December 2018

Gaseous State: A Historical Geography of Natural Gas and the Capitalist State in an Age of Climate Change

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Abstract

In the 1930s U.S., a set of social forces and crises pushed forward state energy regulation. As states struggle to end greenhouse-gas emissions from fossil fuels, the threat of climate change demands new explanations for how energy policy emerges. In this dissertation, I explain the period of U.S. natural gas regulation between 1938 and 1978 from critical political economy and Marxist state theoretical perspectives. My main conclusion is that the capitalist state stabilizes markets for energy to serve capital with an auxiliary means of production. Based on that conclusion, I recommend that Marxist state theory be class-centered, i.e., recognize that the agency of mass movements and state workers to reform the capitalist state is structurally constrained by the state's role of maintaining capitalist class relations. In the introduction I explain how it is important to consider capital-gas relations because natural gas is a greenhouse gas and burning of gas by capital is causing climate change. In chapter one I explain how energy is a means of production, how the state relates to it and the class politics that result when the state allows markets to provision energy. In chapter two I show how, why, and for whom the state stabilized natural gas markets during the Great Depression. In chapter three I argue that the state governed natural gas for capital as a whole instead of fractions of capital in the postwar period. In chapter four I argue that the state allowed gas into markets previously served by coal because it strengthened capital's control over the means of production. In chapter five I argue that state gas law throughout the Fordist-Keynesian period locked industrial and commercial capital into patterns of high natural gas consumption. Along the way I engage with academic debates and literatures from energy studies, value theory and political ecology, among others. I conclude with a suggestion for state-energy relations that could replace capitalist state-energy relations and explain why that replacement is necessary given the threat of climate change.

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by

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Dissertation

Submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Geography.

Syracuse University

December 2018

Acknowledgements

Thanks to my adviser Matt Huber who gave me detailed, lengthy, comments on at least four or five drafts of every chapter and the intro and conclusion. Thanks, Matt, for leading by example and being funny and a great listener too. Matt and I worked on the chapters' arguments over many beers, so thanks to all the farmers, civil engineers, brewers, bottlers, truck drivers, bartenders and service staff who produced our beers. My proofreader, Shelley Gallagher, caught many split infinitives and made many helpful suggestions. The other members of my dissertation committee: Jamie Winders, Don Mitchell, Tod Rutherford, Antonio Ioris and Mark Rupert shared their wisdom and guidance and are model scholars that I aspire to be like someday. My older brother, Enzo Sica, helped clean up many of the figures. Pat Oberle helped me scan some maps at high resolution. Tio Teixeira talked with me about Marxist state theory at the office and over email. Akemi Inamoto, Andi Aguilar, Anna van de Grift and Jewell Bohlinger made the struggle through a difficult program bearable and even fun. Anna van de Grift, especially, gave me endless laughs and smiles when I was taking trips to archives and drafting chapters. Also, a special thank you to Akemi Inamoto for sharing many meals, drinks, and laughs with me as I finished the writing. *Gracias por su hospitalidad, amiga*. Ben and Kate Hutton and Tom Magner shared many laughs and drinks with me every year from start to finish. My "Ma" and "Pop," Dr. Alan Meyer Sica and Mrs. Anne Ryland Sica, spent many Sunday nights on the phone with me, listening to me rage and dispensing useful sympathy and advice. I expected the PhD to be difficult, but I never expected to find friends and mentors who would help me out every step of the way. Thank you for helping me write this. I couldn't have done it without you. One final note just for my Dad, Professor Sica. You always told me I could do this and you were right. I dedicate this document to you. I love you Dad.

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Introduction

Natural gas is easy to forget, ignore, or just overlook in the first place. It comes to homes, businesses, and industries in underground pipes and is colorless, odorless and tasteless. A rotten-egg smell (a sulfuric odorant called mercaptan) must be added so that if we forget to turn the stove off we don't fill the room with gas and asphyxiate. Gas's impact on the landscape, after pipelines are installed, is minimal. Innocuous utility markers and tiny plastic flags are sometimes the only indication that explosive fuel is flowing three or four feet below a road median.

It's so easy to overlook natural gas that even when disaster strikes gas infrastructure it doesn't attract much attention. In the autumn of 2015, workers discovered a massive gas leak from an underground storage facility at the Aliso Canyon oil field outside Los Angeles (McNary 2016). A subsurface well casing installed in 1954 when the well was drilled to extract natural gas failed (Byington 2017). It was repurposed in 1972 for gas storage without updating the equipment to handle accidental leaks or blowouts (Ibid.). As many as 20% of the underground natural gas storage sites in the U.S. are vulnerable to the same structural failure (Ibid.). The leak lasted 16 months and was the worst human-made greenhouse-gas disaster in U.S. history, according to atmospheric scientists at UC-Davis (Warrick 2016). It released 97 thousand tons of methane, with a global-warming potential larger than the 2010 Deepwater Horizon leak (Walker 2016). The Pew Research Center found that the Deepwater Horizon oil spill was the most-covered news story for nine straight weeks in 2010 (Statler-Throckmorton 2016). The mainstream media, however, was relatively quiet when it came to Aliso Canyon, treating it more like a local news story than a national, environmental disaster (Ibid.). We can ignore natural gas even when major disasters strike but gas *is* vital, and it affects us in ways that we may not realize.

Gas permeates the commodities that capitalist societies require to reproduce themselves every day. It's a feedstock in the production of fertilizer, which has allowed the human population to grow well beyond previous limits (Huber 2017a). Its hydrocarbons are also a building block of many plastics, chemicals, and pharmaceuticals (NGSA 2013). Natural gas is a fossil fuel, and like oil and coal, when burned, it releases a significant amount of energy that can be used as heat or to generate electricity. In heat processes, gas is used to make paint stick to all types of metals including vehicles, household appliances, electronics, and parts of homes like windows and doors (PCI 2016). Gas is used for food processing, for baking grain into breakfast cereals, and for melting sugar into candy (Busby 1999, 87). It's used to heat process iron, steel, glass, cement and water for industrial boilers (UCS 2015).

In Marxian terms, natural gas is an essential *means of production* for a broad swath of goods. How did it reach this position with such little attention paid to it? In this dissertation, I argue that the capitalist state made it possible for natural gas to become a critical means of production for capital. I discovered that the taken-for-granted aspect of gas in the U.S. resulted from decades of gas regulation that took this resource from a fringe source of energy to a mainstream one. I explore the regulation of natural gas based on a wager that 20th century gas regulation holds important lessons for how the current gas system might be transformed to deal with global climate change. As I will explain, markets alone are not doing enough to either stop methane leaks or hasten the transition away from natural gas. Despite its relative advantages, gas still emits carbon when burned, which makes its use a part of the overall climate change dilemma.

To avoid the worst effects of climate change, high-energy consuming societies must be weaned off gas, but energy markets aren't making this happen by themselves. If the U.S. state

adopts a plan to mitigate climate change, it will have to take a greater role in markets. Approaching that likelihood, it would help to know the purposes the state set up the gas system to serve. By knowing the purpose the gas system was built to serve, we can better understand how to alter it to serve new ends. One of the state's primary objectives in regulating natural gas was to serve capital with an essential means of production at prices that allowed for profit maximization. As the state addresses climate change, it will once again be confronted with capital's imperatives when it drafts new energy policy. Policy that ends fossil fuel use and transforms energy systems to run on climate-stabilizing energy will most likely not always allow for profit maximization by many fractions of capital that depend on fossil energy for high profits. Therefore, it is important that civil society push actors within the state to deprioritize capitalists' profits and thereby change the capitalist character of the state as it relates to energy.

A dissertation devoted to natural gas is unusual within the broader context of energy studies, where even the experts choose to pass (over) gas. Although reflecting on academic literatures in political science, Balmaceda's recent argument (2018) on the conflation of fossil fuels with *oil* is more widely applicable. She finds that while authors implicitly or explicitly refer to fossil fuels (Ibid., 131), the literature on other fuels remains much smaller than that of oil (Ibid., 130). "We have been so overloaded with oil-related discussions, that we have forgotten oil is far from the only game in fossil energy town" (Ibid.). Fossil fuels include petroleum (oil), coal and, critically, *natural gas*, and their conflation is problematic for understanding the dilemma of fossil fuel addiction in the age of climate change. Following President George W. Bush's diagnosis of U.S. "oil addiction" in his 2006 State of the Union address, many energy experts have widened the scope of this "addiction" to include all fossil fuels. Despite broadening the

'addiction' to include fossil fuels, most devote their discussions to oil (Braml 2007; Klare 2014) or to coal (Perera 2008).

When natural gas is mentioned it is frequently treated as somehow outside the category of fossil fuels, which it is decidedly not. In an article where he compares fossil fuel addiction to tobacco addiction, Suranovic (2013, 601) says that natural gas is a suitable replacement for coal in power plants used to generate electricity and for home heating. Tollefson (2018) mentions coal eight times, yet only includes gas in a passing statement about how it releases less carbon dioxide than coal when burned. Thompson (2014) praises gas for having "eaten into the coal share of the energy mix," even though he is allegedly decrying *fossil fuel* addiction. Goswami (2006, 39) proposes hydrogen fuel as a cure for fossil fuel addiction, despite his own admission that a principle source of hydrogen is natural gas. Goswami's proposition epitomizes the tendency to place natural gas somehow outside the category of fossil fuels, and it parallels another argument about natural gas serving as a "bridge" fuel (Levant 2015, 27). Analysts suggest that gas may serve as a less-carbon intensive bridge between a fossil-fueled present and a renewably-powered future (Ibid.). Regardless of whether that prediction should prove true, natural gas releases climate-warming carbon dioxide when it is burned (Cooper 2018). It is still a fossil fuel, despite its advantages over coal and oil. Overall, the general neglect of natural gas conforms with trends in the discipline of geography where natural gas is a neglected resource compared to oil (Haggerty 2017, 66).[1] This gap will be of interest to geographers of energy, but why should anyone outside of that small cohort care about gas?

[1] Haggerty doesn't mention the geographer, James Parsons, whose article (1950) offers an historical/idiographic approach (albeit dated) to the U.S. natural gas system.

Climate change is a global dilemma demanding that scholars and citizens pay more attention to all fossil fuel resources, including the neglected (up until now) natural gas. One geographer, Vaclav Smil, author of over 40 books and 500 papers on energy,[2] has *not* been neglecting gas (2015a). Gas is, in Smil's view, "a preferred fuel" (Ibid., 192) because it is a less-polluting alternative to oil for heating, or coal for electricity generation (Ibid., 154). Renewables trump all fossil fuels, including gas, when it comes to reducing pollution and greenhouse gas emissions (UCS 2017). Smil, unfortunately, doesn't see renewables replacing fossil fuels. In 1990, 88% of the world's total energy supply came from fossil fuels (2015a, 154). Twenty-two years later, that share had decreased only one percent (87%) (Ibid.). With nuclear generation stalled or stagnant in most cases, Smil considers (mostly methane-based) gas the "best option" for decarbonizing the world's energy supply as it is currently constituted (Ibid.). However, he is not overexaggerating its importance.

Smil tempers claims made by the International Energy Agency (IEA) that we are living through a "golden age of gas" (Ibid., 196). "A more accurate characterization of the coming decades of changes in global fossil fuel composition would be not an age of gas but the era of rising natural gas importance" (Ibid., 219). Smil anticipates gas will never attain the same level of dominance that wood had in the preindustrial era or coal in the late-19th to early-20th centuries (Ibid., 215), but it will still be a key 'card' in the energy 'hand.' Even as wind and solar electricity generation expand, there will still be a need for baseload generation on calm or cloudy days, at night, and during the winter (Ibid., 207). Electricity storage would eliminate the need for non-renewable baseload generation, but it would require storage options (batteries, among

[2] Bill Gates claims to have read all 40 books (Voosen 2018) and recently said "I wait for new Smil books the way some people wait for the next *Star Wars* movie" (Ibid.).

others) that could hold gigawatts of electricity, which Smil thinks are unlikely to be invented given present market conditions (2015b). Therefore, because of gas's relatively low carbon content and its potential to complement renewable generation, fellow energy scholar Daniel Yergin concurs with Smil that gas is a "fuel of the future" (2011, 340).

Even if Smil's and Yergin's predictions fall short, at the moment gas looks like a rising contender in the global fuel mix. There is no shortage of supply, and demand is rising, with U.S. natural gas exports quadrupling to two billion cubic feet a day over the last year (Butler 2018). High-volume hydraulic fracturing in the U.S. has made gas inexpensive, and prices are expected to stay that way for the near future (Smil 2015a, 199). In China, gas has grown from two percent of final energy demand in 2000 to six percent today, with most of the supply coming from imports (Butler 2018). Gas is the largest source of electricity in the U.S., at 32% of total generation, and the U.S. Energy Information Administration (U.S. EIA) expects that more than a quarter of added capacity will be gas-fired in the coming decade, at a cost of over $500 billion (Crooks 2018a). Small-scale gas-fired power plants are gaining in popularity in Southeast Asia, Latin America, the Middle East, and Africa (Ward 2018). However, the story of gas's rise in importance is not an unalloyed good for the environment.

The IEA credits the slowdown in greenhouse gas emissions (GHG) in recent years to U.S. power plants switching from coal to natural gas, which slowed anthropogenic emissions of carbon dioxide (CO_2) into the atmosphere (Reed 2017). Natural gas releases less CO_2 than wood, coal, or oil when burned, but its chemical composition is almost completely methane (CH_4), which is itself a potent GHG (Smil 2015a, 169). According to the United Nations Intergovernmental Panel on Climate Change (IPCC), CH_4 is 21 times as potent as CO_2 as a GHG (Ibid., 170). CH_4 is responsible for one fifth of anthropogenic climate change since the start of

the Industrial Revolution (Ibid., 169). Its CO_2 savings are thus cancelled out by CH_4 leaks from gas pipelines, compressor stations, gas flaring at oil wells, and deliberate or accidental gas well venting (Ibid., 170). The Environmental Protection Agency (EPA) estimated that in 2013 30% of the U.S. natural gas supply leaked out of the oil and gas supply chain (*Economist* 2016a). A more recent study in *Science* claims that the rate is 2.3% of total gas production per year, 60% more than the EPA estimate (Schwarz and Plumer 2018).

Experts assume that oil and gas companies would try to plug leaks to conserve their product and sell it to customers rather than waste it into the atmosphere (Crooks 2018b). That assumption is mistaken. Small producers have been chafing against regulations passed under the Obama administration that require gas infrastructure be tested for leaks with more regularity (*Economist* 2016b). The head of the Texas Railroad Commission called the regulations part of Obama's "war on fossil fuels" (Ibid.). Before resigning as head of the EPA, Scott Pruitt tried unsuccessfully to block the implementation of Obama's new rules about leakages (Loria 2018). ExxonMobil unveiled plans to phase out valves and controls in oil fields that vent methane and replace them with compressed air (Krauss 2017), but the oil major is under no obligation to follow through with these plans and could cancel them at any point. Left to themselves, private companies are not doing enough to reduce CH_4 leaks, but this is a similar story to how humanity is responding to climate change in general. Climate change is increasing the power and frequency of heat waves, floods, sea level rise, hurricanes (NASA 2018) and decreasing the ability of humanity to survive and flourish especially in the developing world (Parenti 2011).

Although the IEA estimated that GHG emissions have slowed down in recent years, significant growth in global energy-related emissions resumed in 2017 (Pfeifer 2018). This rise, according to the IEA executive director, Fatih Birol, indicates that "current efforts to combat

climate change are far from sufficient" (Ibid.). The current paradigm of non-legally binding treaties by the United Nations Framework Convention on Climate Change (UNFCC) and a market-led, private energy sector is failing to mitigate climate change. Newly built, gas-fired electricity generation plants will have to operate for at least two more decades to recoup their construction investments (Smil 2015a, 205). Markets alone are not reducing dependence on gas or other fossil fuels, and this is a major problem. Energy companies and utilities are more concerned with showing their shareholders steady returns on investment than ending climate change. Therefore, regulation will have to play a key role in ending fossil fuel use in order to slow down and potentially reverse climate change.

Natural Gas, Capitalism and The State

This dissertation makes both empirical and theoretical/conceptual contributions to geography. The topic is natural gas, which is a neglected energy resource compared to oil in energy geography (Haggerty 2017, 66). The approach I took to studying natural gas is political ecological but rather than looking at the politics of gas extraction (Perreault 2006) or rent distribution (Perreault and Valdivia 2010), I explain how massive demand for natural gas was produced. A great deal of this explanation leans on how the state facilitated gas's adoption by industrial and commercial users as a preferred fuel. Political ecologies have made great strides in recent years integrating environmental concerns in political geography (Robbins 2003). I contribute a theory of state-energy relations inspired by Marxian state theory to conversations on the political ecology of the state (Ioris 2014; Whitehead et al. 2007).

In writing about gas policy I depended on an interdisciplinary body of scholarship as a springboard for my arguments. Compared to geography, much more research has been done on natural gas by historians, political scientists, economists, and scholars of energy working in

interdisciplinary departments (Peebles 1980; Sanders 1981; Davis 1984; Tussing and Barlow 1984; Vietor 1984; Clark 1987; Yergin 1991; Castaneda 1993; Castaneda and Pratt 1993; Vietor 1994; Tussing and Tippee 1995; Castaneda and Smith 1996; Castaneda 1999; MacAvoy 2000; Yergin 2011; Makholm 2012; Waples 2012). Policy-centric and political science scholars use gas as an object through which to test theories of American political behavior (esp. Sanders 1981; Clark 1987; Makholm 2012; Vietor 1994). These authors share a technocratic approach, emphasizing control of the natural gas system by elite, technical experts in government and industry. I corresponded with one of these authors – a gas industry consultant – about how he thought the modern gas market came to be. I asked him who he thought was most responsible for creating the modern market in natural gas. "Who created it? As much as anybody, representing dozens of distributors for years in Federal Energy Regulatory Commission (FERC) proceedings against the pipelines, *I did* (his emphasis)." According to him, the market is notional; it can be created out of thin air by business consultants in Washington, DC. His statement showcases the elitism of technocracy that overlooks the social forces of capital, labor and the state that produce the natural gas system through political struggle and contestation.

These readings of the origins of the gas system are also economistic, emphasizing the impersonal forces of supply and demand over any specific person, expert or otherwise. IN this frame, government intervention in gas markets is a response to price signals getting temporarily distorted and needing to be restored, rather than from industrial and commercial consumers demanding the state restore the provisioning of an essential production input. In these narratives, supply imbalances indicated by changes in the price of gas precipitate policy solutions for meeting demand, usually by altering incentives and adjusting levels of market oversight (Peebles 1980; Davis 1984; Vietor 1984; MacAvoy 2000). Some adopt a similar economistic approach

but credit cunning and brave entrepreneurs willing to take risks for increasing supply in the face of fuel scarcities (Yergin 1991; Castaneda 1993; Castaneda and Pratt 1993; Castaneda and Smith 1996; Castaneda 1999; Zuckerman 2013). Although entrepreneurial gas drilling and exploration was obviously important to the formation of a national gas market, the government stabilized the young industry, built some of the earliest gas pipelines, facilitated its successful competition over other fuels and directly and indirectly facilitated gas becoming a favored fuel by industries and commercial users.

Another common approach to natural gas focuses on issues of international sovereignty around gas pipelines. Like Sanders (1981), these works approach natural gas as a political object, the study of which can be used to advance theories of governmentality, territory, sovereignty, etc. These include studies of Russian-European pipeline politics by geographers and political scientists (Bouzarovski and Konieczny 2010; Schmidt-Felzmann 2011; Bradshaw 2014; Bouzarovski et al. 2015; Mišík and Prachárová 2016; Stephenson and Agnew 2016), the disruption of continental markets by liquified natural gas (LNG) (Bridge 2004; Harrison 2008; Bradshaw et al. 2015; Bridge and Bradshaw 2017), or a combination of those topics (Grigas 2017). These approaches share a tendency to reduce economic geographies of energy to conflicts between states, focusing on conflicts around "access points, conduits, and chokepoints through which energy flows" (Sica and Huber 2017, 339). Energy is not just a chess piece in a game of territorial competition between nation states. Flows of investment in energy systems cross borders within and between nations. States cooperate with other states and investors from other countries to ensure energy projects generate profits and tax revenues. States also repress opposition within their own borders all in the name of ensuring that energy systems remain stable and the energy continues flowing.

Political ecologists also have examined the distributive politics of resource rents and struggles around extraction of natural gas (Kaup 2008; Nevins 2009; Perreault and Valdivia 2010). Most recently, interest in natural gas has followed the rise of hydraulic fracturing (fracking), a technique for extracting oil and natural gas from shale rock formations using highly pressurized water, sand, and chemicals that has allowed a new oil and natural gas boom in the U.S. (Andrews and McCarthy 2014; Lave and Lutz 2014; Wylie 2015; Sica 2015; Sneegas 2016; Sica and Huber 2017; Murphy et al. 2018). The object of study in these literatures is local environmental and social impacts of gas extraction rather than natural gas demand or consumption. Research on extraction and fracking takes the massive demand for natural gas in the U.S. for granted because it narrows the historical lens from the mid-2000s to the present. This makes sense if fracking, and especially the laws that allowed it to flourish (Andrews and McCarthy 2014), is the main object of inquiry. Focusing on fracking or the politics around gas production obscures how massive demand for gas from fracking came about, which also has a political ecological explanation.

This scholarship shows natural gas governance evolving in response to changing regimes of technocratic control, price signals, international competition, and the rise of new technology. My study was built on these insights, but by focusing on relations between natural gas and the U.S. state, I came to some different conclusions. Technocratic explanations overestimate the impact of individual experts (like government bureaucrats) on the gas system, which is a cooperative effort between thousands of workers, consumers, capitalists, and state agents. Economistic analyses either grant too much agency to capitalists or collapses capitalist social relations to impersonal forces of supply and demand. Studies that frame gas as an object for inter-state competition omit the cooperation within and between states that pipelines and gas

markets require just to function day to day. Studies of struggles over gas extraction and the distribution of gas rents take for granted the demand that natural gas systems have locked-in through decades of oil and gas capitalist development and state intervention in energy markets.

As I explain in the body chapters of this dissertation, the U.S. state stabilizes the gas system during moments of market turbulence because gas is a critical means of production for capital. In recent years, scholars have begun to offer explanations of mass politics and culture that place fossil fuels at the center of historical change (Mitchell 2011; Szeman and Boyer 2017). More critical contributors have explained how capitalism depends on fossil fuels (Altvater 2006; Urry 2014) for making capitalist relations of production possible (Malm 2016) and for fueling the social reproduction of capital (Huber 2013a). Less attention has been paid to the crucial role that fossil fuels play as a productive force (although see Christie 1980). The bulk of Marxian approaches to energy also focus on coal and oil to the exclusion of natural gas. Huber's analysis of oil finds it to be central to social reproduction of capitalism and neoliberal individualism in the postwar U.S. (2013a). Malm's research on coal concludes that it allowed early industrialists in England to move factories into towns where labor power could be more easily found and controlled (2016). Although these literatures have shown how energy is an essential foundation for capitalism, Marxist state theorists have yet to integrate energy into their theories of the capitalist state.

Understandably, Marxist state theory focuses on political systems, ideology and political philosophy, and theories of the welfare state (Jessop 1990; 2008; Poulantzas 1973; 1978; O'Connor 1973). These studies have illuminated how the capitalist state becomes involved in reproducing capital-labor relations, alienation and exploitation, maintaining stable accumulation, and restoring capitalist social relations following crisis. I argue that the capitalist state also

intervenes in energy markets to restore the provisioning of this vital means of production for capital. Unregulated markets are too turbulent and prone to ruinous competition or oligopoly to provision energy unsupervised. As I argue in chapter one, when energy markets fail, the capitalist state steps in to ensure that energy is provisioned to society because it is a vital means of production for capital. This point has also eluded theorists of the environmental state, who study the politics of environmental agencies within states but avoid the environmental impacts of fuel and industrial policies (Whitehead et al. 2007; Harris et al. 2017).

