Sub-replacement_fertility).

Thus, the question we ask is: what are the goals of economic and climate policy and what level of GDP growth is compatible with them? Unfortunately, the answer to that question is "brutal" (Anderson 2012). In the Global North, we should have reached peak emissions some years ago, but have not. Given the current political environment, it is likely that feasible GDP growth is at zero or below.

Does this conclusion apply to all countries or just the wealthy nations of the Global North? While Global South countries must achieve massive emissions reductions, the degrowth paradigm is explicitly directed at the rich. (We therefore find Pollin's characterization of degrowth as nationally generic somewhat surprising, especially because the sources he cites are all clear on this. Indeed, as early as 1992, Schor argued for shorter working hours in the North for the express purpose of opening up more "ecological space" for growth in the Global South.) Furthermore, as academics from a wealthy country, we find it problematic to advocate for degrowth in the Global South.

The argument against degrowth assumes that absolute decoupling of emissions from GDP is possible. But despite economists' optimism, almost no countries have achieved absolute decoupling, particularly once trade-related emissions are accounted for (Knight and Schor 2014; Cohen et al. 2017). Indeed, it is the uptick in GDP growth, both globally and in wealthy countries, which is largely responsible for the recent surge of emissions. We have addressed this issue in multiple studies.

An extensive treatment of decoupling is Jorgenson and Clark (2012), who use longitudinal modeling techniques and statistical interactions between GDP per capita and time to study three national-level territorial carbon emissions measures—total emissions, per capita emissions, and emissions per unit of GDP from 1960 to 2005 (see also Jorgenson 2014; Longhofer and Jorgenson 2017). Their results indicate a strong relationship between per capita emissions and GDP per capita in developed nations that is stable through time. For developing countries the association between emissions and GDP per capita actually increased over time, the opposite of decoupling, although it is smaller than in developed countries. For total emissions, the estimated effect of GDP per capita decreased in magnitude over time in developed countries, providing some evidence of a relative decoupling for such nations, while for developing countries the results indicate a stable effect of GDP per capita on total emissions through time. The analysis of emissions per unit of GDP suggest a slight relative decoupling for the sample of developed nations, while the findings for the sample of developing countries are inconclusive. In a more recent longitudinal study that extends the analysis to 2010, Thombs (2018b) replicates the findings of Jorgenson and Clark (2012) across all three measures of territorial emissions. This body of work provides some evidence of relative decoupling, but not the absolute decoupling required to achieve emissions targets.

Once embodied emissions in trade and cyclical variations are accounted for, the picture is even more pessimistic. Knight and Schor (2014) find no decoupling using consumption (i.e. trade adjusted) rather than territorial carbon emissions. Cohen et al. (2017), using data from 1990–2012 and accounting for business cycle effects and trade, find that almost no countries (with Germany as a notable exception) have been able to decouple GHGs from GDP over time. The United States, notably, has not, and is estimated to have a long-term GHG elasticity of 0.6. It is important not to conclude too much from the substantial post-2005 decline in official US emissions, as those measures exclude trade-embodied emissions and the rapid increase in methane associated with hydraulic fracturing. Furthermore, a majority (52 percent) of the decline between 2007 and 2011 was due to the impact of the Great Recession (Council of Economic Advisers 2013: 194–6).

As climate scientists grow more pessimistic about the ability to reach emissions targets while continuing to expand output in already wealthy economies, we believe economists must also acknowledge this reality (Anderson 2012). Kevin Anderson and Alice Bows have chided their fellow climatologists for allowing economists to lead them into the "misguided belief that commitments to avoid warming of 2°C can still be realized with incremental adjustments to economic incentives," by which they mean continued economic growth. They continue: "Put bluntly, climate change commitments are incompatible with short- to medium-term economic growth (in other words, for 10 to 20 years)." They note that the optimistic low-carbon scenarios rely on increasingly implausible assumptions, including negative emissions.

Anderson and Bows rightly focus not on the ideal world of models, but the one we actually live in. As observers have noted throughout nearly three decades of IPCC reports, emissions trajectories and climate outcomes have consistently been on the high end (or even beyond) what the relatively conservative consensus process has predicted. As a group of prominent climate scientists wrote in *Nature*: "We show that CO2 emissions track the high end of the latest generation of emissions scenarios, due to lower than anticipated carbon intensity improvements of emerging economies and higher global gross domestic product growth" (Friedlingstein et al. 2014). In the Global North, it's time to meet our climate responsibility by using means other than generalized growth to meet economic and social needs.