Methods and Plan of Work

This dissertation is based on primary source, archival research conducted at the National Archives at College Park, Gerald Ford Presidential Library, Jimmy Carter Presidential Museum, Eisenhower Presidential Library, and the Penn State Special Collections between 2015 and 2017. While reading archival records, I looked for public responses (letters to the president and members of congress) and moments of conflict (between energy companies, unions, civil society groups etc.). Many of the secondary sources I consulted before conducting my own original research gave fine-grain, day-by-day historical narratives of gas legislation as it proceeded through the legislative or executive branches of government. I wanted my approach to be different because I was interested in understanding the broader social forces that motivated the state to intervene in energy markets. My aim was not to represent the history of natural gas regulation, but to describe the general thrust of the state as it related to energy and uncover the base of popular support for that general thrust.

The remainder of this dissertation proceeds in five substantive chapters. Chapter one engages with academic discussions regarding energy and the state and offers a conceptual argument that joins Marxist state theory with an analysis of energy markets. I argue that energy

is crucial to the functioning of capital as a critical means of production that is very difficult to substitute for other resources. The remaining four chapters are built around historical-geographical case studies drawn from primary source, archival research. In chapter two, I argue that the state intervened in 1930s energy markets to restore the proper circulation of capital through natural gas. Here, I engage with geographical literatures on Marxian theories of value and capital circulation. In chapter three, I engage with political ecologies of the state and the work of the political sociologist, Nicos Poulantzas, through a case study of a 1954 Supreme Court decision. I argue that when the state governs natural resources, it does so with an eye toward issues like sinking the value of labor and the cost of constant capital. In chapter four, I argue that the politics of energy transitions have a class dimension, with a case study of the state using natural gas policy to weaken coal miners' unions. The final chapter uses the deregulation debates of the 1970s to argue that scholars of neoliberal nature need to contextualize the rise of neoliberalism within the contradictions of Fordist-Keynesianism. I show how state institutions made gas cheap and more widely accessible, allowing capital to become dependent on it as a means of production. In the conclusion, I argue for a state energy policy to address climate change that serves people instead of capital.

Chapter 1

Fanning the Flame: Energy, The Means of Production, And the Capitalist State

> *There are few beliefs more important to the health of the status quo than the one which treats state institutions as neutral in the political economic clashes between different groups, such that each of them has a more or less equal chance of winning the support of these institutions.*
>
> - Bertell Ollman 1993, 95

Introduction

If you want to get the latest news about energy you might pick up a copy of *The New York Times* or go to their website. There you would find that most energy news is listed under four sections: business, science, technology, and politics. In industrial societies, it's common sense that you can't run an economy without energy and that society's ability to harness energy progresses with the frontier of science. But energy also shows up in the *national news* because it is a subject of great concern to the capitalist state. Every day there's some new story about a government agency or politician passing a law or making a statement about the energy supply, the types of energy we should be harnessing, or how we should be using energy. In this chapter I explain why energy is such a central concern to the capitalist state and how the state relates to energy based on that concern. To begin, I'll review how academics already explain energy-state relations to better contrast it with my own.

The literature on the relationship between energy and the state is overly focused on states that control lots of oil and gas. State-owned oil companies like ARAMCO use the revenues from selling oil to "stave off criticism, dissent and potential revolution" (Jones 2010, 5). The "development tap" used to quell dissent among the Kingdom of Saudi Arabia's subjects can be turned off at any point at the king's discretion (Vitalis 2007, 213). In Ba'athist Iraq, Saddam Hussein used oil revenues to fund welfare programs and wage war against neighboring Iran

throughout the 1980s (Le Billon and El Khatib 2004, 112). Russian state-owned oil and gas enterprises built during the Soviet period were sold to a financial oligarchy, following the breakup of the Soviet Union (Labban 2008, 115). The period of Russian reconsolidation in the 2000s coincided with an oil boom, and Vladimir Putin's pre-presidential dissertation charted a modernization path for the nation paid for by oil rents (Rogers 2015, 147). Following the rise of tar sands in the Canadian province of Alberta, oil rents grew to constitute 20% of the provincial government's total annual revenues over the past five years (Adkin 2016, 14). Revenues generated from Chinese state-owned oil and gas companies flow directly into the coffers of the Chinese Communist Party, empowering its energy fractions (Isoaho et al. 2016, 10). In Venezuela, oil wealth is the basis for political power (Coronil 1997, 8), and the Ecuadorian government uses oil patronage as a "vehicle for progress" (Valdivia 2008, 473).

Terry Karl uses the term "petro-state" to describe governments that control large flows of rent from oil sales but lack strong democratic institutions (Karl 1997). [3] Some of these states are under a "resource curse" (Ross 2012; Le Billon 2015), meaning that exporting large amounts of resources like oil, diamonds, and copper afflicts states with "high levels of corruption, authoritarianism, and poor governance" (Kennedy 2014, 264). When applied to oil-and gas-producing countries, resource curse arguments reproduce a type of oil-based fetishism (Huber 2011a, 33). This is the idea that oil itself *causes* social relations or is the main explanation for how social formations arise and persist. (See Watts [2004] for a damning critique of resource-curse thinking.) In direct opposition to resource curse narratives, Walker shows how California's

[3] Karl says her petro-state category applies only to "capital-deficient oil exporters" (1997, 17). Using GDP per capita as a measure of capital, she avoids making claims about "capital-surplus," i.e. rich countries, like Kuwait, Saudi Arabia, Qatar, UAE, Libya, and Iraq (Ibid., 18). She limits her petro-state thesis to poor countries like Algeria, Indonesia, Nigeria, Venezuela and Iran, even though Iran had a higher GDP per capita than Iraq according to her own data (Ibid.).

rich resource endowment became a springboard for strong capitalist growth and the formation of a robust capitalist state (2004, 190). Natural resource development also can lead to positive feedbacks that strengthen economies and governments in unpredictable ways (David and Wright 1997; Wright and Czelusta 2007). Oil and gas cannot distribute and exert legitimate force and power throughout society because they have "no inherent power outside the social and political relations that produce (them)" (Huber 2013a, 3).[4]

Despite oil not determining the state's structure and orientation, large oil and gas producing states other than the U.S. still share things in common. Governments like the Saudi monarchy and the Maduro administration in Venezuela control and direct rents gained from the sale of oil to non-market institutions of government. That said, states are not monolithic entities that act as unified actors in anything, including their relation to resources. Indeed, this form of "state fetishism" (Huber 2012, 402) obscures how states are made up of thousands of people with their own agency to change the way state policies are implemented. However, it is fair to assume that state employees' agency is limited by the related material needs (1) not to get fired and (2) to continue earning the wage they need to pay their mortgage. Also, the distribution of rents from oil in many oil-producing countries is deeply contested from within and without the state (Bridge 2008; Kashi and Watts 2008; Valdivia 2008; Perreault and Valdivia 2010; Valdivia and Benavides 2012; Zalik 2012). The politics of state-energy relations in many of these cases is a distributional one (Emel and Huber 2008), focused more on the parceling up of rents than on how energy is used in capitalist production (cf. Huber 2009a, 105).

[4] This has not stopped Karl's petro-state thesis from being applied to Russia (Goldman 2010) and Canada (Nikiforuk 2012).

The above-mentioned literatures explain the distributional struggles around rents from energy sales, which is *one* essential energy-state relation but perhaps not the most essential one for thinking about energy's role in capitalism. The focus on rents shows that many states experience energy primarily as a windfall that can be used to fund non-market-based institutions. The capitalist U.S. state also collects rents on oil/gas produced on public lands (including offshore) and taxes oil and natural gas companies, employees, etc. However, energy also is a central concern to capitalist states because it is a vital means of production for capital.

Energy: A Vital Means of Production

The means of production are the raw materials, tools, facilities etc., that capitalists buy to produce commodities. Marx broke the means of production down into three categories: raw materials, auxiliary materials, and instruments of labor (1867a, 209). Instruments are the things that come between the worker and her object of work (Ibid., 179). "An instrument of labor is a thing, or a complex of things, which the labourer interposes between himself and the subject of his labour, and which serves as the conductor of his activity" (Ibid.). They include not only the tools and machines but also the factory where she works (Ibid., 203). Raw materials become the substance of the product after their form is changed through the labor process (Ibid.). Soy beans, for example, are fed by workers to cattle that metabolize the beans into muscle fibers that form the product, beef. Auxiliary materials are substances combined with either the raw materials or the instruments of labor to modify the product (Ibid., 181).[5] These include grease used to

[5] Marx uses the words auxiliary (1867a, 203; 209) or accessory (Ibid., 181) interchangeably when referring to means of production that vanish during the labor process but modify the product. I picked auxiliary because scholars working with Marx seem to have converged around the term *auxiliary* to describe energy as a means of production (Harvey 1982, 206; Heinrich 2004, 136).

lubricate wheels and gears (Ibid., 203), dyes used to color cloth (Ibid., 181), and coal used "under a boiler" (Ibid., 181; 203).

Coal is useful for turning water into steam in a boiler because when burned, it releases *energy*. Coal, oil, and gas were once immense quantities of photosynthetic plants that were fossilized and retain solar energy in a highly concentrated form (Crosby 2006, 62). "Fossilized sunshine" (Ibid., 59) gave capital access to unprecedented amounts of solar energy compared to our previous sources: plants, human and animal muscles, winds, and flowing water (White 1943; Cottrell 1955; McNeill 2000; Huber and McCarthy 2017). The incredible energy density of fossil fuels (Smil 2015c, 97) made it possible for capitalists to replace waterwheels with steam engines and move factories from rural riverbanks to cities with exploitable proletarians (Malm 2016, 146). Beginning in the late-19th century, the core productive force of capitalism became automatic machinery (Huber 2009a, 108), and from then on modern industry became completely dependent on inanimate forms of energy (Christie 1980, 15).[6]

> The dominant theme of technological innovation throughout history has been the effort to shift the burden of energy use from human muscles to other physical and biological systems, such as animals, machines and computers. The expansion in mechanical output facilitated by technological progress typically leads to more energy-intensive societies where those who control the means of production can generate greater surpluses and profits. (Kolasi 2018, 39)

Boilers, furnaces, ovens, lights, conveyor belts, robots, punches, presses, hoists, assemblers, sorters, saws, sprayers, water systems, communications, transportation and logistics systems, computers, security systems, quality control systems would be so much wasted space without the coal (for use in electricity generation especially), natural gas, oil, hydroelectric,

[6] It's true that fossil fuels are an indispensable feedstock ("raw material" in Marx's terms) for fractions of capital in petrochemicals (Huber 2013a, 61-95) and fertilizer production (Huber 2017a) but I'm mostly interested in energy as an auxiliary means of production here.

nuclear energy, renewables etc. that energize them. Whether the capitalist adds auxiliary means of production at the point of production or takes energy from a pipeline, electrical grid, or tanker truck alters the geography of production, but not the dependent relationship of industry on energy.

The capitalist state, because it is ultimately dependent on surplus value production (Block 1987, 62), tries to ensure that capital receives adequate energy supplies to serve as this essential means of production (Jessop 1982, 234). Marxist state theory has three main approaches to conceptualizing state-capital relations. The *instrumentalist* theory espoused by early Miliband (1969) and Marx and Engels of *The Communist Manifesto* (1848a) says that the state is basically captured from the inside by the bourgeoisie. This theory is criticized because sometimes the capitalist state must act against the interests of particular capitalists. In other words, the capitalist state cannot just be a tool of the bourgeoisie because the bourgeoisie is made up of competing interests (Das 2006, 65-66). *Structuralist* state theories say that the autonomy of capitalist state action is constrained by the need to reproduce capitalism as a whole (O'Connor, 1973; Poulantzas 1973; Miliband 1977; Hirsch 1978; Holloway and Picciotto 1978; Offe 1984). Poulantzas encapsulates this thinking with his concept of *relative autonomy*: the capitalist state has to be free from the control of any particular fraction of the bourgeoisie in order to safeguard capital as a whole (Poulantzas 1973, 284-5).[7] One drawback of structuralist theories is they don't

[7] Even though Poulantzas says that states operate under the control of a dominant group of capitalists, his idea that states retain their own autonomy relative to any particular fraction of capital was embraced more often by the Marxist state theorists who followed. Like a lot of Marxist state theory from the 1970s, Poulantzas's work is complex and hard to follow, and he contradicts himself in places. (This might stem from errors in translation, and there is a need for a reading of Poulantzas by a French-speaking political ecologist.) For example, he contradicts his own notion of the state's relative autonomy in the same book where he introduces that concept, "The relation between the capitalist state and the dominant classes or fractions pushes them towards their political unity under the protection of a hegemonic class or fraction" (Poulantzas 1973, 239)." Regardless, relative autonomy was picked up and developed by the scholarship (Das 2006) and improved upon by the likes of Clarke (1983).

leave enough space for the agency of class struggle and state employees to influence the state (Das 2006, 74). *State-centered* state theories highlight the agency of class struggle (Poulantzas 1978; Clarke 1983; Wright 1978) and the workers within the state itself (Skocpol 1985) to change how the capitalist state functions.

Using energy-state relations as a basis for understanding the capitalist state, I argue that the agency of state employees and mass movements is limited by the capitalist class relations that the capitalist state upholds. In the language of Marxist state theory, I espouse an updated structural theory that takes agency seriously while recognizing the structural constraints the capitalist state is under. The agency of mass movements and state workers is limited by the capitalist state's imperative to maintain capitalist class relations. No amount of struggle can overcome the structural limitation of needing to reproduce capitalist class relations *without changing the character of the state itself.* I call this theory of the capitalist state *class-centered*. Centering the capitalist state on class allows theorists of the state to understand the limits to state reform of capitalism. Under capitalism, exploitation of labor by capital must be maintained if capital is to survive. The state can change how that exploitation is expressed or the form it takes, but it cannot eliminate it entirely. Doing so would risk capital's survival and would change the character of the state from capitalist to something else e.g., socialist or communist.

Scarcities of energy pose an existential threat to capitalist class relations, and the capitalist state responds by stabilizing energy markets. Even before production came to be dominated by engines, crucibles and electrified motors running on oil, gas and coal, capitalist production was dependent on the energy in human and animal muscles, powered by food calories, or by the windmills and waterwheels, powered by the sun and gravity. If the capitalist state were to be forced by state agents or a mass movement to stop the flow of energy to capital,

the state would oversee the collapse of capitalism as a whole. Without energy as an auxiliary means of production, the other means of production (raw materials and instruments of labor) cannot be animated by labor power to produce surplus value. Inanimate energy (coal, oil, gas, uranium) powers machinery and is tremendously important for modern industry. However, at a very basic level, energy expended by laborers' minds and animate bodies is still (despite fears of automation and robotization) irreplaceable to a capitalist mode of production. Capitalists buy labor power not only can it can produce value like the means of production, but because workers can produce more value than they require to survive (Marx 1867a, 193).

Scarcities of energy were dangerous to capital even when labor was only formally subsumed to capital i.e., when workers still controlled the means of production, even if their labor was directed by capital and capital profited from it. Despite cottage industries or putting-out subcontracting systems not being heavily reliant on mechanized production, the energy provided by human muscles and food calories was still an irreplaceable input to production even at smaller scales of production. However, under the real subsumption of labor to capital, productive forces have advanced in a technical sense, and their continued functioning has become dependent on more energy than labor power alone can provide.

In terms of energy use, the significant capitalists aren't dropping in on their cottage industries at the end of month to drop off steel thread and collect pins from workers using their own hammers, tongs, and fireplaces. Modern industry chews through 51% of the world's energy supply (Huber 2017a, 154) because capitalists demand that workers strap in and hitch on to blast furnaces, 13,000 ton, open-die, forging presses, bucket-wheel excavators, battalions of electrified robots, and factories lit for day, swing, and night shifts. Asking the capitalist state to relate to energy differently, perhaps by stopping the flow of fossil fuels to industries that burn them, is to

ask the capitalist state to kill capitalism (or at least put it on life support). It could be demanded that the state cease being a capitalist state, but that is a different type of demand and deserves to be recognized as such.

Capitalist state interventions into energy markets vary in their depth of state control. In Fordist-Keynesian France and the U.K., the capitalist state nationalized coal, gas, and electricity to avoid the disorder of privately controlled energy markets (Miliband 1969, 97; O'Connor 1973, 184). In the U.S., the capitalist state allows industries that produce the means of production to be profit-seeking, but steps in at moments of crisis (Hirsch 1978, 93). Examples include the National Guard stepping in to restore profitable oil markets in 1930s Texas (Huber 2011b) and governor Charles Bryan taking over Nebraska's coal market to end a monopoly in the 1920s (O'Connor 1973, 197). Given energy's importance to capital, U.S. capitalist state intervention in energy markets is a logical response to market failure.

Intervention has also led to a false narrative that energy markets are apolitical when the state isn't intervening. Historically, U.S. energy markets have been constructed as a realm beyond politics (Huber 2013a, 125), where actors like the Saudi royal family or Russian petrogarchs cannot meddle with the forces of competition. Free markets were supposed to resolve the 1970s energy crises that were blamed on political manipulation of otherwise apolitical market forces (Ibid.). Markets exist in many different political-economic configurations (Lindblom 2001) and are not inherently exploitative or undemocratic (Frase 2016, 112). Markets are a technology, and like other technologies, their social impacts depend on the economic logic guiding their use (Ibid.). By allowing energy to be provisioned by markets (as opposed to nationalizing it, for example), the U.S. capitalist state grants the capitalist class considerable influence over energy. If energy systems are allowed to be run for capitalists' use in

profit maximization, then climate change demands that civil society must push the state to end market-provisioning until markets are not controlled by capitalists.

Energy Markets Under Capitalism

> *A market is a cash nexus between buyers and sellers, but this nexus does not just exist; it has to be made… To be sure, there is government intervention in markets, government regulation and guidance… but intervention and regulation simply seeks to influence the terms on which capitalist enterprises exercise their power to make markets…*
>
> - *Diane Elson 1988, 10*

Under pre-capitalist social formations like feudalism, most people lived as peasants under the supervision of a lord (Harman 1999). Control over the means of production (land, first and foremost) was the basis of survival for the peasantry, and access to land was granted to the peasantry in exchange for tribute to the lord (Ibid., 140). An individual's access to the food, fuel, and materials they needed to survive was dependent on usufruct rights to land rather than on market transactions. Capitalism is marked by a "market compulsion," where workers and non-capitalists (i.e., most people) are divorced from the means of production and must sell their labor power for a wage to buy the means of subsistence in the market (McNally 2011a, 37).[8]

This situation doesn't arrive out of nowhere; it takes a sustained effort on behalf of the capitalist state. Geographers have a longstanding interest in state policies that bring about neoliberalization, i.e., the deregulation of state functions and their reformation into market-based provisioning systems (Peck 2001, 445). Much of this work focuses specifically on the state as a critical "resource actor" that intervenes to allow capital to acquire and mobilize natural resources (Bridge 2014, 124). Many case studies examining the neoliberalization of the environment

[8] For the purposes of my argument I'm leaving aside how rentiers and other non-capitalist, yet non-productive (of surplus value), members of society figure into the analysis. In general, they depend on the goods and services produced by workers, so their class (though not always personal) interests align more with the capitalist class than the proletariat.

(Heynen et al. 2007; Castree 2008a; 2008b; Bakker 2010a) share the theme of how state policies "create the conditions for market to function – via licenses, emission credits, privatization programs, and so on" (Huber 2017b, 1852). The focus on the state serves as a corrective to the relative dearth of scholarship on the "specific roles, capacities, and shortcomings of the state itself in environmental governance" (McCarthy 2007, 177). Work on neoliberal environmental governance acknowledges that alongside the "roll back" of state functions came an institutional reconfiguration to "favor market-based actors" (Bridge and Perreault 2009, 487). To sharpen this analysis, we might ask who are "market-based actors?" And how are they favored under neoliberal governance regimes?

Under capitalism, the great mass of society depends on markets for their day-to-day survival. Capitalism offers few other ways of getting by other than buying commodities in markets. It's this observation that led David McNally to say that under capitalism the market becomes "the central regulator of our well-being" (2011b, 69). What differentiates capitalist markets from markets under other modes of production is that a class of capitalists determines which products reach the market because they control the means of production.

> One thing is clear – nature does not produce on the one side owners of money or commodities, and on the other men possessing nothing but their own labour-power. This relation has no natural basis, neither is its social basis one that is common to all historical periods. It is clearly the result of a past historical development, the product of many economic revolutions, of the extinction of a whole series of older forms of social reproduction. (Marx 1867a, 169)

The capitalist state's actions to stabilize markets are "absolutely essential to sustain the operation of capitalist production and market relations" (Jessop 1982, 80). This is especially true in the case of energy markets because energy is such a vital means of production as I argued in the previous section. Despite being essential, capitalist state interventions in energy markets are restricted by the need to retain capitalists' control over the sector. The state is obliged to

compensate for the failures of energy markets but without dominating or usurping the capital-labor relation by extending "non-commodity forms of social relations" (for example, nationalization and provisioning for social need) (Jessop 1982, 109). State policy is "imprisoned" by the need to maintain capitalist control over the means of production (Barrow 1993, 62). Capitalists decide what to produce, what technologies to use and how, where to do business, how to allocate resources within the enterprise, etc. (Lindblom 1977, 171). Although businesses are dependent on wider organizational relationships beyond their own shop, establishing these long-term relations also is entirely under the control of company management (Sayer and Walker 1992, 205). Capitalists decide which goods to produce, and then workers and non-capitalists face a "pre-specified set of goods at pre-specified prices, which households are free only to take or leave" (Elson 1988, 7).

Capitalists may whimper that once a commodity is produced, they are *at the mercy* of the consumer, who makes the final decision on whether to purchase it (Ollman 1971, 154). For example, when the "coercive laws of competition" compel capitalists to speed up commodity production while reducing overhead costs (Marx 1867b, 433), capitalists face the possibility of drowning in overproduced commodities and paying ruinous storage and warehousing fees. However, capitalists are not subject to the same levels of deprivation that workers and non-capitalists face every day.[9] The capitalist state will bail out bankrupt companies in the name of saving capitalism if those companies are essential for the functioning of daily life under capitalism (Harvey 2010a). While consumers in capitalist societies face decisions over which

[9] I'm talking about major fractions of capital that consume significant amounts of energy, not petty bourgeois small business owners although politically, they constitute an important fraction of capital. Sadly, mom-and-pop operations can go out of business and leave their owners destitute, but the mass of society doesn't depend on these companies to reproduce their daily lives like they do Exxon Mobil, American Airlines, or DHL. If you don't get gas, you can't get to work, you'll lose your job, and your means of subsistence. If you can't get a candy bar at a corner store or a haircut at a locally owned barber shop, you'll just be shaggy looking and (temporarily) less happy.

products to consume – if they are to survive – they have no choice but to depend on some form of market. The case of energy shows this uneven power dynamic in perfect clarity. Non-capitalist consumers exchange their labor for wages and buy the energy they need to keep from freezing, fuel their car, cook their food, or entertain themselves. The "sheer need to survive" (Van den Berg 1988, 351), once markets are established, is incentive enough to compel workers and capitalists to enter into market-based transactions for energy. Demand for energy is quite "inelastic," meaning its consumers cannot simply choose not to consume it or choose some other alternative to energy (Makholm 2012, 136).

Conclusion

> *The best form of state is not that in which social antagonisms are blurred or forcibly shackled, … It is rather that in which they can freely come into conflict, and thus be solved.*
>
> - *Marx and Engels 1848b, 133*

In this chapter I argued that the capitalist state stabilizes energy provisioning systems because energy is an irreplaceable means of production for capital. This point departs from most other literatures on state-energy relations that focus mainly on the politics of rent distribution. In Marx's terms, energy is an auxiliary means of production that is used up in the production process. Both animate and inanimate forms of energy have been crucial to the growth of capitalism through its history, but animate energy (coal, oil, gas, uranium) has become increasingly critical as capital automates production. Capitalist states have used markets as the provisioning system for energy because, as I argued, markets under capitalism are controlled by the capitalist class. I conclude that if states allow capitalists to retain power over energy by facilitating market-based provisioning of energy, they are only ensuring that capitalists will manage energy primarily as a means of production (as opposed to a major driver of climate change, or a means of fulfilling social needs).

The market is the capitalist state's perfect, ready-made excuse for policies that favor capital's interests at the expense of workers, their communities, and the environment. Invoking 'the market' is a perfect way of diffusing antagonism between social classes because it blames no one in particular, yet so many people depend on it for their daily survival that it can appear eternal and immutable. If a company pollutes a stream or fires a worker, it can blame the market for its poor performance this quarter. Meanwhile, the worker must scramble to find a new way to keeping her family indoors this winter, and the stream will need to be painstakingly cleaned up. When states construct markets, establish the legal rules within which markets operate, guarantee property rights and contracts, they are supporting a system of social relations based in exploitation (Lilley 2011, 80). This is disastrous for mitigating climate change because state energy policy is geared more toward serving capital with a vital means of production than toward maintaining a habitable biosphere for humans (and non-human life too).

In this chapter, I argued that the state will go to great lengths to force resources into market-based provisioning systems, which are not "class-neutral" institutions (Van den Berg 1988, 376). This does not mean that states have no role to play in creating markets, quite the contrary. States can and should make resources available in noncommodified or de-commodified forms rather than depend on markets that are controlled by a profit-maximizing capitalist class. A good first step would be building new state-energy relations that prioritize meeting social needs for energy over capital's need for means of production. As I have argued, however, this would require ending the capitalist state's character from within it, specifically, by passing socialistic energy laws instead of capitalist ones.

Chapter 2

Plugging the Pipeline: Realizing the Value of Natural Gas in the 1930s U.S.

Introduction

For fourteen days in March 2017, California's electrical grid paid the state of Arizona twenty-five dollars a megawatt to accept surplus electricity generated by solar, which was threatening to overload California's grid (Penn 2017). Solar's share of California's electricity generation grew 10 percent in the preceding seven years as the falling price of photovoltaic panels made solar competitive with fossil fuels (Ibid.). Democrats in the state senate concerned with climate change were in an uproar over utilities' decisions to continue running natural gas-fired power plants despite the availability of cheap, clean(er) solar power (Ibid.). Three investor-owned utilities, Pacific and San Diego Gas and Electric and Southern California Edison, provide three-quarters of the state's electricity supply (State of California 2017). They had "legacy" contracts that mandated natural gas be delivered, no matter how much energy was generated by solar or wind (Gimon et al. 2015). These legacy contracts lock utilities into long-term agreements with fossil-fuel companies and these agreements are inflexible and cannot readily accommodate a market transition to renewables (Golden and Paulos 2015, 47). California would not have dumped solar energy on to Arizona if the social provisioning of use values had been prioritized over the realization of capitalist value. In terms of Karl Marx's value theory, the *realization* of value embodied in natural gas was more important than the use value of solar power.

In nature-society scholarship there is a tendency to conduct fieldwork on the productive stage of capital circulation (see Figure 1) when valorization occurs, e.g., farms (Zimmerer and Douches 1991; Grossman 2000), forests (Prudham 2005), mines (Bebbington and Bury 2013;

Perreault 2013), and fisheries (Mansfield 2004). These studies, however, miss important socioecological dynamics of capital circulation that occur after the moment of valorization. I argue that we can better understand the ecological waste and destruction that occur in the productive stage of capital by also viewing production from a vantage point at the commodity stage (*C'-M'*). For example, a great waste of resources can ensue if the value congealed within them cannot be realized during a time of glut and overproduction (Huber 2011b). Agribusiness will continue degrading farmlands if it can realize value by dumping overproduced, low-nutrition food on poor, racially marginalized communities (Guthman 2011). Oil and gas capital will cool natural gas to (-)163°C to transport it to markets for realization (Bridge and Bradshaw 2017, 223). The special tanker ships built to haul LNG are just one example of the extreme lengths to which capitalists will go to ensure realization (Zalik 2008).

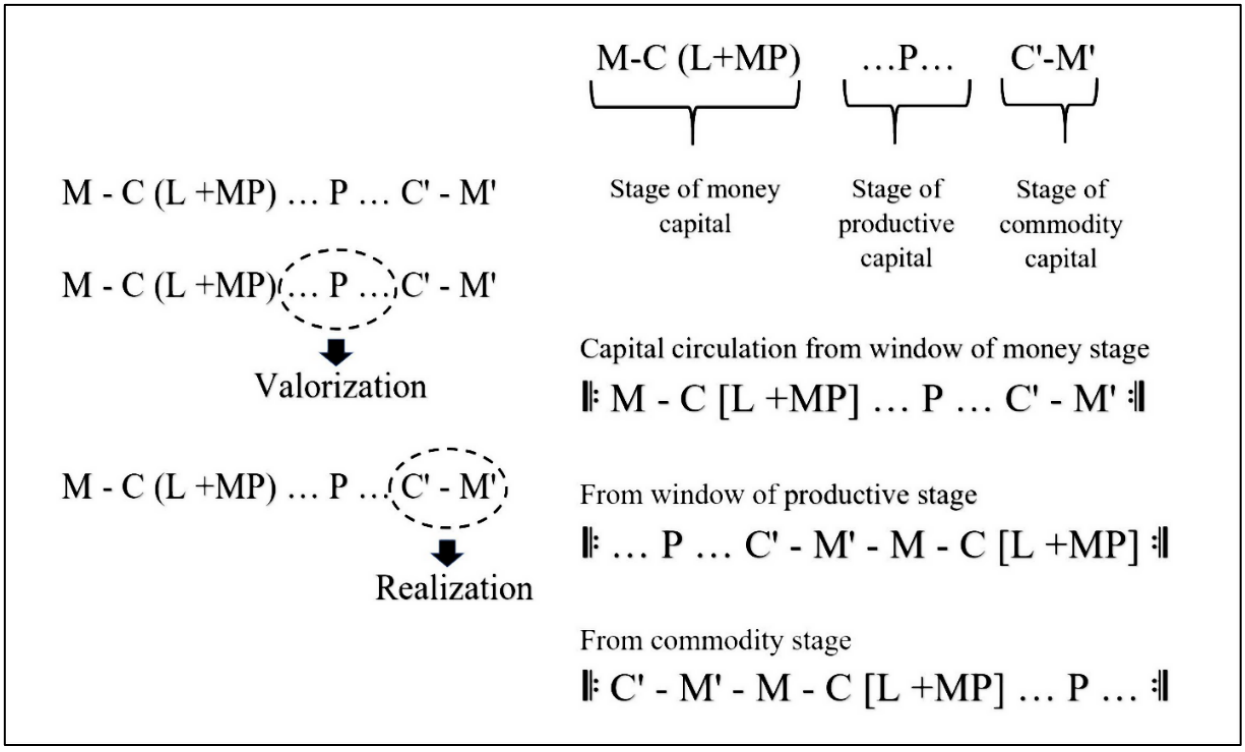

Figure 1: (Left side) Capital circulation and moments of valorization and realization highlighted. (Top right) The different stages within the circuit. (Bottom right) Windows into capital circulation from the vantage point of its different stages.

There are many more precautions taken by capital to safeguard the passage of value through valorization and realization. Under capitalism, value is valorized and realized at moments within the stages of the circuit that constitute the process of capital circulation (Harvey 2017, 6). Yet in geographers' recent explorations in value theory (Gidwani 2008; Wainwright 2010; Hudson 2012; Karatani and Wainwright 2012; Henderson 2013; Christophers 2013, 2014), including nature-society geography (Henderson 2004, 2009; Prudham 2009; Moore 2011; Huber 2013a, 2017c; Robertson and Wainwright 2013; Labban 2014; Ioris 2016; Kenney-Lazar and Kay 2017), the moment of realization has not been dealt with extensively. Partially this focus on valorization is an outcome of methodological decisions. Political ecologists tend to do long-term fieldwork in developing world settings where raw materials and food are produced for export to developed economies where those primary goods are either consumed or used to produce finished goods. However, as I will argue, there are important socioecological effects of capital's value circulation at the stage of moment of realization as well.

Marx defined value as the abstract, socially necessary labor time embodied within commodities (1867a, 38). [10] Marx adapted the labor theory of value from classical political economists like Adam Smith and David Ricardo. He added the notion that value could be abstracted from concrete circumstances and made to circulate, or be hoarded, in the commodity or money forms. Marx also appended "socially necessary" to his definition of value to indicate how the coercive laws of competition force capitalists to always be reducing labor time as much as possible (Harvey 2010b, 20). Much like the natural gas that this dissertation discusses, value is undetectable: colorless, odorless, and tasteless. "Not an atom of matter enters into the objectivity

[10] This understanding of value is a "qualitative theory that explains how and why labor under capitalism assumes the form that it does" (Webber and Rigby 1996, 96) and has been elucidated by Elson (1979), Harvey (1982), Postone (1993) and Heinrich (2012).

of commodities as values; in this it is the direct opposite of the coarsely sensuous objectivity of commodities as physical objects" (Marx 1867b, 138). Despite value's immateriality, when the circulation of value through valorization and realization is interrupted, the effects can be pronounced, tangible, and objective. This is Harvey's point when he describes value as "immaterial but objective" (2010b, 33).

The capitalist state played a central role in reestablishing conditions for successful circulation of capital through moments of valorization and realization. Christophers argues that the capitalist state uses the law to strike a balance between the tendencies toward monopoly and competition in capitalism (2016, 15). With no one coordinating their collective behavior, individual capitalists will attempt to "overcome the barrier of the market by suppressing competition, by fraud and, *in extremis*, by force" (Clarke 1988a, 124). Energy policy acts as a counteracting force against capitalists' tendencies to either monopolize energy markets or engage in ruinous competition. The state reinforces markets with "institutional and fiscal encouragement" (Ibid., 231), e.g., laws that stop monopoly (Sica 2018) or over-competition (Huber 2011b). This balancing is especially important for the energy sector because energy serves as a crucial means of production for so many other industries. When monopoly or ruinous competition throws the energy sector off balance, many sectors outside energy capital are affected.

In the following two sections, I apply a political economy lens to the historical geography of natural gas in the 1930s U.S. I begin by making the case that most scholarship concerned with capitalism in nature-society geography focuses on the stage of productive capital within the wider circulation process. As I show, there are important socionatural dimensions of capitalist value circulation during the other stages as well i.e., the money and commodity stages. In the

next section I explain how the Power Trust used pipeline control to block the circulation of its competitors' value through the stage of commodity capital. This led to the waste of billions of cubic feet of gas and the unnecessary and avoidable dumping of methane -- a potent greenhouse gas -- into the atmosphere. In the same section I also examine the crisis of gasoline stripping and explain how state regulation reformed gas markets. This case illustrates how the capitalist states intervenes to restore capital circulation through the energy sector, when it is destabilized through oligopolistic control.

Nature, Value and Capital Circulation

Most nature-society geography focuses on how capital extracts and transforms physical objects and instruments of nature into goods and services. These studies unveil the social and environmental processes and conditions required to produce commodities like water, timber, meat, fiber, grain, produce, energy and minerals, and fish, among others (Bridge 2000; Braun 2002; Bakker 2003; Guthman 2004; Mansfield 2004; Moseley 2005; Prudham 2005; Swyngedouw 2005; Eaton 2013; Huber 2013a; Emel and Neo 2015). Even studies of more abstract commodifications of nature, like payment for ecosystem services (Lansing 2011; McElwee 2012; Robertson 2012; Cavanagh and Benjaminsen 2014; Keul 2014; Osborne 2015), explain the acts of measurement and calculative labor at the productive stage of capital (Huber 2018, 151). Ecosystem services are "produced" through the labor of ecologists and other scientists who quantify and standardize heterogeneous nature into tradable credits. Geographers critique the labor involved in valorizing natural services for being fraught with contradiction, exploitation, and ecological destruction (Dempsey and Robertson 2012).

In Marx's terms from *Capital Vol. II*, these studies explain what occurs at the stage of productive capital (…*P*…) within the wider process of capital circulation (see Figure 1). Other

scholarship examines the financialization of nature, whereby resource futures and insurance policies integrate further abstractions of nature into the money stage (*M-C(L+MP)*) (Labban 2010; Zalik 2010; Johnson 2014). George Henderson also focused on the contradictions of Californian agriculture at the money stage while framing those relations within the wider circulation process (1999). I expand on Henderson's work by examining the nature-society relations caused by interruptions at the stage of commodity capital (*C′-M′*). Once again, there are important socionatural dimensions of capitalist value circulation that occur at the commodity stage.

Nature-society geographers conduct research on the stage of productive capital when valorization occurs. Marx defined valorization as the process by which surplus value is added to the value advanced in production (1867b, 252). In nature-society geography, valorization includes processes through which natural resources come to objectify or materialize "congealed" labor time (Harvey 2013, 55). Despite some exceptions (Henderson 1999; Huber 2009b; Lansing 2011; Karatani and Wainwright 2012), realization has been of more long-standing interest outside nature-society scholarship. e.g., urban and economic geography (Harvey 1982; 2013) and other disciplines working in the Marxian tradition (Wilkinson 1973; Boddy and Crotty 1976; Wolff 1978; Sherman 1983; Clarke 1988a; Jessop 1990; Kenway 1990; Amariglio and Ruccio 1994; Hein 2006; Barba and de Vivo 2012; Ramirez 2012). Realization is the moment when the abstract human labor "objectified or materialized" in a commodity (*C′*) transitions through act of exchange into money (*M′*) (Marx 1867b, 129) (see Figure 1). When viewed from the window of the commodity stage of capital circulation, realization is an essential moment when capitalists gain the profits to finance expanded valorization.

In a notable exception, Lansing points out how the accurate determination of carbon offsets' use values are essential for value realization (2011, 747). Lansing's focus on use values explains part of the process of commodification in Marx's first sense of a commodity as a "thing which through its qualities satisfies human needs" (1867a, 125; see Huber 2009b for a similar analysis). Societies have "wants, needs, and desires" for items that originate in nature, like iron from ore and paper from trees (Harvey 2014, 275). Nature-society metabolism under capitalism is not directed by a will to satisfy needs, however, but by capitalists' imperative to realize value through market exchange.

As Michael Heinrich explains, "In exchange, the concrete acts of expended labor count as a particular quantum of value-constituting abstract labor" (2012, 50). Marx saw that the value of a commodity had a "dual character" (1867b, 131), first as a concrete product of labor and second as an objectification of "abstract social labor" (Huber 2017c, 45). Every commodity is, at once, both a useful article and the crystallized labor-time that is socially necessary for its production (Marx 1867b, 129). It is through exchange that a commodity's abstract value is realized as money that the capitalist can hoard, use to consume, or reinvest in capital circulation (Ibid., 166). Therefore, capitalism's primary aim regarding nature is the passage of nature-derived commodities' value through moments of valorization and realization.

By not problematizing the realization of value, nature-society literatures are upholding Say's law, invented by the political economist Jean-Baptiste Say. Say posited, "It is worth while to remark, that a product is no sooner created, than (sic) it, from that instant, affords a market for other products to the full extent of its value" (1803, 138). Say was denying that there could be a problem of realization because, according to his logic, the simple fact that values are produced creates the demand for their full realization (Sherman 1983, 206). Marx critiqued this notion

throughout *Capital, Volume II* (1885a), and some nature-society scholarship has shown how scarcity and demand are produced to guarantee realization (Huber 2011b; Guthman 2011). In *Capital Vol. I*, Marx suspended any realization problems for the purposes of analysis by assuming that all goods trade at their values. As Harvey usefully explains, Marx's purpose in *Volume I* was to reveal capital's inner workings in a "normal" state of functioning, free from realization problems (2010b, 245). In *Vol. II*, however, Marx explains how capitalists are constantly under assault by crises of realization emanating from ruinous competition and capitalists' tendency to restrict wages to their lowest possible price (the effective demand problem).[11] Nature-society geography seems to adopt Marx's assumptions from *Vol. I*, but as this case will show, the realization problem (as elucidated in *Vol. II*) has a profound effect on nature-society relations. As Harvey argues (2017), geographers can sharpen our focus on value by expanding our analyses to include more of the total circulation process, including the moment of realization.

Capital-nature relations in the stage of productive capital are affected by capitalists' need to avoid obstacles in the overall circulation process. California farmers decided to diversify their crops, practice intercropping, and sell goods in fresh, dried, and canned forms so that their lenders' capital could circulate more quickly (Henderson 1999, 57). Banks deciding to whom to provide credit would monitor the productive sphere to ensure that capital passed through

[11] The classic quote on the effective demand problem appears as a footnote in *Vol.II* (1885a, 391, §1). Marx explains a contradiction of capitalism wherein a poorly paid proletariat cannot adequately consume all the available commodities (Harvey 1982, 90) and the coercive laws of competition force capitalists to continue production regardless of consumption (Clarke 1994, 229). A realization problem occurs when the value congealed in commodities is not realized through an exchange into the money form of value. I depart from this common understanding of the realization problem as a lack of effective demand. I argue that an oligopoly of large producers kept smaller, unaffiliated producers from realizing value, specifically by blocking their access to markets for exchange. Once monopolies form, they can use their power to safeguard the circulation of capital under their control by blocking the realization of a competitor's value (Harvey 2013, 74). My point that monopoly power can cause realization problems will be discussed further in the second section of this chapter.

valorization successfully. “Some banks making a large number of citrus loans, check to see that certain groves are properly irrigated in the summer, heated in the winter and treated at the proper time for pests, for only in this way can they be certain of the value of the security” (Ibid., 69). While Henderson focuses on capital’s socionatural dynamics from the window of the money stage (*M-C (L+MP)*, see Figure 1), I argue that the circumstances at other stages can have significant socioecological effects as well.

The realization of value occurs during the stage of commodity capital (*C′-M′*). This stage contains the moment of sale, when the original money plus a profit (*M′*) is recuperated, allowing production to proceed on an expanding scale (Harvey 2013, 55). From the window of the commodity stage, capital circulation proceeds when capitalists use the money gained through value realization to purchase labor power and means of production for the subsequent moment of valorization. As Marx pointed out, realization can pose difficulties to the capitalist. “We already know from the analysis of simple commodity circulation (Volume 1, Chapter 3) that *C—M*, the sale, is the most difficult part of its (capital’s) metamorphosis, and thus forms the greater part of the circulation time in normal circumstances” (1885a, 204). Following Marx, Henderson’s analysis of the circulation of value through California agriculture shows how capital’s time spent in commodity form poses risks and opportunities to agribusiness. “Capital’s time in circulation – that is, the time capital spends in the commodity form, from the moment it is put in storage (whether a box or a grain elevator), on through its journey to market, to the moment the capitalist receives payment from sale – can present an obstacle” (Henderson 1999, 32). Henderson argues that these obstacles appear as costs to be averted and are therefore opportunities for potential capitalists willing to get involved in covering those costs (Ibid.). The blockage of capital’s circulation in the case of natural gas presented an opportunity to gasoline manufacturers (a point

I explain below) but created problems for the wider society and environment. However, it was not a conventional "realization problem" as Marxist scholarship typically considers them (Sherman 1983; Kenway 1990).

The emblematic realization crisis was the Great Depression, which was caused by what Harvey calls the "effective demand problem" (1982, 90). This was a systemic breakdown of circulation wherein a central contradiction of capitalism erupted into a systemic crisis. As Marx explained, "the sale of commodities, the realization of commodity capital, and thus of surplus-value as well, is restricted not by the consumer needs of society in general, but by the consumer needs of a society in which the great majority are always poor and must always remain poor" (Marx 1885a, 391). In other words, an oversupply of goods cannot be sold because the great mass of society is the poorly paid proletariat who cannot afford to consume away the surfeit of commodities. Although gas markets were in disarray during the Great Depression, the realization problem in gas markets had little to do with the effective demand problem. There was no paucity of effective demand, as evidenced by the consumer groups testifying before Congress against the waste of gas (Herbert 1992, 63). They took offense at the waste of gas while prices for it rose, and as upper-middle-class city dwellers, they were suffering less from an inability to pay for gas than an inability to get it (Castaneda 1999, 76-8). The realization problem as it was experienced by independent natural gas producers in the 1930s came less from a lack of effective demand than from the gas industry's structure.

The oligopolistic Power Trust controlled portions of the Texas Panhandle's oil and natural gas fields located near independent gas producers' own lease holdings. The Power Trust was competing with independent producers to realize the most value from the Panhandle's gas

reservoirs as fast as possible.[12] To assure the integrity of its value regime, the Trust shut out the independents' commodities from entering interstate pipelines. The Trust plugged the pipeline to protect itself from competitive capital, and the independent producers were stuck. They could not sell the natural gas they had extracted because their commodities could not reach urban markets where they could be exchanged. In value-theoretical terms, the passage of value through the independents' natural gas was interrupted at the stage of commodity capital when their value's realization was disallowed by the Trust. In those dire straits, the independents totally abandoned the circulation of capital through natural gas and forged ahead with an entirely new circuit based in *gasoline* production. The process of gasoline stripping (a technique of running natural gas through filters to remove traces amounts of gasoline) was extremely wasteful, which incited a consumer outcry. It also was an ecological disaster, as it released billions of cubic feet of methane, which is a potent greenhouse gas, directly into the atmosphere.

The following case of the massive waste of natural gas during the era of the Power Trust exhibits the importance of realizing abstract value to the capital-nature relation. In the 1930s, gas was scarce in urban markets, and prices were rising. By all accounts, gas demand signaled a social need for fuel, especially for cooking and indoor heating, which grew each passing winter. If capitalists approached nature intending to provide consumers with its use values, one would expect them to exploit all available natural gas supplies. However, in the oil fields of the Texas Panhandle, gas producers were venting billions of cubic feet into the atmosphere. They did so not because gas had no use value but because its value could not be realized within the market conditions of the time. As Marx explained in *Capital Volume III*, "Any commodity can realize its

[12] In the U.S., the "rule of capture" grants property rights over oil and gas to whoever develops them first, thus inculcating a "race" mentality in drillers who then drain reservoirs as fast as possible (Huber 2013a, 45). The film *There Will be Blood* explained the rule of capture as an oilman's strategy of using one well (or straw) to drain a shared reservoir (or milkshake) out from under a group of leaseholders (Ibid., 193).

value only in the process of circulation, and whether and to what extent it does realize this depends on the market conditions of the time" (1894a, 777). The market conditions of the 1930s U.S. gas sector were antithetical to realization for anyone but the oligopolistic Power Trust. Its power over the pipelines – the means of realization – would lead to social and market dysfunction and environmental waste and needless destruction.