The question of whether the US economy can perform at a near-zero, zero, or negative GDP growth rate is an important one. We believe it can, but a no- or low-growth regime will require ongoing downward shifts in working hours to absorb excess labor, an increasing state role in the investment process (necessary in any case with an energy transformation), and an ongoing process of community wealth creation. A full discussion of these issues is beyond the scope of this short note, but has been addressed formally (Victor 2008) and informally (Jackson 2009; Schor 2010) as well as in numerous more recent papers by Victor and Jackson, who are developing a new macroeconomics for a post-growth world (Jackson and Victor 2016).

Conclusion: The Politics of Growth

Pollin claims that abandoning growth as a policy goal is politically infeasible. But this perspective is rooted in a previous political era which is being rapidly eroded. The inequality-enhancing aspects of growth and the need for targeted interventions to address particular needs have made the postwar growth-centricity increasingly obsolete. Progressive politics in the United States are focusing not on a generic growth agenda, but targeted policies such as living wages, healthcare, education costs, childcare, and most recently a Federal job guarantee. It seems that the population increasingly understands that growth does not necessarily yield well-being for the majority any longer. This has been the conclusion of a large and well-known literature questioning the link between GDP growth and well-being. We believe that a combination of the kinds of energy sector measures Pollin advocates plus agricultural transformation plus attention to the specific areas we have discussed—inequality, disproportionality, and shorter working time—will meet the needs of large majorities as we rapidly decarbonize. In the United States, the platforms of the popular progressive political figures, such as Bernie Sanders, Elizabeth Warren, or the newest superstar, Alexandria Ocasio-Cortez, already address inequality, and are compatible with shorter working time policies and targeting hyper-polluting plants. We believe that moving away from a purely technological approach to climate change and integrating it with other progressive policies holds both more promise for policy take-up and more chance of achieving emissions reductions (Schor 2015).

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References

Ackerman, Frank, and Elizabeth A. Stanton. 2012. Climate risks and carbon prices: Revising the social cost of carbon. *Economics: The Open-Access, Open-Assessment E-Journal* 6 (2012-10): 1–25. http://dx.doi.org/10.5018/economics-ejournal.ja.2012–10.

Anderson, Kevin, and Alice Bows. 2012. A new paradigm for climate change. *Nature Climate Change* 2 (9): 639–40.

Bowles, Samuel, and Yongjin Park. 2005. Emulation, inequality, and work hours: Was Thorsten Veblen right? *Economic Journal* 115 (507): F397–F412.

Boyce, James K. 1994. Inequality as a cause of environmental degradation. *Ecological Economics* 11 (3): 169–78.

———. 2007. Inequality and environmental protection. In *Inequality, Collective Action, and Environmental Sustainability*, eds. Jean-Marie Baland, Pranab Bardhan, and Samuel Bowles, 314–48. Princeton, NJ: Princeton University Press.

Chancel, Lucas, and Thomas Piketty. 2015. Carbon and inequality: From Kyoto to Paris. *Vox: CEPR Policy Portal* December. http://piketty.pse.ens.fr/files/ChancelPiketty2015.pdf.

Climate Central. 2018. *2018 Global Heat So Far*. Princeton, NJ: Climate Central. http://www.climatecentral.org/gallery/graphics/2018-global-heat-so-far.

CO_2.Earth. 2018. *Daily CO_2*. Victoria, BC: CO_2.Earth. https://www.co2.earth/daily-co2.

Cohen, Gail, Joao Jalles, Prakash Loungani, and Ricardo Marto. 2017. *Emissions and growth: trends and cycles in a globalization world*. WP/17/191. Washington, D.C.: International Monetary Fund.

Council of Economics Advisors. 2013. *Economic Report of the President*. Washington, DC: Government Publishing Office.

Downey, Liam. 2015. *Inequality, Democracy, and the Environment*. New York: NYU Press.

Doyle, Alister. 2018. Exclusive: Global warming set to exceed 1.5°C, slow growth—U.N. draft. *Reuters Environment* June 14. https://www.reuters.com/article/us-climatechange-report-exclusive/exclusive-global-warming-set-to-exceed-15c-slow-growth-un-draft-idUSKBN1JA1HD.

Eisenstein, Michael. 2017. How social scientists can help to shape climate policy: Developing strategies to ensure that the "needs of the few" do not outweigh those of the rest. *Nature* 551: S142–S144.