Natural Gas Market Failure

By the 1930s, an oligopoly of power utilities called the "Power Trust" controlled a value regime based on valorizing natural gas in the Texas Panhandle and realizing it in urban markets (Castaneda 1999, 69). Harvey defines a value regime as a relatively stable, geographically fixed, regional configuration around which value production, realization, and distribution form (2017, 157). Advancements in long-distance, high-pressure pipelines in the late 1920s allowed the Power Trust to introduce natural gas in Eastern and Midwestern markets previously served by coal (Vietor 1994, 4). The Power Trust was made up of four principle companies: Columbia, Standard Oil, Cities Service, and Electric Bond and Share (EB&S). It controlled roughly 70% of all United States natural gas production, pipeline transportation, and interstate sales (Sherrill 1983, 539; Castaneda 1999, 107). The Power Trust's value regime was broken up into four sub-regional zones of influence. Columbia and Standard Oil controlled gas in the Appalachians, Cities Service dominated the lower Midwest and upper Southeast, and EB&S served the Great Lakes (Castaneda 1999, 89). The Power Trust used its control over the nascent interstate pipeline network to block their competitors' gas from reaching urban markets (Ibid., 69). In *Capital Vol. II*, Marx discusses how monopoly power allows some industrial capital to "ride out" periods of "disturbances in the repetitions of the (value) circuit" (1885a, 187). The Power Trust used its

oligopolistic market position to charge “monopoly rents” on pipeline transportation of natural gas (Harvey 1982, 349-50) and to limit its competitors’ access to the means of realization.

The Power Trust blocked unaffiliated, independent producers from accessing the pipeline network and transporting their gas to urban markets where its value could be realized. Independent producers in the Panhandle leased gas rights from landowners, typically farmers, who kept a gas well on their land as supplemental income (*Associated Press* 1934, 8). The Power Trust bought gas rights adjacent to farming properties in the Panhandle, and independents feared it would “drain” the shared reservoir out from under them (*Amarillo Daily News* 1934, 13). Gasoline manufacturers used this blockage in the circulation of the independents’ value through natural gas as an opportunity to form a new value circuit based on gasoline stripping.

Natural gas deposits contain only a meager gasoline content. Thousands of cubic feet of gas yield only a single gallon of gasoline (Miller 1935, 3E). However, gasoline stripping permitted the independents to “derive some revenue through stripping their unmarketable gas of its little but marketable gasoline content” (Ibid.). The 41 total gasoline stripping plants in the Panhandle used $500 million worth of natural gas to create $500 thousand worth of gasoline (*Canton Herald* 1935), out of which landowners could expect rents of $300 a month (*Amarillo Sunday News-Globe* 1934). Gasoline stripping was an appealing option to independents compared to the zero remuneration they would receive if the Power Trust continued to control the means of realization while draining the common reservoir.

The waste in the midst of price increases caused great uproar among urban consumers who were dependent on natural gas for heat, industrial power, and lighting and had suffered price

gouging by the Power Trust. [13] Natural gas is principally composed of methane, which is a potent greenhouse gas (Brandt et al. 2014). Through gasoline stripping, the independents dumped a product that was needed and useful and further aggravated climate change by disposing of methane directly into the atmosphere. The successful circulation of capital through gasoline took precedence over both social and socioecological concerns, as it does in contemporary capitalism.

The Power Trust and the Pipelines

In the 1930s U.S., the Power Trust controlled interstate pipelines that transmitted gas from northern Texas to cities such as Chicago, Denver and Indianapolis (see Figure 2). Natural gas from the Texas Panhandle was proving to be a cheaper, cleaner, and more convenient form of energy than competing fuels. Relative to coal, which had to be blasted, shoveled, and carried to the surface, natural forces of geologic pressure allowed gas producers to radically undercut the socially necessary labor time for energy.[14] When oil and gas producers puncture subterranean reservoirs, they release the tremendous pressure that formed most of the world's known oil and natural gas (along with heat) 100-150 million years ago (Hilyard 2012, 2). This geologic pressure carries oil and natural gas to the surface and is appropriated by oil and gas capitalists as a "free gift of nature" that lowers the value of oil and gas compared to coal and allows oil capital to undersell competing fuels (Marx 1894a, 745).

[13] In recent years, geographers have examined issues of value and waste in various subdisciplines, e.g., economic (Herod et al. 2013, 2014; Gidwani 2015), nature-society (Gidwani 2012, 2013), urban (Gidwani and Maringanti 2016) and cultural (Henderson 2011). My argument deviates slightly from this work by considering the unused, overproduced commodities immediately destroyed at the point of production, rather than the salvaging of value from the unserviceable material remaining after consumption (i.e., trash or garbage).

[14] Timothy Mitchell makes a similar point about fuel oil requiring less coordination within the workforce than coal in Marshall Plan-era Europe (2011), although he doesn't frame that conclusion in value-theoretical terms.

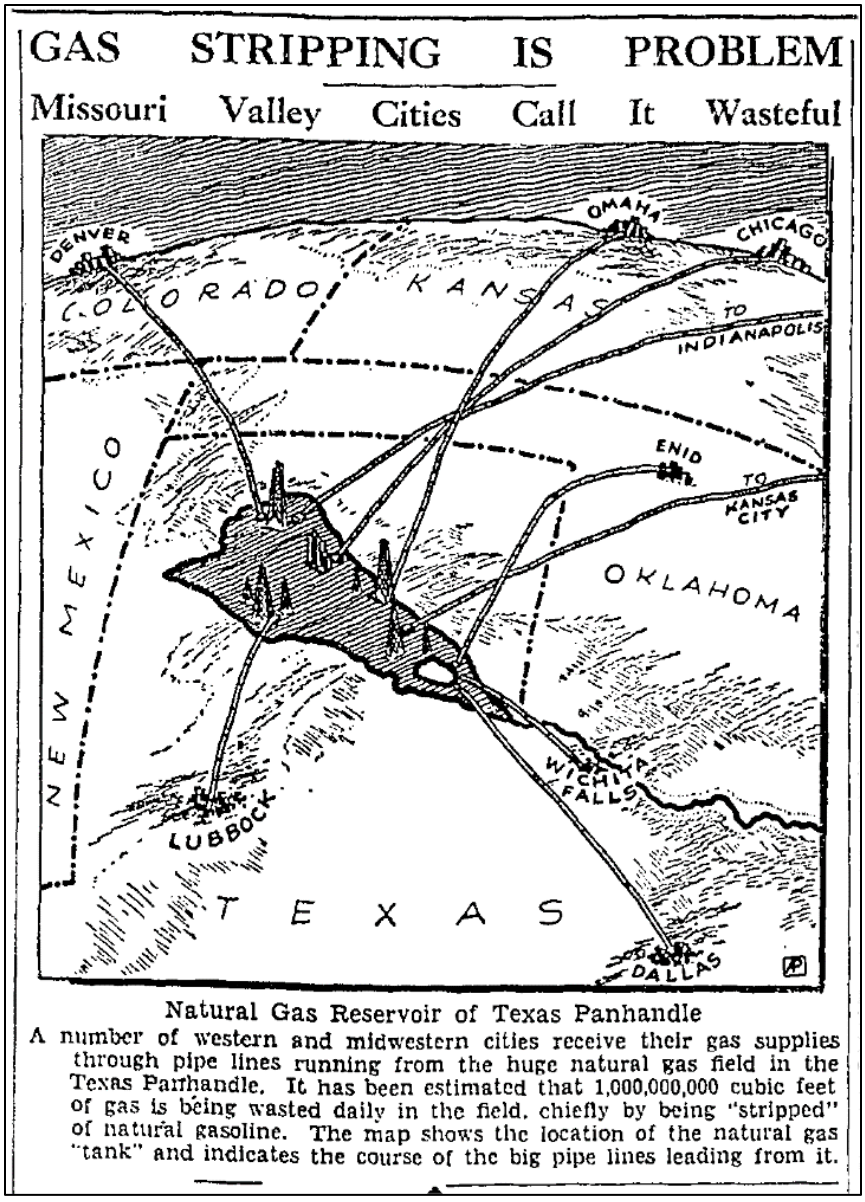

Figure 2: Los Angeles Times 1934. Gas stripping is problem: Missouri Valley cities call it wasteful. 4 June: financial page - oil and mining.

Another physical property influenced the emergence of natural gas as value-bearing capital in the 1930s. Natural gas is *buoyant* and must be contained in airtight pipelines and storage containers along every step of its supply chain. Massive natural gas fields were first discovered in the Texas Panhandle in 1918 and 1919 (Castaneda 1993, 17). However, it wasn't

until welding technology improved in the mid-1920s that Panhandle gas could be shipped to faraway markets in strong pipelines that were durable and impervious. Once pipelines are constructed, they are cheaper than any other form of bulk, overland transport (Smil 1999, 189). However, the labor of trenching, cleaning, coating, laying, welding, and testing pipelines for leaks is expensive and requires significant, upfront investment long before any returns are made. Because of pipelines' high initial costs, gas companies that might have competed frequently ended up cooperating to finance construction projects (Sanders 1981, 26). The Power Trust's holding company structure allowed it to marshal tremendous amounts of investment financing to construct pipelines, promote gas utilization, and extend gas service into markets previously served by coal (Castaneda 1999, 89). Metropolitan gas distribution companies, nested within the Trust's holding company structure, built most of the pipelines between the mid-1920s and early 1930s (Castaneda 1993, 18).[15] By the early 1930s, the Trust owned and controlled a network of gas wells and pipelines spread across Appalachia, Southern California, and the oil and gas fields in and around Texas, Louisiana, Oklahoma, and Arkansas (Schurr and Netschert 1960, 128).

The Power Trust's value regime expanded dramatically under the direction of oligarchs like Henry Doherty of Cities Services. Doherty was a self-taught gas engineer, who between 1905 and 1930, acquired control of 190 utilities and oil and gas companies (Castaneda and Smith 1996, 53). Doherty was a savvy marketer, establishing demonstration programs for neighborhood associations and their urban, upper-middle-class members (Castaneda 1999, 76-8). By 1936, Cities Services controlled one billion dollars ($18 billion in 2017 dollars) in petroleum and utility related assets and Doherty himself had $500 million ($9 billion in 2017 dollars) (Cutlip 1994,

[15] A holding company is a trading company which possesses the whole of, or a controlling interest in, the share capital of one or more other companies (Oxford English Dictionary).

546). To finance the construction of pipelines, the Power Trust bought up "huge tracts" of gas-producing lands adjacent to and interspersed among independent gas producers' lands (Sanders 1981, 25). By owning the supply, the Trust could assure pipeline investors of a return, but it also forced independent producers that were unaffiliated with the Trust to rely on pipelines owned by their direct competitor. The Power Trust asserted "iron-fisted control" over the pipeline distribution system, thereby quashing competition from the independents (Herbert 1992, 64).

Prices Rise While Gas is "Popped"

When the Great Depression befell the United States, the natural gas business experienced a full-blown "market failure" (Castaneda and Smith 1996, 75). Gas prices for residential consumers were rising, while consumers' average incomes fell (Herbert 1992, 61), and the prices consumers were paying bore no relation to the actual cost of the service (Ibid., 65). Households switched to other fuels, doubled up on living quarters, or sometimes migrated from cities back to the farm (Dawson 1937, 126). Although there were shortages and rising prices in the Eastern and Midwestern states, simultaneous gluts in the Southwest resulted in the massive wasting of gas (Sanders 1981, 24). With no way to realize the value of gas, independent producers resorted to stripping off marginal amounts of gasoline, while "popping" the associated natural gas into the atmosphere (Zimmermann 1957, 253). Popping gas entailed using filters to strip off miniscule amounts of gasoline mixed in with natural gas and then flaring or venting off the greater part of the reservoir (see Figure 3). A cartoon in *The Pampa Post* decried the "millions of dollars of waste" that resulted (see Figure 4).

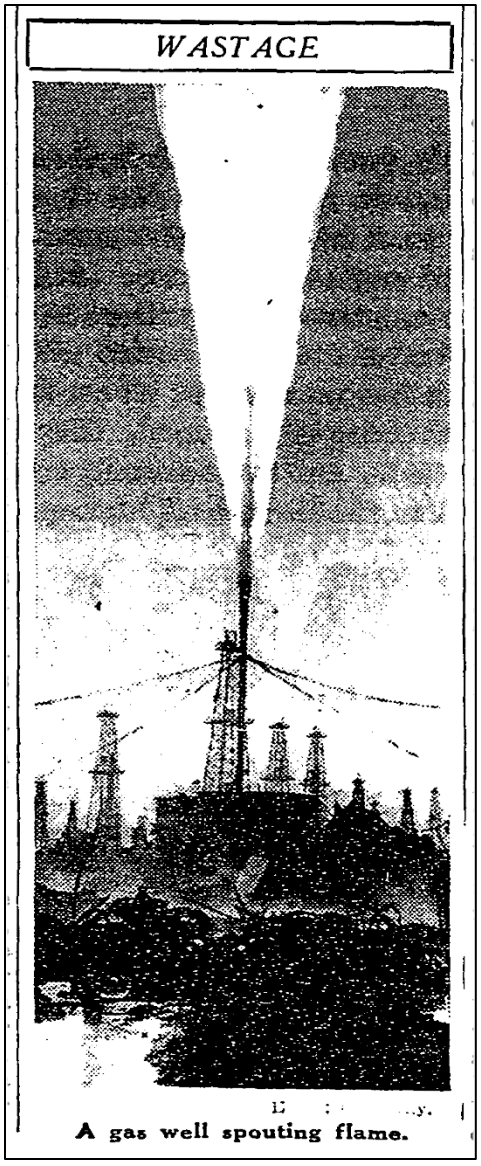

Figure 4: Source: Miller 1935.

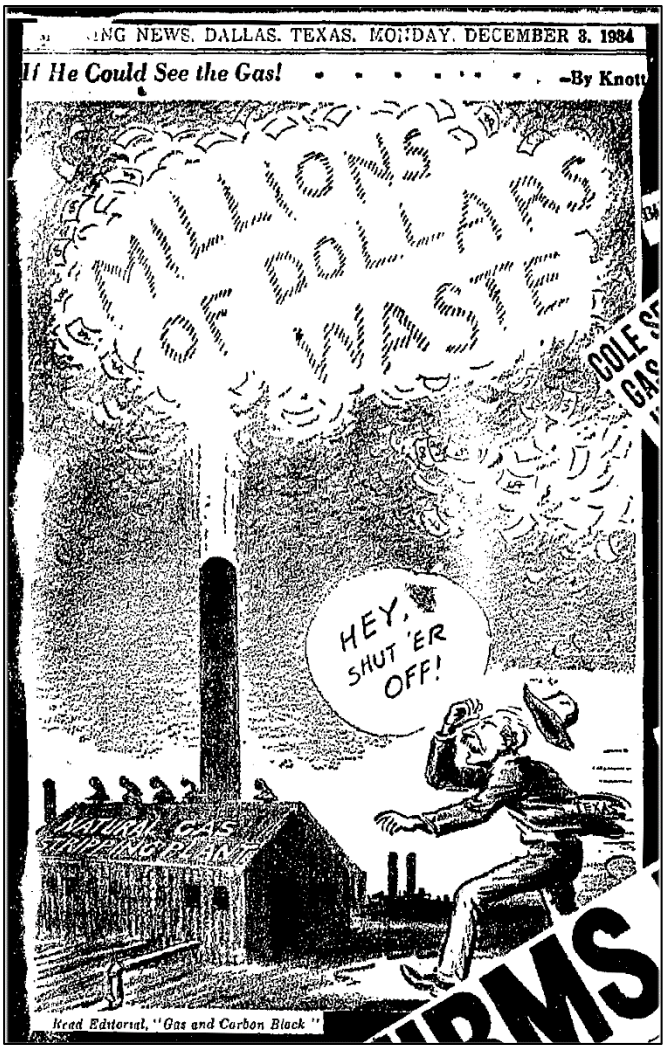

Figure 3: Cartoon by John F. Knott appears in Panhandle Conversation Association advertisement. The Pampa Post 1934 26 December: 3.

Consumer groups testified before Congress, decrying the rising price of gas despite the "well-known surplus" in the Southwest (Herbert 1992, 63). Estimates of the natural gas wasted totaled 50 % of total production (Ibid., 64), which in one year (1933) equaled 1.5 billion ft^3, which would have satisfied the total U.S. residential and commercial demand (Sherrill 1983, 538). Another estimate found that in 1933 producers wasted enough gas to fuel a town of 15,000

for five years (Sanders 1981, 33). The Federal Trade Commission found that the total amount of gas wasted in the Texas Panhandle equaled or exceeded the total U.S. natural gas demand each year between 1927 and 1930 (Castaneda 1993, 25). Ads in Texas newspapers decried the waste, citing how the gas wasted had an energy content of 62 million barrels of oil, enough to "form a solid belt around the earth!" (see Figure 5).

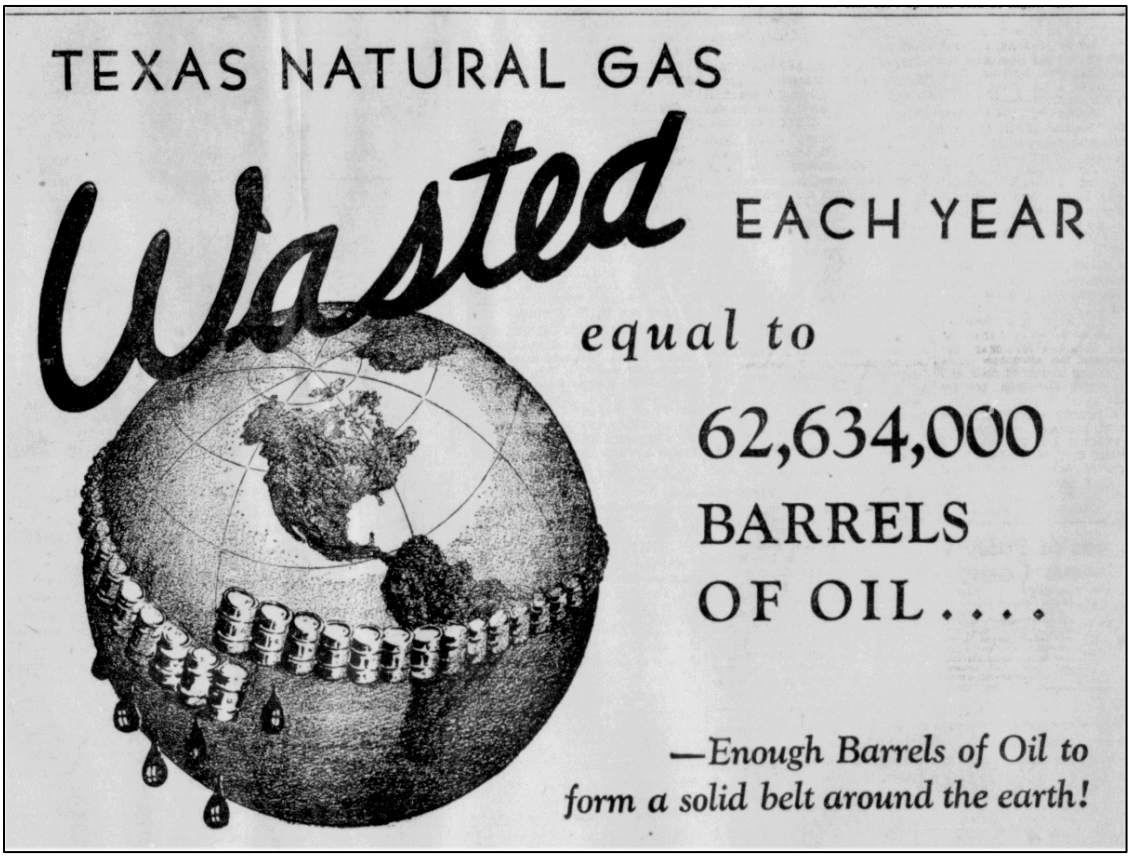

Figure 5: Texas Natural Resources Committee advertisement. The Abilene Morning News 1934 17 October: 5.

Rising prices amid waste made perfect sense for independent gas producers from a value-theoretical perspective. Independent oil and gas producers were desperate to realize whatever value they could before the Power Trust drained the gas reservoirs out from under them. While city dwellers in the Midwest and Eastern United States were literally freezing from a lack of gas

in the winter, the Power Trust was *freezing out* Southwestern value from those markets (Sanders 1981, 26). Under the circumstances, the independents could either stand by and watch the Trust drain the Panhandle or resort to popping gas. Popping was incredibly wasteful but without access to the interstate pipelines, independents could only produce and sell gasoline, which allowed them to realize at least some small value from their lease holding.

The presence of massive waste in a market context of rising prices eventually proved intolerable, and the state stepped in to restore stability and the price mechanism. Officials from Oklahoma, West Virginia, and Missouri that demanded federal authorities impose rationality and order to the chaotic and wasteful market (Tussing and Tippee 1995, 133). Texas and Oklahoma mobilized the National Guard and declared martial law in the oil fields to staunch overproduction and save the industry from itself (Huber 2011b). Producers and some pipeline companies favored government oversight if it would only stabilize to the chaotic market (Sanders 1981, 58). Texas House Bill 266 in 1935 implemented pro-rationing plans to stop flagrant waste of natural gas in the Panhandle (Zimmermann 1957, 255; Olien and Hinton 2000, 206). At the national level, New Dealers ushered in a suite of laws to combat market failure, which included bipartisan congressional support for the Public Utility Holding Company Act (PUHCA) of 1935 (Castaneda and Smith 1996, 75). These New Deal reforms ended the Power Trust's natural gas-based value regime by breaking off pipeline companies into smaller, separate firms not under its direct control. Under the PUHCA, the Securities and Exchange Commission forced the Power Trust to divest itself of stock in multiple utilities and break up their oligopoly (Vietor 1994, 99-100). Between 1935 and 1947, 306 utility companies were spun off from the Trust, and more than a third became stand-alone natural gas companies (Sanders 1981, 38).

State Audits and Market Reform

In 1938, the New Deal Congress passed the Natural Gas Act (NGA) to reform the gas business by breaking up the Power Trust. The Supreme Court would later say, "Protection of consumers through exploitation at the hands of the natural gas companies was the primary aim of the Natural Gas Act" (Sherrill 1983, 540). The NGA was the capitalist state's attempt to end the monopolistic practices that threatened an essential means of production. Under the NGA, the Federal Power Commission (FPC) had the authority to demand gas companies involved in interstate trade submit construction plans for approval, submit rate schedules for auditing, and seek permission to abandon service or equipment (Zimmermann 1957, 294). The rate audits revealed that the Power Trust was charging prices far above the socially necessary labor time for gas. The Trust's value regime rested on valorizing low-labor natural gas and realizing it at prices that were marked up far beyond cost of production. Before regulation, gas companies massively inflated the worth of assets to appear as though utilities were providing more and better service than they were (Castaneda 1993, 25). By claiming that they were installing more pipelines and compressor stations and drawing from a greater network of gas wells, the Power Trust raised the real rates that consumers paid for gas.

The Power Trust could get away with price gouging because it held oligopolistic control over the circulation of capital through natural gas. Whichever firm first established itself in a region charged prices that were significantly more than the cost of the service (Herbert 1992, 65). In Marxian terms, not only was the Power Trust realizing value free from competition, it also was raising prices beyond the value and surplus value crystallized in natural gas. This was disastrous for capitalist *consumers* of gas who needed to maintain low expenditures on constant capital to boost profits. The Trust set profit rates high above costs and defended those rates "by

all the means, both old and new, which are at their disposal" (Meek 1956, 292). In major consuming states like Ohio, Pennsylvania, and New York, prices rose 14, 22, and 47% (respectively) in the five years between 1931 and 1935 (Herbert 1992, 61). The Power Trust justified these rate increases by claiming that costs for the service were increasing, but this was later shown to be false (Sanders 1981, 38). Throughout the 1920s, gas companies profited greatly by steadily increasing prices on residential consumers while maintaining low, wholesale prices for industry (Herbert 1992, 39). With minimal regulation, the Power Trust could practice discriminatory pricing to maximize profit. Herbert speculates that intra-capitalist cooperation between the Trust and industries such as steel mills and smelting operations resulted in low gas prices for industry during this period (Ibid., 37). Bringing prices of gas back into line with their true value was a crucial step in restoring public faith in the savings that fair market competition brought to their pocketbooks (Jacobs 2005). The state's elimination of price gouging also was a boon to capital, which had suffered from having to pay inflated prices for this vital means of production.

Enormous write-offs of industry assets were crucial to restoring natural gas prices to a more accurate reflection of value. Through auditing, the FPC used the NGA's authority to eliminate millions of dollars' worth of assets through write-offs and rate reductions. The FPC found natural gas companies to be charging unnecessary and exploitative overcharges at a rate of $34.6 million per year ($600 million in 2017 dollars).[16] In total, between 1938 and 1943, the FPC eliminated $173 million ($2.5 billion in 2017 dollars) of fictitious holdings from natural gas companies used to justify higher rates (Ibid.). To take one example, the FPC found that Interstate

[16] U.S. Federal Power Commission. 1943. FPC Orders Interstate Natural Gas Company, Inc. to Reduce Rate for Natural Gas for Resale for Ultimate Public Consumption By $1,100,345 A Year; Directs That New Schedules Shall Be Filed and Become Effective May 15, 1943. U.S. National Archives and Records Administration: College Park, Maryland. Department of Energy records. News and press releases 1934-1999. Box 3. 3 May.

Natural Gas Inc. was claiming asset depreciation at two completely different rates to overcharge customers and avoid paying taxes. For the purposes of determining how much to charge consumers, Interstate claimed assets of 11 million dollars and for tax purposes they claimed assets of four million dollars (Ibid.).[17] Between 1941 and 1945, the FPC made 113 gas and electric utilities eliminate $820 million (11 billion in 2017 dollars) worth of assets from their accounts.[18] The last company in this group, Appalachian Power, was carrying reported assets 43 % above their actual cost.[19] Once these "write-ups" were eliminated, the company lost $40 million ($550 million in 2017 dollars).[20] Conor Harrison describes a similar process where the state voided "written up" asset values in the electrical utility sector, also under the authority of PUHCA (2013, 179). The state eliminated unnecessary expenses for all capitalists who needed gas as a means of production when it voided the write-ups. Most companies in the Power Trust voluntarily complied with the FPC orders, suggesting that state-mandated write-offs were taken as the price for restoring stable, functioning markets.[21] In sum, to restore the circulation of value through gas, the state had to disassemble and reform the gas industry to save it from its oligopolistic structure.

[17] U.S. FPC 1943.
[18] U.S. Federal Power Commission. 1945. Federal Power Commission Approves Proposal by Appalachian Electric Power Company For Elimination of $36,870,306 From its Plant Accounts - This is Ninth and Last American Gas And Electric System Company To Dispose Of Excess Over Original Cost Of Plant Without Hearings or Litigation. U.S. National Archives and Records Administration: College Park, Maryland. Department of Energy records. News and press releases 1934-1999. Box 4. 16 April.
[19] U.S. FPC 1945.
[20] U.S. FPC 1945.
[21] U.S. Federal Power Commission. 1944. FPC Makes Comprehensive Report to Chairman Lea Covering First Five Years of Administration of The Natural Gas Act of 1938; Says Rate Reductions Approved to Date Aggregate $34,680,000 a Year. U.S. National Archives and Records Administration: College Park, Maryland. Department of Energy records. News and press releases 1934-1999. Box 3. 23 January.

Conclusion

Questions of value lie at the heart of current debates over capital-nature relations in nature-society geography. The moments of valorization and realization of value occur within the broader circulation process of capital, yet in nature-society geography we tend to focus on the nature-capital relations at the stage of productive capital when labor valorizes commodities. The stage of commodity capital, when consumers realize value through the transformation of commodities into money, can also be a major driver for capital-nature relations. In the case of natural gas in the 1930s United States, the circulation of capital was blocked for independent producers, leading them to vent methane (a potent greenhouse gas) directly into the atmosphere. Four vertically-integrated firms – the Power Trust – used its power over interstate gas pipelines to block competitors' commodities from reaching markets. The Power Trust was ensuring that the value of its commodity capital was successfully realized, by blocking their competitors' gas from exchange and value realization. Their competitors – the independents– found themselves with no ability to realize the value of their gas and opted instead to dump it into the atmosphere through the process of gasoline stripping. The importance of realization within the wider capital circulation process is not only a historical-geographical problem. Modern utilities and energy companies are compelled to realize the value crystallized in fossil fuels, despite the availability and superiority of renewable energy.

To push beyond the surface appearance of commodities is a perennial project of Marxist political economy. To grasp the social and socionatural relations necessary to produce goods and services is to unveil capitalist ways of producing and reproducing life. Critical nature-society geography maintains a dedication to the socionatural relations behind a panoply of resources across space, place, and scale. These studies typically examine the productive stage, and in more

exceptional cases the money stage, of the circulation of capital. My objective in this chapter was to develop nature-society geography's engagement with capital circulation, specifically the stage of commodity capital and the moment of realization, upon which continuing valorization depends. The sequence of value production *and* realization is the "determining purpose" that guides capitalist social relations and capital-nature relations (Harvey 2013, 67).

Value realization was a crucial determinant of natural gas markets in the oligopolistic 1930s United States, but it matters more than ever today. Despite a dire need to transition toward clean(er) energy to avert worsening climate change, fossil fuel companies are compelled to realize the value of every cubic foot of natural gas in their reserves.[22] As the opening anecdote from California illustrated, these commitments to value realization are delaying a transition to cleaner forms of energy. However, even if the state can assert its power over capital to write off these assets, value will simply take new forms. Although fossil-fueled societies have a tremendous need for solar panels, wind turbines, battery storage, and electric cars, capital demands these use values be produced as values (McCarthy 2015), which pass through moments of valorization and realization in the broader process of capital circulation. Geography's engagements with value theory provide a crucial perspective on how and why the survival of value poses an obstacle to the survival of life. Capitalists are concerned with surplus value production above all other concerns, including humanity's survival on the planet.

The real objective of any left struggle should not be the replacement of one value regime with another but the abolition of capitalist value itself. Capitalist natures follow a logic that prioritizes realizing privately held value over the provisioning of socionatural goods that fulfill

[22] They are compelled by their responsibilities to increase shareholder value and not to abandon infrastructure used to produce fossil fuels that is worth billions.

social needs. Although we live and die by our ability to satisfy physical needs, capital requires that we relate to nature, and each other, as homogeneous abstractions of our working lives. As this case illustrates, the pursuit of immaterial value leads to material outcomes that are wasteful, destructive, and exploitative. Replacing fossil capital with renewable capital would perpetuate familiar, violent contradictions that produce social injustice and ecological destruction. Nature-society metabolism under capitalism entails the successful passage of value from valorization through realization, all within the wider circulation process. Blockages and interruptions in that process will bring further waste, unnecessary human deprivation, and environmental waste. Rather than seeking to eliminate blockages in valorization and realization, the productive labor of society must be spent satisfying human needs in replacement of capital circulation.

Chapter 3

Beyond the Fractured Environmental State: Capital, Labor, And Natural Gas

Introduction

In 2012, the U.S. was producing more natural gas than ever before through fracking (U.S. EIA 2017a). Fracking is a technique for extracting oil and natural gas from shale rock formations using highly pressurized water, sand, and chemicals that has allowed a new oil and natural gas boom (Sica 2015). In his State of the Union address that year, President Obama highlighted the broader economic significance of fracking for the economy. “The development of natural gas will create jobs and power trucks and factories that are cleaner and cheaper, proving that we don't have to choose between our environment and our economy” (White House 2012). Although the U.S. had yet to establish a natural gas-powered transportation sector (and still has not, six years later), Obama was correct that industries throughout the economy benefited from the boost in natural gas supply and declining price. For example, a new methanol plant slated for construction in Chile was rerouted to Louisiana because the “outlook” of low natural gas prices in the U.S. was so bright (Nemec 2012). (The facility now produces two million metric tons of methanol a year according to its website.) However, he was incorrect in another, deeper respect.

In the case of gas, we can’t choose between the environment and the economy because one is an essential input to the other. Gas is an essential resource that originates in the environment and is used to run the economy. In this chapter, I explain how and why the U.S. came to depend on natural gas, focusing on a crucial mid-1950s Supreme Court decision. I argue that political ecologies of the state principally study the fractions of the capitalist state that

regulate "nature-centered industries"[23] (Whitehead et al. 2007; Ioris 2014; Harris et al. 2017). Some of the most ecologically significant government policies are not always framed as environmental or are not legitimized on environmental grounds. Decisions over policy based primarily on the health of the economy as a whole can have long-lasting impacts on the environment.

Political ecology has an overly narrow conception of the state-environment relation under capitalism that mirrors an overly limited theory of the capitalist state that emerged in the 1970s. Marxist state theorist Nicos Poulantzas espoused a "fractionalist" approach to studying the capitalist state that shares some similarities with political ecology's empirical approach to the state. Poulantzas advanced the idea that states represent a condensation of the balance of class forces, which functions under the hegemony of a dominant class fraction.

> The (capitalist) State… is rather a relationship of forces, or more precisely the material condensation of such a relationship among classes and class fractions, such as this is expressed within the State in a necessarily specific form… However, the State is not purely and simply a relationship, or the condensation of a relationship; it is the specific material condensation of a relationship of forces among classes and class fractions. (Poulantzas 1978, 128-9)

Simon Clarke criticized this theory for leading to tautological and analytical cul-de-sacs when it was put into practice by state theorists. Rather than focusing on class fractions à la Poulantzas, Clarke suggested that attention be given to how the state reproduces a more general – yet fundamental – social relation of capitalism: the capital-labor relation. Rather than focusing on how the capitalist state supports capital as-a-whole, Clarke argued, Poulantzas emphasized the importance of particular capitals (Das 1996, 42). This focus is more in keeping with Marx, who

[23] Boyd et al. categorize "nature-centered production" as the "food, fiber, and raw materials sectors" and give a convincing argument for why these industries should not be thought of as analytically distinct within a Marxian, political-ecological framework (2001, 555).

said little about the capitalist state but considered the subjection of labor to capital to be the foundation of the capitalist mode of production.

> The production of absolute surplus-value turns exclusively upon the length of the working day; the production of relative surplus-value, revolutionizes out and out the technical processes of labour, and the composition of society. It therefore pre-supposes a specific mode, the capitalist mode of production, a mode which, along with its methods, means and conditions, arises and develops itself spontaneously on the foundation afforded by the formal subjection of labour to capital (1867a, 510).

I argue that political ecology employs a similar "fractionalist" approach by cordoning off its research gaze to those fractions of the state involved in governing nature-centered industries. This is a problem because political ecology overlooks the state's critical role in reproducing capitalism *in general* through environmental governance. Natural resources are a critical means of production under capitalism, and they are also an ecological foundation for the social relations of production. I explore this argument through a case study of the regulation of natural gas in the United States. Although gas is a nature-centered industry, the state governed it with an eye toward keeping the price of labor power low and reducing capital's expenditures on constant capital. I precede that case study with a review of the political ecology literatures that regard the state's role in capital-nature relations.

Political Ecologies of The State

Despite trends away from state-centered analysis, political ecologists have – with some consistency – answered Robbins' call for greater engagement with the state (2003).[24] That said, recent years have witnessed the emergence of literatures on "environmental governance" that

[24] For the purposes of this review, I define the state as public-sector workers operating within "an ensemble of socially embedded, socially regularized and strategically selective institutions, organizations, social forces and activities organized around (or at least actively involved in) making collectively binding decisions for an imagined political community" (Jessop 2002, 6).

"problematize state-centric" explanation (Bridge and Perreault 2009, 476), preferring to examine the state in relation to the power of corporations, NGOs, and social movements (Himley 2008). Quoting state theorist Bob Jessop, Himley notes, "It is precisely this 'destatization of the political system' that the concept of governance seeks to capture" (Ibid., 435). Despite the emergence of environmental *governance* – as opposed to environmental *government* – there has always been an interest in integrating theories of the state with political ecology, including a recent surge in scholarship on the topic (Bridge and Jonas 2002; Carter and Zalik 2016; D'Alisa and Kallis 2016; Harris 2017; Ioris 2014; McCarthy 2007; Meehan and Molden 2015; Parenti 2015a; Robertson 2015; Whitehead et al. 2007). Contemporary political ecologists find the state central to "the organizational and institutional arrangements through which society-environment relations are governed" (Himley 2008, 434), and the articulation of these organizational arrangements is of long-standing interest to the field.

Some literatures have recently called for "political ecologies of the state"; however, this phrasing seems redundant if we accept Blaikie and Brookfield's definition of political ecology. As Robertson mentioned in a recent review (2015, 459), one sentence following Blaikie and Brookfield's oft-cited definition of political ecology ("concerns of ecology and a broadly-defined political economy") they add, "We also derive from political economy a concern with the role of the state" (1987, 17). Blaikie and Brookfield intended to situate the decisions of independent land managers in "chains of explanation" that explained smallholder land use in the context of state policy and global economic change (1987, 27). They focused on how structures at "higher levels of influence," i.e., the state, international financial institutions, and NGOs, condition the decisions of independent land managers (Bridge 2002, 371). Over time, critics pushed the field to strengthen the political-economic and state *links* in chains of explanation by focusing on the

topics of "control and access" to resources and property (Peet and Watts 1996, 8-9). New research over the next decade witnessed a shifting toward the "complex relations between Nature and Society through careful analysis of social forms of access and control over resources" (Watts and Peet 2004, 4). In these struggles over control and access to resources, the state is both a persistent "mediator between capital and nature" and a "site of struggle" itself (Robbins 2008, 212). Crucially, "one of the central functions of the state is to provide for the conditions for the accumulation of capital" (Ibid., 210). Theorists of the state working in the Marxian tradition have been grappling with this "function" for decades (Das 2006), and some have begun to see the parallels between state theory and political ecology.

Although nature or the environment was not in their purview, the Marxist state theory debates of the 1970s and 1980s recently have reemerged as a common point of reference for political ecologists. Reviewers have pointed out how political ecology lacks a "warranted" engagement with state theory (Bridge 2014, 126), given state capacities for mobilizing land and resources and facilitating legal appropriation. Parenti also points out how Marx-inspired nature-society studies have "not quite linked up with" Marxist state theory (2016, 172). Robertson says the necessity of a state theory within political ecology is thrown into "sharp relief" with the development of first-world political ecology and suggests the *regulation* approach (citing Huber 2013b) as a possible entry point (2015, 462). In his review, Ioris acknowledges the *regulation* approach's strong, historical grounding, before reviewing the widely acknowledged state-theory debate of the 1970s between Ralph Miliband and Nicos Poulantzas (2015). Ioris's own theorization of "environmental statehood" builds on the main threads of that historical debate. He holds that state-nature practices are profoundly affected by "historical and class commitments," which arise from a "tacit separation" of state and capital (2014, viii, 9). In their day, both

Miliband and Poulantzas tried to draw out the intricacies of the unity between state and capital. The former saw the state as "colonized and primarily represent(ing) the capitalist class," and the latter saw the state as "permeated" by capital "in a more systemic manner that connects the structures of society and the state" (Ioris 2015, 172). Early endorsements of Miliband in political ecology (Blaikie 1985, 83) have given way to calls for limited engagement with Poulantzas's work.

Wainwright and Mann recently said that "we urgently need a study that draws on Poulantzas's thought to study climate change and the capitalist state" (2015, 320). Although not focused on climate change specifically, some nature-society research has drawn on Poulantzas's idea that "the state is a condensation of societal relationships of forces" (Brand et al. 2011, 162; see also Andreucci 2017, 172) and an "outcome of struggle" (Angel 2017, 561). Others suggest political ecology should engage with Jessop's strategic-relational approach (SRA) (Robertson and Wainwright 2013, 899; Whitehead et al. 2007, 44), which Jessop considers an extension and development of Poulantzas's state theory.[25]

Both Whitehead et al. (2007, 44) and Robertson and Wainwright (2013, 899) borrow Poulantzas's recognition that the capitalist state cannot work in unity with capital because the capitalist class is split into "fractions." According to Poulantzas, this disunity on the economic level requires a means of unifying and legitimizing state policy amongst different capitalist class

[25] Jessop explains the evolution of the SRA out of Poulantzas's work in several places: "I refer to the 'strategic-relational' approach. Its basic theme is expressed somewhat obliquely in Poulantzas's claim that 'the state is a social relation'. This suggestion can be reformulated in the proposition that state power as revealed in the conjunctural efficacy of state interventions is a form-determined condensation of the balance of political forces" (Jessop 1990, 149). "…the influence of theorists, for good or bad, continues as long as their work leaves identifiable traces on the work of others... his (Poulantzas's) work remains a critical source for a continuing critical tradition of state theory … There is also enormous value in his strategic-relational approach. We should approach his work in the same critical spirit as that adopted by Poulantzas in his own studies: to appreciate its significant theoretical ruptures, to fill its gaps, to assess its relevance to new problems and theoretical currents, to develop it in new directions" (Jessop 2008, 137-9).

fractions (Benton 1984, 162).[26] Poulantzas argued that a hegemonic fraction existed within the capitalist class, and it was around this fraction that the state formed as a "material condensation."[27] Poulantzas was drawing on the Gramscian notion of a "hegemonic bloc," i.e., "a durable alliance of class forces organized by a class (or class fraction) that has proved itself capable of exercising political, intellectual, and moral leadership over the dominant classes and the popular masses alike" (Jessop 1997, 56-7). Jessop speculates that had Poulantzas paid attention to environmental politics, he would have analyzed how disputes over environmental policy and issues are shot through with disputes between different fractions of capital (2017, 196). Before we follow Wainwright, Mann, et al.'s suggestions and develop a more Poulantzas-inspired political ecology, it might be wise to consult a critique focused on the empirical applications of Poulantzas's state-theoretical framework.

When practitioners of Marxist state theory brought Poulantzas's theories into empirical inquiries, there were mixed, and not maximally useful, results. Methodologically, a great deal of "fractionalist" research tried to determine the "hegemonic fraction" in a particular time and place (Clarke 1977, 43).[28] As Clarke points out, this methodology frequently led to tautological

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[26] Benton provides a very helpful overview of structural Marxism, including Althusser and Poulantzas (1984).
[27] Although Poulantzas's commitment to Althusserian structuralism waned with time, the idea of a dominant hegemonic fraction around which the state formed remained central to his thinking right up until his premature death. "With respect to the state, these elements structure a political bloc within which the hegemonic fraction, to whose specific interests the class state 'corresponds', presents itself as guarantor of the general interest of the dominant classes and fractions, which it concentrates in their political expression (Poulantzas 1965, 107). "The relation between the capitalist state and the dominant classes or fractions pushes them towards their political unity under the protection of a hegemonic class or fraction" (Poulantzas 1973, 239). "The (capitalist) State… is rather a relationship of forces, or more precisely the material condensation of such a relationship among classes and class fractions, such as this is expressed within the State in a necessarily specific form. … However, the State is not purely and simply a relationship, or the condensation of a relationship; it is the specific material condensation of a relationship of forces among classes and class fractions" (Poulantzas 1978, 128-9). "The strategic organization of the State destines it to function under the hegemony of a class or fraction located within it" (Poulantzas 1978, 137).
[28] This wasn't just a kneejerk reaction to the Miliband-Poulantzas debate. Clarke critiqued fractionalism and maintained a focus on the wider capital-labor relation in future work. In a monograph on the Keynesian state in the U.K. he said, "Thus the conflict between the needs of the domestic economy and the interests of multinational capital is not a conflict between the interests of different fractions of capital, but between the interests of multinational capital and the needs of the mass of the population" (1988a, 5).

thinking. If a policy adopted by the state was in the interest of the hegemonic fraction, then a fraction of capital proved itself hegemonic once its favored policy was implemented. With no way to illustrate whether political dominance preceded economic dominance, or vice versa, fractionalist theory explained every situation at all times, reducing its historical-geographical utility. For political ecologists interested in empirical rigor, this method would be unhelpful for analysis at a close level of historical-geographical specificity.[29]

Rather than focus on capital's fractionation, Clarke suggested we focus on how states facilitate the reproduction of the capital-labor relation in general. There was little theorization of the relation between labor and capital in fractionalist state theory, which was more concerned with inter-capitalist class struggle. When Poulantzas's thought was applied to case studies of South Africa's political economy (Morris 1976; Kaplan 1976; Fransman and Davies 1977; Kaplan et al. 1977), these studies focused on conflicts within the capitalist class rather than the relation between labor and capital (Clarke 1977, 47). The structural Marxism of Poulantzas and Louis Althusser held that workers and capitalists *both* provided *träger* (support) for capitalist relations of production (Ibid., 157). Although he later departed from this position, Althusser's early works displayed no interest in the politics of Marxist theory, e.g., mass movements, actually existing class struggle, etc. (Benton 1984, 84). Fractionalist state theory also overlooked the capitalist class's shared interest in the state's facilitation of labor's subservience to capital (Clarke 1977, 61). Clarke took the relation between capital and labor to mean the specific, historical social relation through which capitalism functioned as a mode of production (1977,

[29] Poulantzas published some empirical studies but is cited more for his theoretical work. As Jessop explained, "Poulantzas was concerned with the *theoretically typical* capitalist state and not with any state whatsoever in capitalist societies" (1985, 65). Despite this, early adopters of Poulantzas's approach did have one empirical study to work from: *Fascism and Dictatorship* (1974). It could be argued that an empirical study of fascism, which is a distinct form of political economy, should not have been applied to liberal-capitalist states. Regardless, Clarke's critique (1977; 1978) was directed at adopters who followed *Fascism and Dictatorship*.

10). He thought, therefore, that Marxist analyses of the state should show how and to what extent the state reproduces that relation (Ibid.).

The challenge for political ecology, in their attempt to integrate Marxian state theory, is to show how the state leverages nature-society relations to support exploitation, domination, and subsumption of labor to capital. This approach should necessarily entail a more explicit political-ecological engagement with class (Huber 2017d) and show how state environmental and energy policies support the social relations of class under capitalism. Much of the literature on the state in political ecology has been concerned with relations between the capitalist state and nature-centered industries, which are important *fractions* of capital. However, I argue here that the capitalist state relates to nature with an eye to reproducing capitalism *as a whole system* because capitalism uses natural resources as critical means of production and socioecological foundations for the social relations of production. Das (2017b) critiqued Harvey (2003) for a similar reason when he said Harvey used a fractionalist approach that failed to frame accumulation by dispossession from the standpoint of the capitalist class as a whole or capitalism as a whole (2017, 605). In the following case study, I provide an example of how state regulation of a nature-centered industry was crafted with attention to how it would maintain the broader capital-labor relation across the U.S. economy.

Phillips Petroleum Co. v. Wisconsin

Most political ecology does not focus on the judicial branch of the state, despite its importance to environmental governance (except see McCarthy 2005). This is unfortunate because the courts can influence how energy and environmental laws are enforced once they are passed. In 1954, the Supreme Court, in a majority decision (Tussing and Barlow 1984, 100), extended FPC control over natural gas producers not affiliated with pipeline companies, so-

called independent producers (Landsberg and Schurr 1968, 204). The State of Wisconsin filed a complaint with the FPC that Phillips Petroleum Co., a large oil and gas firm responsible for 15% of all interstate gas sales in the U.S. (Castaneda 1999, 152), was price gouging. The FPC ruled that Phillips's rates were outside its jurisdiction because the NGA did not grant them federal authority to set prices for natural gas companies not directly affiliated with interstate trade, in this case, interstate gas pipelines. The FPC was correct that Phillips was only producing gas and not directly involved in transporting it across state borders in a pipeline. However, the State of Wisconsin sued the FPC and demanded that they intervene to regulate Phillips's prices under the NGA's authority, and the case went all the way to the Supreme Court (Kohlmeier 1969, 194).