Fitzgerald, Jared B., Andrew K. Jorgenson, and Brett Clark. 2015. Energy consumption and working hours: A longitudinal study of developed and developing nations, 1990–2008. *Environmental Sociology* 1 (3): 213–23.

Fitzgerald, Jared B., Juliet B. Schor, and Andrew K. Jorgenson. 2018. Working hours and carbon dioxide emissions in the United States, 2007–2013. *Social Forces* 96 (4): 1851–74.

Friedlingstein, Pierre, Robbie M. Andrew, Joeri Rogelj, Glen P. Peters, Josep G. Canadell, Reto Knutti, Gunnar Luderer, Michael R. Raupach, Michiel Schaeffer, Detlef van Vuuren, and Corinne Le Quéré.

2014. Persistent growth of CO_2 emissions and implications for reaching climate targets. *Nature Geoscience* 7: 709–15.

Friedrich, Johannes, Mengpin Ge, and Andrew Pickens. 2017. *This Interactive Chart Explains World's Top 10 Emitters, and How They've Changed*. Washington, DC: World Resources Institute. http://www.wri.org/blog/2017/04/interactive-chart-explains-worlds-top-10-emitters-and-how-theyve-changed.

Givens, Jennifer. 2018. Ecologically unequal exchange and the carbon intensity of well-being, 1990–2011. *Environmental Sociology* 4 (3): 311–24.

Grant, Don, Andrew K. Jorgenson, and Wesley Longhofer. 2013. Targeting electricity's extreme polluters to reduce energy-related CO_2 emissions. *Journal of Environmental Studies and Sciences* 3 (4): 376–80.

———. 2018. Pathways to carbon pollution: The interactive effects of global, political, and organizational factors on power plants' CO_2 emissions. *Sociological Science* 5 (4): 58–92.

Hansen, James, Makiko Sato, Pushker Kharecha, David Beerling, Robert Berner, Valerie Masson-Delmotte, Mark Pagani, Maureen Raymo, Dana L. Royer, and James C. Zachos. 2008. Target atmospheric CO_2: Where should humanity aim? *The Open Atmospheric Science Journal* 2: 217–31.

Heller, Martin C., Amelia Willits-Smith, Robert Meyer, Gregory A. Keoleian, and Donald Rose. 2018. Greenhouse gas emissions and energy use associated with production of individual self-selected US diets. *Environmental Research Letters* 13 (4). http://iopscience.iop.org/article/10.1088/1748–9326/aab0ac.

Hill, Terrance D., and Andrew K. Jorgenson. 2018. Bring out your dead! A study of income inequality and life expectancy in the United States, 2000–2010. *Health & Place* 49: 1–6.

Huang, Xiaorui. 2018. Ecologically unequal exchange, recessions, and climate change: A longitudinal study. *Social Science Research* 73: 1–12.

Hubacek, Klaus, Giovanni Baiocchi, Kuishuang Feng, Raúl Muñoz Castillo, Laixiang Sun, and Jinjun Xue. 2017. Global carbon inequality. *Energy, Ecology and Environment* 2 (6): 361–69.

International Energy Agency. 2018. *Global Energy Demand Grew by 2.1% in 2017, and Carbon Emissions Rose for the First Time since 2014*. Paris, France: IEA Newsroom. https://www.iea.org/newsroom/news/2018/march/global-energy-demand-grew-by-21-in-2017-and-carbon-emissions-rose-for-the-firs.html.

Jackson, Tim. 2009. *Prosperity without Growth: Economics for a Finite Planet*. London: Routledge.

Jackson, Tim and Peter A. Victor. 2016. Does slow growth lead to rising inequality? Some theoretical reflections and numerical simulations. *Ecological Economics* 121: 206–19.

Jacobs, Jerry and Gerson, Katherine. 2005. *The Time Divide: Work, Gender, and Family Inequality*. Cambridge, MA: Harvard University Press.

Jorgenson, Andrew K. 2012. The sociology of ecologically unequal exchange and carbon dioxide emissions, 1960–2005. *Social Science Research* 41 (2): 242–52.

———. 2014. Economic development and the carbon intensity of human well-being. *Nature Climate Change* 4: 186–89.

Jorgenson, Andrew K., and Brett Clark. 2012. Are the economy and the environment decoupling? A comparative international study, 1960–2005. *American Journal of Sociology* 118 (1): 1–44.

Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. Inequality, poverty, and the carbon intensity of human well-being in the United States: A sex-specific analysis. *Sustainability Science* 13 (4): 1167–74.