Gas consumers argued that the fixity of natural gas's infrastructure made pipeline companies captive to producers' prices; pipelines cost between $40,000 and $100,000 per mile to build and couldn't be easily moved in search of lower gas prices from competing production companies (Sanders 1981, 118). The NGA empowered the FPC to demand that prices of gas sold through interstate pipelines be kept low for consumers, but by 1940 this level of control was proving inadequate to the task (Kohlmeier 1969, 193). The AFL-CIO said that independent producers were increasing prices, and utilities and pipeline companies were passing these costs along to consumers (see Figure 6).[30] Distribution by public utilities and transmission by pipelines were already under regulation, but one final link in gas's commodity chain relied solely on

[30] AFL-CIO IUD (Industrial Union Department). 1958. Folder: 129-D-1 1958. Box: 1018. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

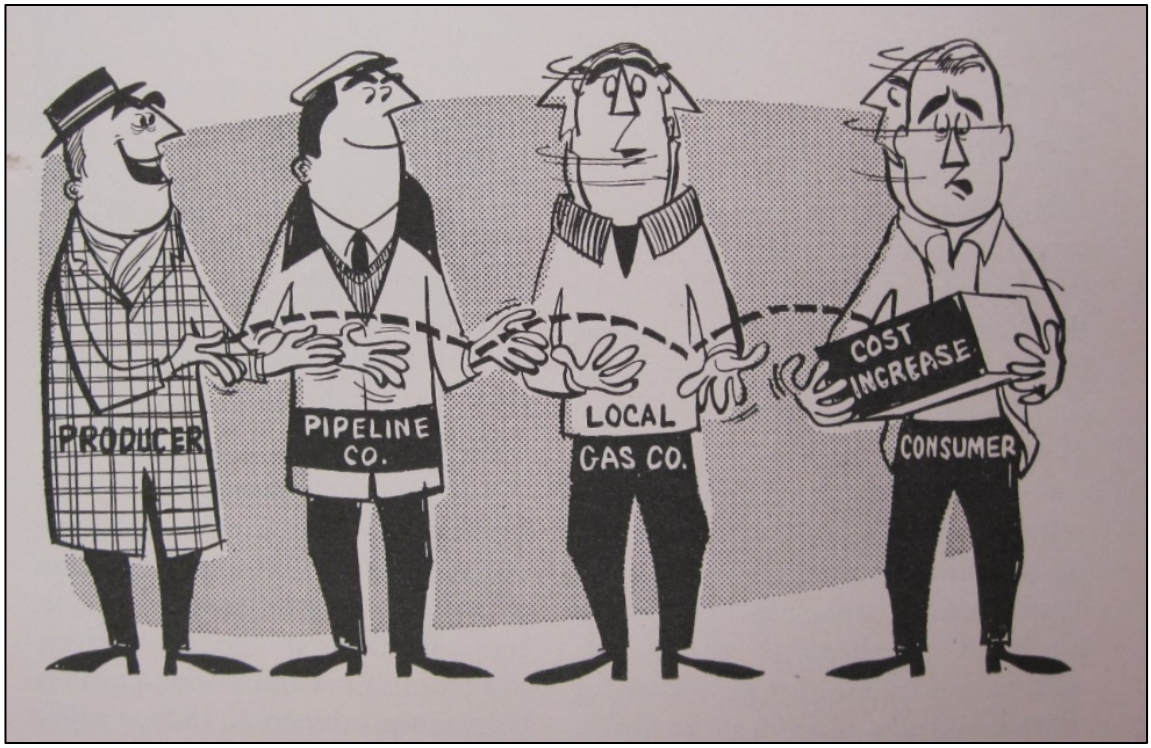

Figure 6: Source: AFL-CIO IUD.

market forces to set prices: *production*, which included many thousands of independent producers.

Phillips Petroleum Co. was the largest independent natural gas producer in the postwar U.S. (Kohlmeier 1969). In the oil and gas fraction of capital, "independent" does not indicate a company's relative size or influence in the natural gas industry. Rather, *independent* implies a production company not affiliated with a transmission or distribution company, i.e., a pipeline or a municipal utility, respectively. Even oil and gas titans like Exxon, Texaco, and Phillips were considered *independent* in the natural gas sector because they produced only gas; they didn't move it around the country through underground pipes (Greenberger 1983, 353). This didn't stop producers from trying to use the "independent" label to leverage populist sentiment against regulation (Ibid.). A majority of the court ruled in favor of the state of Wisconsin, and although

the opinion was unfavorable to the natural gas industry (Herbert 1992, 115), the extension of regulation over production was a reasonable decision at the time (Castaneda 1999, 154).

Without control over production, the FPC had a limited ability to set "just and reasonable rates" for gas users as mandated by the NGA (Ibid.). Between 1938 and 1954, the prices charged by producers to pipelines were being passed along to consumers (Tomain and Cudahy 1992, 206). With no FPC oversight, consumer protection from price gouging by pipeline companies was cancelled out when producers began increasing prices between 1947 and 1954 (Vietor 1984, 84). Price increases were caused by two interrelated factors: increasing demand in the interwar years (Ibid.) and utilities extending service into areas that were further from urban centers costlier to serve (Tussing and Barlow 1984, 102). Regardless, the court decision found that the NGA's "basic intent" could only be carried out if production came under regulation (Barber 1981, 262).

Between 1954 and 1970, high demand incentivized gas firms to explore and develop gas reserves even under price regulation (Castaneda 1999, 179). Eventually, however, *Phillips* led to disruptive gas shortages in the winters of 1971-1972, 1973-1974, and 1976-1977 that shut down schools and factories and left people with no heat at home (Castaneda 1993, 3). Price controls had disincentivized producers from finding and drilling for new pockets of gas (Castaneda and Pratt 1993, 8) and simultaneously incentivized producers to sell existing gas supplies to *intra*state pipeline companies, which were not covered by the NGA or *Phillips* (Castaneda 1993, 167).

Previous analyses of *Phillips* frame it as a conflict between different fractions of the capitalist class, specifically Northeastern and Midwestern industrialists versus Southwestern oil

and gas capital. Political scientist M. Elizabeth Sanders, for example, considered the Supreme Court's 1954 decision on *Phillips* as a win for consuming states in the Northeast and Midwest.

> A Supreme Court decision in 1954 made it possible to implement a program that probably could not have been achieved through legislative means: control of the prices paid to natural gas producers in the South and West on behalf of urban consumers in the Northeast, Midwest, and California… The amorphous supporting coalition of 1938 gave way to a polarized, regionally-based conflict between producer and urban consumer areas that was essentially a struggle over the distribution of wealth between two sets of political constituencies… the producer states believed that their new affluence had been wrested out of the jaws of a regulatory apparatus illegitimately imposed on them, and they resented the fact that a product on which their economies depended should be controlled, while the coal and manufactured goods they imported from other states were not. (Sanders 1981, 198-9)

In Sanders's view, *Phillips* reduced the prices paid by residential consumers, industrial users, gas utilities, and pipelines in gas-importing states and barred gas producers and their states' treasuries from further profiting off higher gas prices. Sanders quotes one Southern congressman who decried *Phillips* as a "massive regional transfer of wealth" from the gas-producing Southcentral U.S. to the industrial Northeast and Midwest (Sanders 1981, 114).

Sanders's regional approach to natural gas politics is "territorially trapped," i.e., she treats politics between states primarily as flows between bounded and discrete containers, which excludes the *internal politics* within states, including in their workplaces (Agnew 1994, 57). Rather than aiding Northern and Midwestern industrialists and harming Southwestern gas producers, *Phillips* provided capital *as a whole* with a newly available fossil fuel for use as a cheap means of production. Cheaper gas provided U.S. capital with two advantages: reductions in the value of labor power and savings on the cost of constant capital. Despite its appearance as an intra-corporate, economic ruling rather than an environmental one, *Phillips* had enormous environmental consequences. A fractionalist approach to the environmental state misses the

significant socionatural elements of governance like *Phillips* that are framed as matters of economic or corporate law.

The price of fuel affects the value of labor power, specifically when changes in the cost of necessities for subsistence cheapen the reproduction of the labor force (Christie 1984, 116). Production of surplus value is the absolute law of the capitalist mode of production, and profits under capitalism come from the exchange of surplus value materialized in commodities.

> Labour-power is sold to-day, not with a view of satisfying, by its service or by its product, the personal needs of the buyer. His aim is augmentation of his capital, production of commodities containing more labour than he pays for, containing therefore a portion of value that costs him nothing, and that is nevertheless realised when the commodities are sold. Production of surplus-value is the absolute law of this mode of production. (Marx 1867a, 618)

Workers spend part of their working day producing enough value to cover their subsistence and the other part (the unnecessary, surplus chunk of their workday) producing value for the capitalist (Ibid., 218). If the length of the work day cannot be increased, then reducing labor's value becomes one of the principle ways capital can increase surplus value (Ibid., 314). Cheapening labor goes "hand-in-hand" with increasing surplus value (Ibid., 604) because by reducing the amount of variable capital (v) laid out for workers, the rate of exploitation (surplus value [s] /v) increases (Harvey 2010b, 164).

Although capital reduces the value of labor power to maximize profits, it still must contend with the pesky problem of workers' survival and reproduction. "The value of labour-power is the value of the means of subsistence necessary for the maintenance of the labourer" (Marx 1867a, 171). The means of subsistence includes things like food, clothing, housing, and, crucially, *fuel* (Ibid.). Although the quantities of socially necessary subsistence are historically and geographically determined, their cost must be covered by workers' average income to avoid

starvation, illness, death and reproduce the next generation of workers (Ibid., 172). Capital's constant tendency is to force the cost of labor back to the bare minimum threshold of survival.

> If labour could be had without purchase, wages might be dispensed with. But if the labourers could live on air they could not be bought at any price. The zero of their cost is therefore a limit in a mathematical sense, always beyond reach, although we can always approximate more and more nearly to it. The constant tendency of capital is to force the cost of labour back towards this zero. (Ibid., 600)

In the case of housing, Harvey points out how state intervention happens before capital can destroy its own labor source (Harvey 1982, 232). My point is that the state intervenes to maintain labor's social reproduction through environmental and energy regulation, not only through urban and housing policies.[31] By reducing the cost of necessities through energy governance, the state creates opportunities for increasing the rate of exploitation of labor.

Reducing variable capital (v) is just one way to increase surplus value for capital, by increasing the rate of exploitation (s/v). Environmental/energy regulation that makes fuel cheaper also increases the rate of profit (s/[c+v]) by reducing the cost of constant capital (c), which includes the costs of fuel to run machinery. Capital maintains a "fanatical insistence on economy in means of production" (Marx 1894b, 83) because cheap means of production like raw materials and fuels will raise profits by trimming the cost of necessary inputs. In his analysis of capital's drive to sink the cost of constant capital, Marx quotes an engineer, James Nasmyth, who describes how innovations in steam and drive shafts allowed for savings in the cost of coal (Ibid., 96-100).

> About ten years ago the extraordinary economical production of power as realised by the engines employed in the mining operations of Cornwall began to attract attention… as indicated by the performance of the Cornish engines, as also the

[31] Harvey has elsewhere made the point that cities are already *socioecological* by dint of all the steel, concrete, plastic, and asphalt it takes to build them (1996, 186). Political ecology has mostly avoided politicizing the ecologies within these types of heavy industries, but that's starting to change (Fry 2013; Huber 2013a; Huber 2017a).

> extraordinary economical performance of Woolf's double-cylinder engines, began to attract increased attention to the subject of economy of fuel in this district, and as the Cornish and double-cylinder engines gave a horse-power for every 3½ to 4 lbs of coal per hour, while the generality of cotton-mill engines were consuming 8 or 12 pounds per horse per hour, so remarkable a difference induced mill-owners and engine-makers in this district to endeavour to realise, by the adoption of similar means, such extraordinary economical results. (Ibid., 98)

Lowering the price of fuels necessary for machinery to function is always attractive to capital because it reduces the cost of constant capital. By lowering the value of the constant capital, *Phillips* made natural gas an attractive fuel for U.S. capital.

This explanation of how the capitalist state allowed capital to become dependent on natural gas would be missed if we employed a fractionalist approach to the environmental state. It would be missed because we wouldn't be looking at the effects of energy or environmental policy on the cost of reproducing labor power. Political ecologists of the state are more concerned with fractions of the state that are framed as distinctly environmental e.g., environmental protection agencies or farming bureaus. They leave aside the ecological aspects of environmental or energy policies that are aimed at reproducing the general economy through sinking the cost of constant capital and the value of labor power. Fractionalist approaches to the environmental state would consider reducing the cost of constant capital more an economic or industrial concern than an environmental one.

Sinking the Cost of Labor Power

In ruling for Wisconsin, the Supreme Court forced independent producers under regulation in the name of protecting consumers from exploitative high prices.

> We have held that these sales are in interstate commerce. It cannot be doubted that their regulation is predominantly a matter of national, as contrasted to local concern. All the gas sold in these transactions is destined for consumption in States other than Louisiana. Unreasonable changes exacted at this stage of the interstate movement become perpetuated in large part in fixed items of costs

> which must be covered by rates charged subsequent purchasers of the gas including the ultimate consumer. It was to avoid such situations that the Natural Gas Act was passed. …Protection of consumers against exploitation at the hands of natural-gas companies was the primary aim of the Natural Gas Act. (Supreme Court 1954 §11; §18)

After World War II, gas shortages and price increases had consumers clamoring for greater federal oversight of the gas industry (Sanders 1981, 83). During a shortage in 1947, Leon Gavin, a representative from Pennsylvania, spoke to the concerns of his district in a House debate on natural gas regulation.

> I come from a district in Western Pennsylvania that has been producing gas for many years. Last winter it was necessary for us to ration gas, the first time it has been rationed to my knowledge. I am greatly interested as are my people and the industrial life of my district in serving an additional supply of gas to supplement the rapidly depleting gas supply in Western Pennsylvania. (Sanders 1981, 85)

Frank Clement, Governor of Tennessee, spoke in very similar terms against any move to remove regulations that would keep prices of gas low.

> I am making this statement as Governor of the State of Tennessee in the interest of the more than 240,000 gas consumers in my State who, during the past 5 years, have become almost completely dependent upon natural gas as the fuel for domestic consumption in their homes, for commercial use in their business, and for the industrial needs of their factories. The pipeline from gas-producing States to Tennessee has become a life line to the economic existence of more than one-third of our State's total population. (U.S. Congress 1955, 1368)

During the shortages, gas producers reaped greater profits by raising prices, which put great stress on the 'industrial and economic life' of Pennsylvania, Tennessee, and many other manufacturing places. Natural gas regulation was much more than a regional competition between different fractions of capital and was more of an issue about the reproduction of daily life for the proletariat.

Two years after *Phillips*, Congress passed a bill (Harris-Fulbright) attempting to water down the ruling by exempting smaller independents from regulation. Letters and telegrams

started arriving at the White House pleading with President Eisenhower to veto the bill.[32] The mayor of Fultondale, Alabama, wrote:

> My Dear Mr. President. Only you can now defeat the vicious Harris-Fulbright natural gas bill. The householder, large and small business people, industry, the whole cross-section of most of our country depend on you for championship in this. We here are afraid of what could happen.[33]

The mayor of Minneapolis said, "For the millions of natural gas consumers in this country we ernestly (sic) urge you to veto the Fulbright Harris bill. Especially do we raise our voices for the thousands of GI's and others whose newly built homes are heated with gas with no provision or possibility of converting to other fuel."[34] The mayor of Baltimore wrote, "A veto of the bill will demonstrate your concern for Mr. (sic) Average Citizen."[35] From Paris, Kentucky, the major wrote,

> As Mayor of Paris, Kentucky where a large percent of our people depend on natural gas for cooking, heating, and other comforts, I urge you to veto the Harris-Fulbright bill. Since the passage of this bill has taken away the Federal Power control over prices of natural gas it is going to be extremely hard for our people to pay the gas bills and feed their families at the same time.[36]

Gas regulation was more than a concern of gas producers and the industrialists who depended on gas to run their factories. The millions of workers and their dependents that constituted the mass of society knew that gas was an essential part of reproducing daily

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[32] Eisenhower eventually did veto the bill after it was revealed that Francis Case, Republican Senator from South Dakota, had been bribed $2,500 by "gas interests" to sign the bill (Woods 1995, 203). Eisenhower was a supporter of the bill, and freeing business from government regulation in general, but felt compelled to veto it on account of the "arrogant" lobbying by the gas interests (Ibid.).

[33] Belcher, R. to D. Eisenhower. February 7, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

[34] Glass, E. to D. Eisenhower. February 8, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

[35] Dalesandro, T. to D. Eisenhower, February 9, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

[36] Glass, E. to D. Eisenhower. February 8, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

life. *Phillips* ensured that laborers could reproduce themselves cheaply, allowing capital to avoid paying higher wages for the means of subsistence.

Beyond family survival or provisioning for veterans, other writers appealing for the veto framed natural gas regulation as a class issue. Mayors and unions sent telegrams to defend Phillips from the Harris-Fulbright Bill, and consumers sent their advocates to Washington, DC, to speak in person. George Meany, President of the AFL-CIO, said, "I respectfully urge you to veto the Harris-Fulbright bill. The workers of this country feel there is no moral or economic justification for this legislation which would cost the nations (sic) gas consumers an additional six hundred million dollars a year."[37] The mayor of a suburb outside Minneapolis wrote, "Respectfully urge you veto Fulbright Harris bill. Incidents of increased gas rates arising from passage this legislature will fall on those citizens least able to pay and will tend to depress standards of living of great mass of laborers and white collar workers in our city and rest of country."[38] The Chairman of the Detroit Board of Commerce voiced his concern tersely but succinctly:

> Industry follows fuel, thus creating jobs. Detroit's growing commercial area depends upon abundance of industrial energy, big percentage of which comes from natural gas. Plenty of gas means expanding pay envelopes. We respectfully urge that you sustain the decision of both Senate and Congress on Harris-Fulbright bill and support our increasing American working force.[39]

The mayor of Gadsden, Alabama, wrote,

> Grant me leave to bring to your personal attention a matter of very vital concern to many of our people particularly the working class. I have reference to the

[37] Meany, G. to D. Eisenhower. February 9, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.
[38] Overlie, R. to D. Eisenhower. February 9, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.
[39] Campbell, H. to D. Eisenhower. February 9, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

> recently enacted Harris-Fulbright Bill pertaining to the Natural Gas industry… this bill is definitely not, repeat, not in the public interest.[40]

Cities like Pittsburgh, Cleveland, Cincinnati, Youngstown, Buffalo, Syracuse, and Louisville sent representatives to Congress to speak on behalf of gas consumers. Wisconsin Senator Alexander Wiley warned the White House that unregulated producer prices would burden 60 million natural gas consumers with $200-400 million in additional expenses (Barber 1981, 262). Producer states in the Southcentral and Gulf regions of the country argued that lowered prices would deprive their state houses of the necessary tax revenues for education and welfare (Sanders 1981, 116). One producer said, "I'll sit on the gas for ten years before I let the boys in Washington tell me what I can sell it for" (Waples 2012, 217). If Congress voted against them, producers threatened to take gas out of interstate natural gas markets and sell it in intrastate markets where prices were not regulated. Eventually this did happen, but for reasons of bureaucratic quagmire rather than producers' spite.

A fractionalist approach to the environmental state would not consider state action that reduces the value of labor to be environmental. Both directly and indirectly, *Phillips* made the U.S. economy more reliant on natural gas than it might otherwise might have been. However, fractionalist approaches to the environmental state wouldn't look at *Phillips* because it didn't involve branches of the state framed as environmental e.g., agricultural ministries, environmental protection agencies or disaster response administrations (Whitehead et al. 2007, 4). These perspectives don't focus in on the ecological effects of state policies framed primarily as economic, industrial or labor issues. This oversight is a mistake because states use the environment (energy, resources, etc.) to reproduce labor for capital, and in so doing, facilitate

[40] Patterson, H. to D. Eisenhower. February 8, 1956. Folder: 129-D-1 CON (1). Box: 1019. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

consumer demand for fossil fuels and other resources. Although not solely responsible, *Phillips* made the U.S. economy more reliant on natural gas thereby locking the U.S. into higher greenhouse gas emissions (both carbon dioxide from gas combustion and methane from gas infrastructure leakage).

Savings on Constant Capital

Phillips kept prices for natural gas lower, both directly and indirectly, once it was implemented. The FPC assigned their examiner, Joseph Zwerdling, to implement the Supreme Court's decision, which would prove very difficult for the agency. The hearings that Zwerdling held for stakeholders on *Phillips* were 10,000 pages long after transcription (Kohlmeier 1969, 194), and the Commission was understaffed to handle the new workload. Previously, the Commission regulated 157 interstate pipeline companies (Castaneda and Smith 1996, 148). *Phillips* put 4,365 independent gas producers under FPC jurisdiction (Ibid.). One estimate found that the FPC wouldn't be able to complete the new caseload until the year 2043 (Tomain and Cudahy 1992, 206). *Phillips*'s initial impact was a regulatory quagmire for both the state and oil and gas producers, one of whom wrote to President Eisenhower.

> The excessive and unreasonable delays by the Federal Power Commission put upon the small independent gas producer who tries to sell his gas to interstate pipe lines (sic) will put him out of business. A small independent producer with its money invested in properties which are ready to start producing cannot continue to wait months and years for the nod of the Commission to start marketing its gas. It is not regulation - it is suppression. At this very moment much needed fuel is being withheld from consumers who have to wait unreasonably while the wheels of the Commission turn ever so slowly or not at all.[41]

[41] Walton, R. to D. Eisenhower, May 19, 1960. Folder: 129-D 1959-1960. Box: 1018. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

Many independent gas producers began to look for alternate markets for their product while the "wheels of the Commission turned ever so slowly" (Ibid.).

Companies like the Texas Eastern Corporation began to sell gas to *intra*state pipelines that could pay them more because they were unregulated (Castaneda and Pratt 1993, 111). The Supreme Court was indirectly responsible for this change, but it was still responsible because *Phillips* incentivized oil and gas capital to shift into unregulated markets. Impelled by the capitalist profit motive, oil and gas firms were forced by state regulations on interstate trade to seek out more profitable sales within state borders. More profitable opportunities included marketing directly to industries located within the borders of oil- and gas-producing states like Louisiana and Texas. Panhandle Eastern Corporation built a plastics factory that became the world's second largest producer of polyethylene (the most common form of plastic) by 1960 and relied on gas as its petroleum feedstock (Castaneda and Smith 1996, 167). Also, in 1960, National Petro-Chemicals Corp. began producing 300 million pounds of polyethylene per year using natural gas as a main feedstock (Leeston 1963, 161). By incentivizing sales to intrastate pipelines, *Phillips* made a wider fraction of the U.S. industrial sector dependent on gas, particularly in gas-producing states. During hearings on *Phillips*, consumer representatives from the Northeast argued that the South lacked the industrial capacity, and population, necessary to absorb the nation's natural gas supply (Sanders 1981, 121). This was untrue. Prior to *Phillips*, many major industrial users of natural gas had located or originated in gas-producing states like Texas, Louisiana, and Oklahoma.

Without significant amounts of coal or water power, the Gulf Coast was dependent on natural gas as an industrial fuel. By 1950, according to geographer James Parsons, the Gulf Coast's utilization of gas as fuel for industrialization was the most well developed in the nation

(1950, 173). “The future of this vigorous new industrial frontier is vitally dependent on the petroleum industry’s ability to maintain its excellent production and discovery record for these preferred fossil fuels (natural gas and oil)” (Ibid., 177). Forty percent of the natural gas consumed by the U.S. industrial sector was burned in Texas factories, which used access to cheap natural gas to attract business to the state (Herbert 1992, 120). Herbert attributes a 34% increase in industrial employment in Texas between 1950 and 1960 to lower natural gas prices relative to states like Pennsylvania and West Virginia, which experienced declining industrial employment in the same period (Ibid., 102). Immediately following *Phillips*, the Empire Trust Company, a commercial bank, published a brochure exhorting new industries to move to gas-producing states (see Figure 7). The pamphlet showed pictures of newly built ammonia-urea, glass, and chemical plants in Oklahoma (see Figure 8) and explained,

> Producers have huge investments in natural gas reserves, producing wells, gathering lines, and gas treating plants required to deliver gas to pipelines. As a matter of plain common sense, they are loath to commit their unsold gas to the interstate market when the purchasers are powerless to assure the producers the price they will pay, and the producers may not cease delivering the gas without the permission of the Federal Power Commission. Even though a contract price is

> agreed upon, there can be no assurance the Federal Power Commission will not reduce it.[42]

Figure 7: Title of promotional pamphlet from investment bank (Source: Empire Trust Company Newsletter).

Oil and gas capital aggressively expanded markets for natural gas into centers of industry throughout the nation as a means of maximizing profits in an unregulated part of the industry (Vietor 1984, 84). Intrastate sales were one way to avoid regulation while providing a valuable means of production at low prices. In two ways, Phillips made industries more reliant on natural gas. First, by incentivizing industrial consumers to use gas because it was cheaper than it would have been without the decision. And second, by incentivizing gas producers to make direct sales to industries to avoid less-profitable regulated sales. Fractionalist approaches to the environmental state would more likely focus on the state response to industrial accidents of the gas industry or gas-consuming factories. They would miss the environmentally-consequential aspect of this Supreme Court decision i.e., that *Phillips* made it easier for factories to burn natural gas. Although this one decision doesn't explain how the industrial sector in general rose

[42] Empire Trust Company Newsletter, November 30, 1954. Folder: 129-D GAS 1952-1954. Box: 1018. Series: Central Files - General Files. Dwight D. Eisenhower Presidential Library.

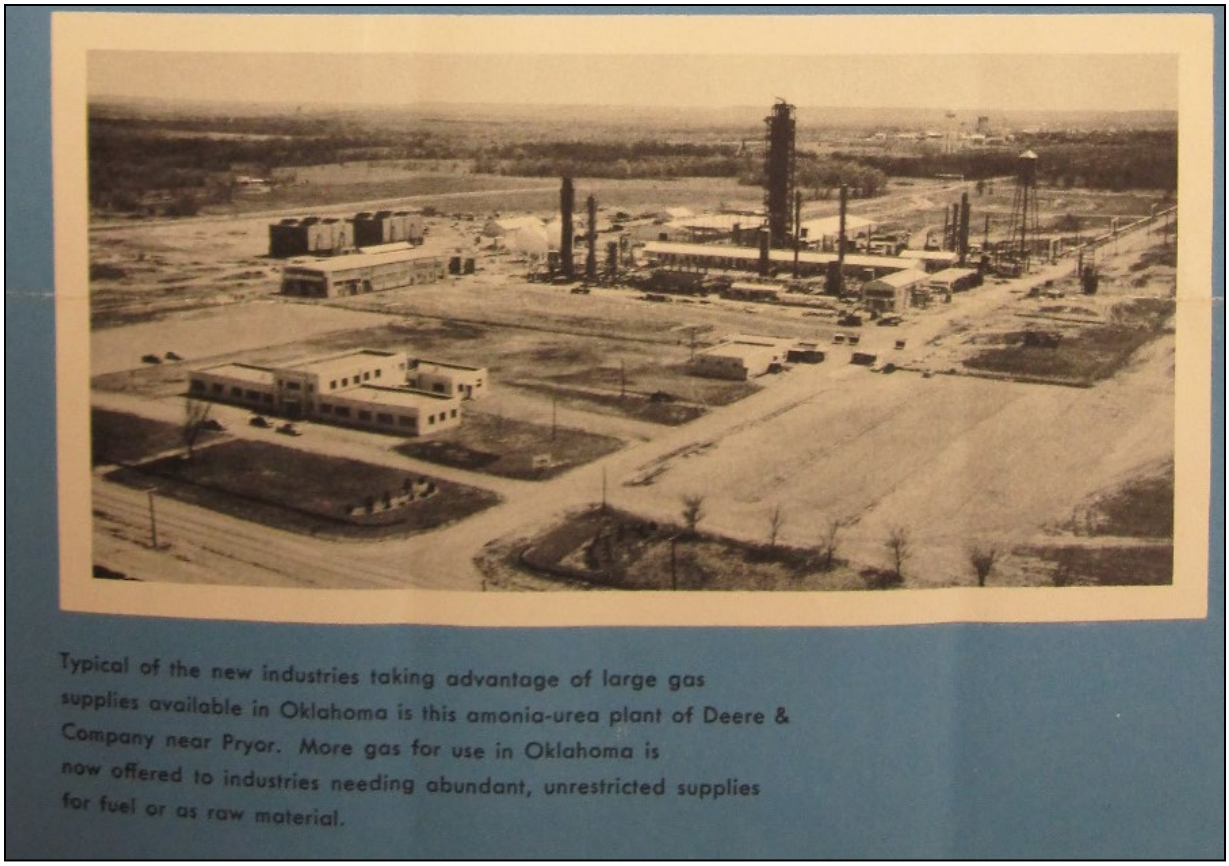

Figure 8: Photo caption: "Typical of the new industries taking advantage of large gas supplies available in Oklahoma is this amonia-urea (sic) plant of Deer & Company near Pryor. More gas for use in Oklahoma is now offered to industries needing abundant, unrestricted supplies for fuel or as a raw material" (Empire Trust Company Newsletter).

to dominate world energy consumption (Huber 2017a, 154), it addresses how state economic policy has tremendous impacts on problems framed as environmental e.g., climate change.

Natural gas companies also were avoiding direct regulation by making a large portion of its sales to industries through *direct* sales. Industries bought large amounts of natural gas "from the field," which meant that they avoided transacting with interstate pipeline companies directly, and these contracts fell outside FPC jurisdiction (Jacobs 1963, 283). The NGA gave the FPC authority to regulate "sales for resale," which did include some industrial sales between utilities and manufacturers but – crucially – did not cover *direct* sales (Davis 1984, 66). Pipeline

companies would transport gas from direct sales to industries through the very same lines as gas that was under price regulation by the FPC (Vietor 1994, 102) (see Figure 9). The difference between regulated and unregulated gas had nothing to do with the material qualities of the gas or its method of distribution and everything to do with legal exceptions to existing regulations. The FPC tried to discourage pipelines' unbundling of transportation services from more all-inclusive gas supply contracts, but with limited success (Tussing and Tippee 1995, 148). The Supreme Court even upheld this distinction between direct sales and sales for resale in *Phillips* (Supreme Court 1954, †14). Ultimately, a modest, semantic inconsistency in legal language resulted in natural gas producers making much higher profits than they otherwise would have by selling directly to industries.[43] Oil and gas capital took advantage of this loophole by aggressively marketing gas to the industrial fraction of capital, making capital in this fraction more dependent on gas than it otherwise would have without *Phillips*.

[43] It's difficult to excavate historical rates of profit from thousands of integrated and independent natural gas producers; however, we know a general level below which profits would not have dipped. Officially, the FPC only allowed firms to make a maximum of 6.5% return on their investments in regulated trade (Castaneda and Smith 1996, 164), but in practice the FPC allowed rates of return on gas sales "considerably above" 9% (Eckstein 1958, 134), reaching 13% as late as 1970 (Davis 1984, 80), on the eve of severe gas shortages and supply curtailments. Therefore, logic would dictate that profits through direct sales would have met or exceeded these rates of profit when considering industries' consistently high demand throughout the year; otherwise, industrial sales wouldn't have been so attractive to gas producers.

Gas suppliers justified direct sales as a benefit to residential customers, specifically to cover the costs of maintaining compressor stations and other infrastructural equipment during periods of low residential demand (like warm summers) when space heating was unnecessary. The industry legitimized direct sales by saying that pipelines operated with increasing efficiency – thereby providing cheaper prices to consumers – when they ran at volume capacities closer to 100%.[44] The FPC's own audits found that the cost savings of delivering gas peaked at 60% of capacity utilization (Herbert 1992, 120) and that further volumes over the 60% mark had no effect on cost savings. As the FPC's audits show, the argument that gas producers were selling

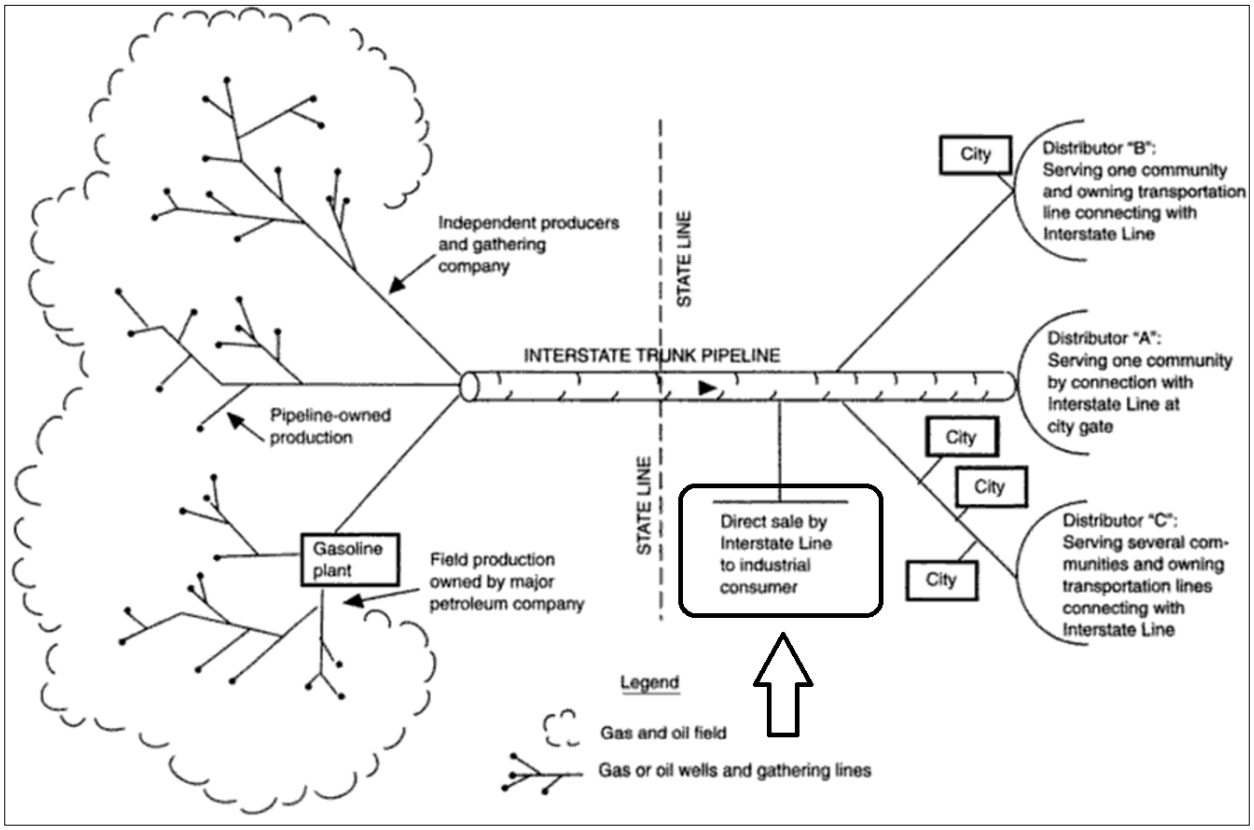

Figure 9: Diagram of the traditional gas industry structure. Arrow points out direct sales to industry. Adapted by the author from Vietor 1994, 102.

[44] The official industry term for this metric is "load factor," which is less intuitive than a term like volume or capacity, which this term is basically describing. Regardless, load factor is the relationship between the average day's delivery of gas and the maximum day's delivery of gas over an annual period (Peebles 1980, 71-2).

direct to industrial consumers because it lowered prices for all consumers was false. They were making direct sales to avoid regulated transactions that limited the profit rate.

Phillips incentivized gas producers to make intrastate sales to industries in states like Texas and Louisiana but it also incentive producers to increase direct sales to industrial consumers all over the country. Ten years after *Phillips,* direct sales had made gas a popular fuel with industries across the country. United Gas, the world's largest "handler" of gas, provided fuel to manufacturers in the Gulf region for producing cement, bricks and tile, lime and other chemicals, oil (refining), paper, sugar, rubber, etc. (Leeston 1963, 129). Southern Natural Gas and Texas Gas Transmission grew alongside the petrochemical industry in the Gulf region, supplying this sector as it experienced explosive growth following WWII (Ibid.). Arkansas Louisiana Gas took a leading role in attracting industry to Arkansas by offering natural gas at lower cost than anywhere else in the country (Ibid.). American Natural Gas served Detroit and Milwaukee, using pipelines built in the late 1940s and early 1950s and shipping gas from Texas, Oklahoma, Kansas, and Louisiana (Ibid.). Columbia served gas to 2,500 industrial customers spread over Ohio, Pennsylvania, Kentucky, New York, West Virginia, Virginia, and Maryland (Ibid., 135). Tennessee Gas Transmission sent gas from Texas and Louisiana to industrial areas in Chicago and Gary, Indiana. Transcontinental Gas fueled the "rapidly industrializing" Carolinas, North Georgia, and major cities of the Eastern seaboard (Ibid., 158). Panhandle Eastern supplied gas to the U.S. industrial heartland in Ohio, Indiana, Illinois, and Michigan for "metallurgical, ceramic and chemical uses" (Ibid., 162).

A fractionalist approach to the environmental state wouldn't see how *Phillips*'s incentivizing the gas industry to sell fuel to industries was necessarily environmental. However, by reducing the cost of constant capital through gas law, the state locked industrial capital into a

high pattern of consumption of this fossil fuel, which – when burned – causes climate change. The industrial sector is disproportionately responsible for climate change through its energy consumption (Huber 2017a, 154), and the petrochemical and plastic industries, which are highly gas dependent, are concentrated within oil- and gas-producing states like Oklahoma, Texas and Louisiana. None of these critical industrial-environmental relations are explained through a fractional approach to the environmental state that would view *Phillips*'s impact more as a question of economics and industrial location than an ecological one.

Conclusion

Phillips made the U.S. economy more reliant on natural gas than it might otherwise have been, therefore, *Phillips* was an ecologically-significant government action that was not framed as primarily environmental. If I had employed a fractionalist approach to the environmental state, I would have missed how the Supreme Court allowed industries to become dependent on natural gas. Political ecologists of the state leave aside the ecological aspects of environmental or energy policies that are aimed at strictly economic or industrial concerns. Fractionalist approaches to the environmental state wouldn't pay attention to *Phillips* because it didn't involve agencies framed as dealing with environmental issues like food safety, pollution abatement or natural disaster response. Although not solely responsible, *Phillips* made the U.S. economy more reliant on natural gas thereby locking the U.S. into higher greenhouse gas emissions in the decades that followed. *Phillips* incentivized industrial consumers to use gas because it was cheaper than it would have been without the decision and incentivized gas producers to make direct sales to industries to avoid less-profitable regulated sales. Therefore, *Phillips* made it easier for factories to burn natural gas and the decision (partially) explains how the industrial sector came to dominate world energy consumption (Huber 2017a, 154). Policies framed in terms of industrial

or employment issues need to be recognized as the practices of the environmental state even though they are not conducted by departments of agriculture, parks or disaster response.

Wainwright and Mann (2015) have pointed out the critical role for states in hastening a transition away from natural gas and other fossil fuels to slow global climate change. Jobs – the lifeline of survival for most under capitalism – are tied to the burning of fossil fuels, including fracked natural gas. State rulings like *Phillips* facilitated the binding together of employment, industrialization, and fossil fuels, all while maintaining the profitability of oil and gas producers. Resistance movements like fossil fuel divestment campaigns and the activist-journalist Naomi Klein espouse voluntarily starving oil and gas capital of investment and state-sponsored retraining programs for fossil fuel workers. However, the connections between employment and fossil fuel burning touch many more workers than just oil and gas workers and affect profits for many more corporations than just ExxonMobil. Policies framed in terms of industrial or employment issues need to be recognized as the practices of the environmental state. Despite the fact that they are not conducted by departments of agriculture, parks or disaster response, state economic policies carry enormous environmental consequences that demand a critical gaze.

Fossil fuels are an essential component of how much of the U.S. population reproduces daily lives, e.g., getting themselves from their suburban homes to their workplaces (cf. Huber 2013a). Fossil fuels also constitute the *means of production*, which combined with labor power, make much, if not most, commodity production possible in the first place. Without a steady supply of this essential means of production, capitalists find no use for hiring workers in the first place. Stopping climate change should entail a referendum on more than the types of energy used and the fate of workers involved in producing them. Fossil energy is a constitutive ecological condition for the current constellation of power between capital and labor in modern capitalism.

Some suggest that saving the planet demands a mobilization of state power that rivals the "total war" conditions of the U.S. during WWII (Malm 2016, 385). If that were to take place, a necessary condition of solving climate change would include a renegotiation of social class relations. Working class survival must be made less dependent on capital's twin demands for the free market availability of labor power and fossil fuel energy. Because states will continue to play a crucial part in producing availability of those resources, socialists should be advocating for state policies that delink survival of the masses of people from their position as workers in the formal, waged economy.

Chapter 4

The "Laborless Fuel": Coal, Natural Gas, And the Capitalist State in Energy Transitions

Introduction

In the 2016 presidential campaign, Donald Trump repeatedly promised to revive the coal industry, a promise that he has reiterated since assuming the presidency. Trump's overt support of coal miners was symbolic of his attempt (however disingenuous) to rebrand the Republican Party as the "party of the American worker" (Pager 2017). Over the last three to four decades, the U.S. working class has seen its government services and benefits cut, jobs automated, and wages slashed (Roberts 2016). In areas like Appalachia that have been hard hit by (the continuing) decline of coal employment, spurred by competition from fracked natural gas, there has been resistance to energy transitions (ETs) that would decarbonize the economy, unless such a transition provided new and better opportunities for employment (Healy and Barry 2017, 455).[45]

Environmental and labor struggles are frequently at odds (White 1995), which is unfortunate given the opportunities presented by a socially "just" ET. While the International Federation of Chemical, Energy, Mine and General Workers' Union has supported a just ET (Podobnik 2006, 166), the AFL-CIO rejected the Kyoto Treaty, and unions supported the Dakota Access pipeline (Medina 2016). The issues of climate change and inequality could be solved through a decarbonization of energy systems, where workers doing the decarbonization received high wages and good benefits and many more workers were employed (Barca 2016). There are plenty of factors that militate against this outcome, least of which is AFL-CIO opposition to

[45] From 2010 to 2016, coal-fired electricity fell from 45% to 30% of utility-scale generation compared to natural gas-fired generation, which increased from 24% to 34% (Boersma and Jordaan 2017, 2). This change occurred in response to the flooding of cheap natural gas from fracking into markets served previously by coal.

environmental controls on fossil fuels (Sweeney 2013). However, labor is not united in this opposition.

Unions have advocated for greening the economy (Snell and Fairbrother 2013) through a government-sponsored "green New Deal" (Sweeney 2013, 210). Currently, countries with cheap labor (e.g., China) shoulder the burden of producing renewable energy technologies (solar panels, wind turbines, etc.) for the rest of the world. Podobnik (2006, 164) anticipated that if market forces alone would decide the course of the next ET, this is exactly what would occur. Currently, cheap solar panels flood the world market from the backs and hands of exploited factory workers in Korea, Singapore, and Thailand (Residential Solar 2015). By incentivizing domestic production, states could use climate change mitigation as an opportunity to create good-paying jobs in the U.S. while promoting clean energy. Increasingly, this opportunity is looking more like a political imperative in U.S. communities dragged down by 40 years of neoliberal austerity, income stagnation, and job loss (Das 2017a, 2).

A decarbonized energy system would still have its sacrifice zones in places where rare earths for solar panels are mined (Bonds and Downey 2012) and in polluted industrial sites where the panels are manufactured (Mulvaney 2013). Decarbonization also would require "deliberate destabilization and decline of fossil fuel-based industries" that may not lead to the types of progressive change that many on the left would prefer (Turnheim and Geels 2012, 36). In the U.K. in the 1980s, for example, the transition from coal to natural gas from the North Sea was made possible by Margaret Thatcher's repression of the coal miners' unions, which were a vanguard of left politics since WWI (Ibid.).

Much of the scholarship on revolutionizing energy systems has tended to focus on the politics of the present (Avelino et al. 2016; Meadowcroft 2009; Scrase and Smith 2009; Shove

and Walker 2007) rather than examine the politics of historical ETs (although see Paul 2018). ET literatures are better at explaining labor and environmental politics than analyzing the role of the capitalist state. For example, as I show in a subsequent section of this chapter, state policy on natural gas allowed oil and gas capital in the Sunbelt to finance a distinctly anti-union, pro-free market political platform. Gas policy also contributed to the downfall of a vanguard of the U.S. left: The United Mine Workers of America (UMWA) in the postwar period. Today, the UMWA is "barely more than a pension administration for retired miners and their families" (Yeselson 2017), but at its peak in the mid-20th century, it was a bastion of working-class power (Podobnik 2006). According to the historian Daniel Yergin (1978, 34), coal represented "old forms of social conflict that most everybody wanted to forget." The struggles that Yergin would have us forget won coal miners a more "egalitarian collective life" (Mitchell 2011, 236). As I show in the following case, U.S. gas policy that encroached on coal markets was a deliberate strategy by the capitalist state to "rein in the power of organized labor" by diversifying away from "reliance on strike-prone coal sectors and toward oil sectors, where it was perceived that labor could be more easily controlled" (Podobnik 2006, 91).

As some have pointed out, the decline of working-class power is attributable to more than the coal-oil and gas transition (Huber 2015, 488). Indeed, it's even inaccurate to say that the U.S. *ever* transitioned away from coal when the shift was more sectoral: from coal-powered transportation (trains, ships) to oil-fueled internal combustion engines (in cars, trucks, planes, and ships) (Huber 2013a, 176). However, increasing oil and gas production did provide some of the wealth, and a crucial political arena, for wider political shifts that Huber mentions. As I show, natural gas production enriched anti-union capital in the Sunbelt, and waves of coal miners' strikes motivated capital and the state to seek out alternatives to coal. The skill level

required of miners gave them more power than other workers (Podobnik 2006, 40-1), but coal itself – or its physical properties (Mitchell 2011) – was not the basis for coal miners' militancy. Mitchell's argument (2011) mirrors the new materialists, who argue that inanimate objects have agency in addition to human beings (Malm 2018, 111). As Labban (2013, 15) points out, what connected the power of labor from mines, through canals and railways, was the *class consciousness* that united isolated struggles into a wider struggle by labor against capital. Coal itself doesn't *do* anything. The lives of working people were improved by miners who went on strike and refused to dig up coal for capitalists unless their demands were met.

Mitchell, and most others, also omits natural gas's role in replacing and supplementing coal. This omission stems from a wider problem in energy literatures, where fossil fuels, their sectoral usage (electricity generation, transportation, heat processing in production, social reproduction), and their substitutability are conflated (again, see Huber 2013a, 176). For example, Jones (2016) points out that energy studies are overly fixated on oil to the detriment of coal. The same fixation leaves out natural gas, misrepresenting its importance as a natural resource. Oil, coal, and natural gas have different physical properties, which don't determine how or why they get used but do make them differently suited for transportation, heating, electricity generation, and industrial manufacturing.

The threat that coal miners posed to capital is testimony of the specifically *class* politics that coal miners practiced so effectively. Like the broader demonization of unions as monopolies and the rise of neoliberalism (Huber 2013a), the coal to oil and gas transition was a *class project* that contributed to the weakening of working-class power and contributed some funding to the postwar flowering of neoliberal thought. Other scholars working on energy in the Marxian tradition have examined the links between social class and fossil fuels (Huber 2013a; Deutz

2014; Deutz and Ioppolo 2015; Malm 2016), but few have focused on the capitalist state specifically.