Jorgenson, Andrew K., Wesley Longhofer, and Don Grant. 2016. Disproportionality in power plants' carbon emissions: A cross-national study. *Nature: Scientific Reports*. https://www.nature.com/articles/srep28661.

Jorgenson, Andrew K., Juliet B. Schor, and Vincentas Giedraitis. 2017. Income inequality and carbon emissions in post-Soviet nations, 1992–2009. *Ekonomika* 96 (3): 33–43.

Jorgenson, Andrew K., Juliet B. Schor, and Xiaorui Huang. 2017. Income inequality and carbon emissions in the United States: A state-level analysis, 1997–2012. *Ecological Economics* 134: 40–8.

Jorgenson, Andrew K., Juliet B. Schor, Kyle Knight, and Xiaorui Huang. 2016. Domestic inequality and carbon emissions in comparative perspective. *Sociological Forum* 31 (S1): 770–86.

Knight, Kyle W., Eugene A. Rosa, and Juliet B. Schor. 2013. Could working less reduce pressures on the environment? A cross-national panel analysis of OECD countries, 1970–2007. *Global Environmental Change* 23 (4): 691–700.

Knight, Kyle W., and Juliet B. Schor. 2014. Economic growth and climate change: A cross-national analysis of territorial and consumption-based carbon emissions in high-income countries. *Sustainability* 6 (6): 3722–31.

Knight, Kyle W., Juliet B. Schor, and Andrew K. Jorgenson. 2017. Wealth inequality and carbon emissions in high-income countries. *Social Currents* 4 (5): 403–12.

Longhofer, Wesley, and Andrew Jorgenson. 2017. Decoupling reconsidered: Does world society integration influence the relationship between the environment and economic development? *Social Science Research* 65: 17–29.

Millar, Richard J., Jan S. Fuglestvedt, Pierre Friedlingstein, Joeri Rogelj, Michael J. Grubb, H. Damon Matthews, Ragnhild B. Skeie, Piers M. Forster, David J. Frame, and Myles R. Allen. 2017. Emission budgets and pathways consistent with limiting warming to 1.5°C. *Nature Geoscience* 10: 741–48.

Pollin, Robert. 2015. *Greening the Global Economy*. Boston: MIT Press.

Robertson, Anya M. Galli, and Mary B. Collins. 2018. Super emitters in the United States coal-fired electric utility industry: Comparing disproportionate emissions across facilities and parent companies. *Environmental Sociology* 5 (1): 70–81.

Schor, Juliet B. 1992. *The Overworked American: The Unexpected Decline of Leisure*. New York: Basic Books.

———. 1998. *The Overspent American: Upscaling, Downshifting and the New Consumer*. New York: Basic Books.

———. 2010. *Plenitude: The New Economics of True Wealth*. New York: Penguin Press.

———. 2013. Why solving climate change requires working less. In *Time on Our Side: Why We All Need a Shorter Working Week*, eds. Anna Coote and Jane Franklin, 3–20. London: New Economics Foundation.

———. 2015. Climate, inequality and the need to reframe climate policy. *Review of Radical Political Economics* 47 (4): 525–36.

Thombs, Ryan. 2018a. Has the relationship between non-fossil fuel energy sources and CO_2 emissions changed over time? A cross-national study, 2000–2013. *Climatic Change* 148 (4): 481–90.

———. 2018b. The transnational tilt of the treadmill and the role of trade openness on carbon emissions: A comparative international study, 1965–2010. *Sociological Forum* 33 (2): 422–42.

van den Bergh, Jeroen C.J.M., and Giorgos Kallis. 2012. Growth, a-growth or degrowth to stay within planetary boundaries? *Journal of Economic Issues* 46 (4): 909–20.

Veblen, Thorstein. 1934. *Theory of the Leisure Class*. New York: Modern Library.

Victor, Peter. 2008. *Managing without Growth: Slower by Design, Not Disaster*. Cheltenham: Edward Elgar.

Watts, Jonathan. 2018. Arctic warming: Scientists alarmed by “crazy” temperature rises. *The Guardian*, February 27. https://www.theguardian.com/environment/2018/feb/27/arctic-warming-scientists-alarmed-by-crazy-temperature-rises.

York, Richard. 2012. Do alternative energy sources displace fossil fuels? *Nature Climate Change* 2 (6): 441–43.

Yu, Yang, Kuishuang Feng, and Klaus Hubacek. 2014. China’s unequal environmental exchange. *Ecological Indicators* 47: 156–63.

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