In this chapter, I show how gas policy contributed to weakening the power of the UMWA in the mid-20th century. In making my argument, I also explain why it would be a mistake to expect a capitalist state to destabilize class relations through an ET. I make this case using historical materials from the archival records of the United Mine Workers of America located in the Pennsylvania State University library's special collection. First, I review literatures on ETs, pointing out how Marxian state theory can contribute to this growing body of research. Second, I explain how wealth generated through the transition from coal to natural gas and oil in the mid-20th century was used to finance anti-union, neoliberal politics that emerged from the Sunbelt. Finally, I turn to the effects of natural gas replacing coal as experienced by coal miners, which I explain in the context of capital and the state's goals for reducing organized labor's power over the economy's operation.

Energy Transitions, Politics and The Capitalist State

ETs are changes in the "composition (structure) of primary energy supply, the gradual shift from a specific pattern of energy provision to a new state of an energy system" (Smil 2010a, vii). Geographers have analyzed ET governance (Calvert 2016; Butler and Parkhill 2017; Hiteva 2017; Kirshner 2017), the social justice of ETs (Baker et al. 2014; Bouzarovski et al. 2017; Fuller 2017), technological path dependency and "lock-in" hindering ETs (Fry 2013, 130), and urban ETs (Bulkeley et al. 2011; Jaglin and Verdeil 2017). Geographic analysis shows how ETs occur in places (Calvert et al. 2017; Darby 2017) within political-economic regions (Coutard and Rutherford 2010; Truffer and Coenen 2012) and develop unevenly across space (Lawhon and

Murphy 2011; Bridge et al. 2013; Becker et al. 2016).[46] Recent studies of ETs focus on the anticipated "green" ET: from fossil fuels to renewable energy sources (Avelino and Wittmayer 2016; Swilling et al. 2016).

For the moment, fossil fuels provide more than 86% of global energy (IEA 2018a), 90% of U.S. energy (U.S. EIA 2018a), 87% of E.U. energy (EC 2018), and 75% of China's energy (IEA 2018b). It would cost trillions of dollars to make the world's economies carbon-emissions free (Smil 2010a, 142), a level of investment unprecedented during peacetime. All fossil fuel electricity generation would have to be replaced, some say with a mix of renewables and nuclear (MacKay 2008, 157-176). Once new emissions have ceased, accumulated carbon dioxide would have to be removed from the atmosphere to cancel its warming effect (Kolbert 2017; Parenti 2017). Auto-centric transportation systems, which run almost entirely on oil, would have to be replaced with electric cars, mass transit, and nuclear-powered ships (MacKay 2009, 118-139).[47] Streams of research funding would have to be made available at levels as high as those that led to major technological breakthroughs like computers, the internet, and GPS (Mazzucato 2013). The only entity with the accepted legitimacy and organizational capacity to redistribute power and resources on this scale is the state (Parenti 2015b).

ET scholars already focus on the state's role (Juisto 2009; Calvert and Şimandan 2010; Turnheim and Geels 2012; Newell and Mulvaney 2013; Curtin 2015; Betsill and Stevis 2016; Broto 2016; Bayulgen and Ladewig 2017; Lockwood et al. 2017; Sovacool 2017). Even analyses leaning heavily on price incentives and innovation maintain that governments play a key role in

[46] Lawhon and Murphy frame their work as "socio-technical transition" studies. I consider an energy transition one type of socio-technical transition. In a green ET, the technologies used for electrical generation, transportation, etc., will have to decarbonize. It's less clear whether the social relations of energy will transform along with the technologies. For example, whether a green ET will transform private, for-profit utilities into democratically controlled public utilities is an open question.

[47] It's unclear how jet engines and modern aviation would survive in a decarbonized world.

creating new, "niche" markets for renewable energy sources (Fouquet 2010, 6593). As Shear (2014) and McCarthy (2015) point out, there are no guarantees that state ET policies would be socially just. For example, Cederlöf (2015) explains how state electrification programs were designed primarily to end peasant-serf and landlord-tenant relationships in the rural U.S. South, Soviet Union, India, China, and Cuba to create an urban proletariat. Many on the left favor state policies that shut down fossil fuel infrastructure (Carton 2017) while protecting jobs (Araújo 2014) and assisting disadvantaged and historically marginalized populations (Baker et al. 2014). On the other hand, libertarians of the "Green Tea Party" favor eliminating publicly regulated electrical utilities altogether and reverting to individualized energy systems, e.g., rooftop solar (Aronoff 2017). Many have adopted a political economy approach to understand the political forces acting on state ET policy (Podobnik 2002; Goldthau and Sovacool 2012; Baker et al. 2014; Cock 2014; Smits 2015; Kern and Markard 2016; Arent et al. 2017).

Absent from these literatures, however, is any explicit discussion of the capitalist state's role in energy transitions, the politics of which depend on the politics of the state itself. Capitalist states manage state functions in the service of capital (Poulantzas 1975, 187). States will, under unusual situations, grant concessions to the working class, but for reasons that ultimately serve the interests of the capitalist class, like expansion of markets for goods and services (Das 2017a, 398). One function of the capitalist state is to provide general material conditions for production (Altvater 1978, 42), e.g., climate change mitigation (Das 2017a, 394). If climate change poses enough of a threat to capital, it's possible the capitalist state will facilitate an ET away from fossil fuels (Mann and Wainwright 2018). However, there's no guarantee that such a transition will be *socially just* in the sense that it would leave most people better off.

For example, most people in the U.S. are working class. Kim Moody calculates that the overwhelming majority – 75% – of the U.S. population are either workers themselves, non-working spouses and dependents, or are unemployed folks in the reserve army of labor (2017, 41). All class societies contain a working class that is exploited and a non-working class of exploiters: slaves and masters in slavery, serfs and lords under feudalism, and the proletariat and bourgeoisie under capitalism (Poulantzas 1975, 22). Under capitalism, the proletariat – most of society – produces all the goods and services that the whole society needs, and a capitalist minority controls this production (Das 2017a, 213). Despite capitalists controlling major decisions within the work process (Wright 1978, 73), the working class struggles against their control (Wood 1986, 12), leading to a foundational antagonism within capitalism.

The capitalist state maintains order by moderating conflicts that threaten to consume society, which spring from "irreconcilable antagonisms which it is powerless to exorcise" (Engels 1884, 208). Class societies like capitalism would not be class societies without hostility between the two major classes: workers and capitalists. "The separate individuals form a class only insofar as they have to carry on a common battle against another class; otherwise they are on hostile terms with each other as competitors" (Marx and Engels 1846, 82). Without an opposing enemy to be hostile towards, the boundaries around classes disappear. A society where only one class existed would be a classless society (Ollman 1971, 121). This antagonism emerges through the social division of labor (Wright 1978, 60), wherein the bourgeoisie seizes control of the technical and social apparatuses of production (Marx 1885b, 55).

Under capitalism, the bourgeoisie have ownership over "the means of existence in the broadest sense of the word" (Engels 1845, 376). They can afford to wait out striking workers, who will starve without work (Das 2017a, 256). Coercion isn't necessary when workers are

forced by the "dull compulsion of economic relations" to come to work each day (Marx 1867a, 737). They can either accept the conditions of capitalist work or perish – not much of a choice really. The means of existence include the means of production, e.g., machinery, factories, and raw materials, and the means of consumption, e.g., food, shelter, and clothing (Das 2017a, 219). The bourgeoisie manages the means of production with an intent to extract as much labor out of the proletariat as it can in a working day (Wright 1978, 67). This imperative explains the tremendous productivity gains made since the 1980s, as capitalists filled the "pores" (small pauses) in workdays with more work (Moody 2017, 15). By controlling the means of production, capitalists can force proletarians to produce a surplus of goods and services which they also own and control (Poulantzas 1975, 19). The divorce of workers from the means of the protection through the process of primitive accumulation (Marx 1867a, 714) was anything but natural (Ibid., 273). It was produced through *state laws* against game hunting, enclosure of common lands, and brutal repression, organized and perpetrated by what would become the capitalist state (Perelman 2000).

The capitalist state tries to maintain social order despite antagonist class relations under capitalism, which are caused by capitalist control over the means of production. Under capitalism, energy is a critical means of production, so unless the capitalist state is pushed by the working class to create policies for a just ET, it will continue serving capital and the capitalist class first and foremost. I base this claim on the following case study of how the U.S. capitalist state used gas policy to limit the power of a fraction of the proletariat (organized coal miners) over the means of production.

The Rise of The Sunbelt and Anti-Union Politics

The Sunbelt's rise is one aspect of the broader historical ET from coal to oil and natural gas. One rough timeline dates the age of coal from 1800 to the 1910s and the age of petroleum and natural gas from 1880 to the present (Burke 2009, 45-7). As Smits points out (2015, 182), the weaknesses of ETs as a conceptual tool start to show when scholars (like Burke) begin applying strict date ranges around complex energy systems, which evade such easy categorization. Even in countries with access to plentiful oil and natural gas, coal's decline was always relative to the dramatic rise of oil and gas (Kern and Markard 2016), as these new energy resources supplemented, rather than replacing coal outright (Juisto 2009). Plentiful coal allowed countries such as the U.S. and U.K. to fuel their rapid industrial growth in the 19th century until alternatives like oil, natural gas, hydroelectricity, and nuclear power arose (Healey 2015; Turnheim and Geels 2012). Even today, coal remains an essential input in the generation of

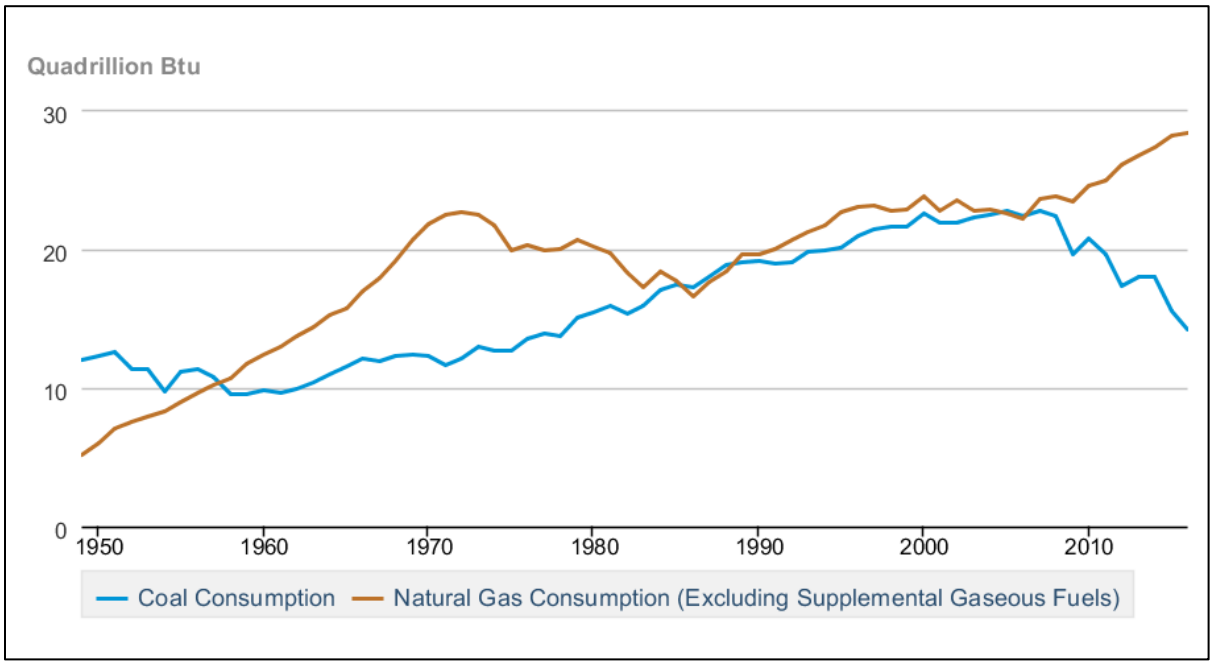

Figure 10: Primary energy consumption by source (U.S. EIA 2017b)

electricity and production of ferrous metals. Regardless, the overall trend in the historical trajectory of the global energy mix is that coal lost ground to oil and natural gas over the course of the 20th century.

Coal's dominance of energy markets began to erode with the development of the internal combustion engine, which made gasoline a competing transportation fuel (Podobnik 2006, 49) and the more gradual elimination of coal as a household fuel (Landsberg and Schurr 1968). When gasoline and fuel oil replaced kerosene as the main products of refined petroleum in the 1910s, they brought new competition to manufacturing and maritime fuels markets previously served by coal (Ibid., 39). By 1944, U.S. coal deliveries peaked (Ibid., 37), and it was clear that oil companies had surpassed coal in the fuel markets for shipping, aviation, and automobile transportation (Podobnik 2006, 49). Between the mid-1930s and the mid-1960s, natural gas overtook coal in markets for residential and commercial heating, industrial manufacturing, and electricity generation (Landsberg and Schurr 1968, 48). Following World War II, the share of U.S. energy coming from natural gas nearly doubled from 17% in 1950 to 32% in 1970 (U.S. EIA 2017b, 5), overtaking coal's share in 1958 (Ibid.). Following shortages during the 1970s, natural gas and coal contributed stable shares of the U.S. energy supply until 2009, when fracking allowed natural gas to regain market dominance (see Figure 10). The rise in wealth and influence of the oil- and gas-rich Sunbelt and the relative decline of the coal-rich Appalachian and Midwestern "Rustbelt" are partially attributable to this historical ET.

In the mid-20th century U.S., coal was the dominant fuel in the older, industrial U.S. centered in the Appalachians, while major oil and gas fields were located in the Southcentral U.S. and in California (Landsberg and Schurr 1968).[48] Undoubtedly, the Sunbelt's low taxes and

[48] Energy historians will note that the first oil fields in the U.S. were located in Pennsylvania (Black 2000), but production from these fields was overtaken by discoveries in Southcentral U.S. beginning in the early-20th century.

hostility to labor unions (Heil 1978; Markusen 1978; Davis 1986; Peck 2016), and also unions' failure to take root there (Ferguson and Rogers 1986), were critical to this region's growth in the postwar period. Indeed, the rising level of working-class militance and union organization in the Rustbelt provided a potent incentive for a spatial fix in the mid-20th century (Smith and Dennis 1987, 164). Additional energy policies, e.g., direct subsidies paid to oil and gas companies, rural electrification, and cheap air conditioning also allowed the Sunbelt to grow as Rustbelt economies declined (Thomas 2014). However, oil and natural gas were one of the "pillars" of post-World War II growth that contributed directly to the Sunbelt's growth and economic success (Nickerson and Dochuk 2011). The continuous, strong demand for oil and natural gas through the 1950s and 1960s brought great wealth and influence to sectors of capital based in the Sunbelt (Schulman 1994, 219). Plentiful oil and gas along the Texas Gulf Coast became the raw materials and energy supplies for petrochemical factories, and also provided the fuel necessary to transport products to market (Feagin 1988, 66). Oil and natural gas were a significant part of the "cowboy" economy based on agribusiness, defense, advanced technology, oil and natural gas, real estate, construction, tourism, and leisure (Lash and Urry 1987, 123). While demand was increasing for the products of the Southern Rim like oil, natural gas, aluminum, and titanium, the need for Rustbelt coal, steel, and iron was stagnant or declining (Sale 1975, 19). This demand was facilitated through state regulation that increased Rustbelt consumers' access to Sunbelt resources like natural gas (see Chapter 3).

The U.S. Army cooperated with private companies to build two long-distance, large-diameter pipelines between the Sunbelt and Rustbelt industries to produce supplies for fighting WWII (Castaneda 1993). In 1947, the War Assets Administration (WAA) sold them to Texas Eastern Corporation, which used them to introduce natural gas into markets previously served by

coal in the Rustbelt (Ibid., 92). The federal government's regulatory apparatuses for overseeing natural gas availability, conservation, and price (including the PUHCA and the NGA discussed in previous chapters) also spurred demand for gas in the suburbs that were growing around the nation (Podobnik 2006, 101). On the eve of the passage of the PUHCA, Senator Everett Dirksen (R-Ill.) warned that coal and utility industries were to be "sacrificed upon the alter of the welfare of a State like Texas, which is only too anxious to reap the profits that would accrue from the distribution of billions of cubic feet of natural gas" (Sanders 1981, 38).

The cheap price of natural gas made possible through regulation also was responsible for the relocation and new growth of industrial production in the Sunbelt (Markusen 1978, 51). The regional differences that emerged were not the direct aim of these policies but were incidental to the needs of capital accumulation at various points (Ibid., 53). Despite repeated petitions by coal companies, coal miners' unions, and railroads, and despite their own recognition that natural gas could compete favorably with coal (Castaneda 1999, 128), the FPC declined to intervene in inter-fuel competition on coal's behalf (Castaneda 1993, 55). Coal workers' unions unsuccessfully lobbied Congress to discourage sales of natural gas to industries that were a key market for coal (Sanders 1981, 122). As I discuss below, these policies weakened coal producers' power in Appalachia but also strengthened the political influence of anti-union, low-tax Sunbelt capitalists by enriching the oil and gas sector.

The types of "anti-state" politics developed in the postwar Sunbelt, which was (ironically) economically dependent on defense contracts and natural gas regulation (Markusen et al. 1991), reflected the ideology of a class of prospering entrepreneurs in the western Sunbelt who "detested" the liberal elite running the country (Fraser 2016, 106). Excepting the military arm of the state and defense contracts, this polity wanted to limit the liberal state in economic

matters (McGirr 2001). They found their opportunity by the mid-1960s, as the Rustbelt ruling elite were under assault by inflation and the relative weakening of their economic base in heavy manufacturing (Henwood 2016, 277). Natural gas companies like Texas Eastern, Tenneco, and Transco were locally financed, which made the success of Sunbelt cities like Houston independent from control by Rustbelt power centers (Feagin 1988, 68). The surge in conservative politics was funded by a relatively young Sunbelt bourgeoisie, including people like William F. Buckley Sr., who funded his son's *National Review* magazine with money made in the oil business (Henwood 2016, 276).[49]

Texan entrepreneurs Harry and Dick Bass used wealth they inherited from their father's natural gas business to create a Dallas-based political network for Republican businessmen "eager to defend capitalism, champion the rights of management, and attack labor unions" (Miller 2015, 40). They drew together Houston's business elite that included Herman and George Brown, the founders of Texas Eastern, and Hugh R. Cullen, oil entrepreneur and founder of the Liberty Lobby, an anti-communist NGO based in Washington (Feagin 1988, 129). Amidst cries of corruption and bribery, Cullen flew segregationist Strom Thurmond to the white supremacist National States' Rights Party convention in Houston on a private plane (Crespino 2011, 58), where he spoke out in favor of racial segregation and right-to-work labor laws (Robin 2011, 250 §18).

Another Sunbelt entrepreneur, H.B. Earhart, created a foundation in his name that funneled money made in oil to free-market economists like Milton Friedman, Ronald Coase, Gary Becker, and James Buchanan in the form of grants and fellowships with his organization (Phillips-Fein 2009, 46). Between the mid-1960s and 2008, every U.S. president hailed from a

[49] Mitchell (2011) also points out how oil and gas wealth funded the rise of conservative political movements in the Middle East (p.226) and Europe (p.237) following World War II.

Sunbelt state, and right-to-work laws and tax cuts for the wealthy became commonplace (Schulman and Zelizer 2008, 6). The wealth and power that accrued to Sunbelt capitalists in the postwar period was used to finance a specifically anti-union, pro-business politics. The transition from coal to oil and gas also undermined one of the strongholds of organized labor in the Rustbelt: coal mine workers.

Natural Gas Competes for Markets with Coal And The UMWA's Labor

Before natural gas overtook coal's share of the U.S. energy supply in 1958, the UMWA knew their industry was at risk from federal regulation disincentivizing coal consumption. When the Rural Electrification Administration made federal subsidies available for Americans to buy millions of new gas ranges, no subsidies were offered for automatic coal stokers (Clark 1987, 287). Energy sources were largely substitutable (Landsberg and Schurr 1968, 180), so regulation that kept natural gas prices low had an enormous impact on consumer decisions over what type of fuel to burn (Ibid., 148), and markets for coal weakened because of rising competition from substitute fuels (Nyden 2010, 177). In a report on inter-fuel competition, the FPC concluded that the essential advantage of gas over coal was "its cheapness" (Olds and Draper 1948, 55). A UMWA planning document outlining "the future of coal" blamed the "use of natural gas" for taking "markets previously served by the coal industry."[50]

> The losses sustained by coal from natural gas competitions are extremely large. The fact is that natural gas is cheaper in many market areas on a heat equivalent basis than either coal or oil. … The maintenance of such low delivered prices has built up the demand for gas at a rapid rate, which of course will mean a much earlier exhaustion of the supply than would be the case if gas sold at competitive level. The policy of the United States, therefore, should be to take such steps as would bring the delivered prices of gas up to levels where it would compete on a fair basis with the price of coal and of oil (Ibid.).

[50] UMWA. 1952. Coal: Future of Coal. General Files of the UMWA Journal Office. Box 5. Folder 46. The Pennsylvania State University Special Collections.

Some say that the coal-natural gas transition occurred in response to urban air quality concerns (Melosi 2001), but *price* was just as important, and was even the "principal criterion" for fuel choice by utilities and other consumers (Landsberg and Schurr 1968, 149). Even coal companies realized that it was cheaper to transport natural gas by pipeline than to haul coal by rail, but natural gas had other advantages when it came to production costs.[51]

FPC commissioners concluded that it was the "small amount of labor involved in its production, transportation and distribution" that made gas the "strongest competitor for any business that it wants" (Olds and Draper 1948, 295). The cost of oil and gas labor totaled only 10% of production costs, while mining labor represented over 70% of coal's final cost (Podobnik 2006, 48). Union representatives referred to gas as a "laborless fuel" which was threatening coal miners' jobs with "each new natural gas hookup" (Clark 1987, 280).[52] In protesting a utility's decision to switch from coal to gas, Dr. Walter Polakov, director of the UMWA engineering department, warned that payroll losses by miners, railroad workers, and truck drivers would total $1,520,000.[53]

> In so doing [using natural gas in place of coal] we throw out of work hundreds – and if the trend increases – thousands of workers in the gas industry, in the coal mining industry, on the railroads, and in trucking. This proposed substitution would have the effect of stopping the use of more than 300,000 tons of coal. It would throw out of employment nearly 300 men in the local gas [coal gas] works. It would render 400 miners idle who are now engaged in producing this amount of coal. It would cause the layoff of 415 railroad employes (sic) who are transporting this coal to St. Louis. It will lead indirectly to unemployment for approximately 300 other workers all having to do in some form or other with all these operations. This means a total of nearly 1,400 men and a total annual payroll of some $1,520,000. (Ibid.)

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[51] UMWA. 1953. Coal: Future of Coal: Pursglove Speech. General Files of the UMWA Journal Office. Box 5. Folder 45. The Pennsylvania State University Special Collections.
[52] UMWA. 1957. Natural Gas Fight Starts On 'Hill': Staggers Ask Amendments to Control Direct Sales, Prohibit Unfair Dumping of Gas in Coal's Market. United Mine Workers Journal 68 (10): 5. UMWA. 1965. Thomas scolds school officials for using high cost gas heat. United Mine Workers Journal 76 (13): 14.
[53] UMWA. 1939. District 50 Campaigns Against Natural Gas. United Mine Workers Journal 50 (1): 15.

UMWA officials and politicians from Pennsylvania testified that if natural gas entered the eastern fuel markets, it would destroy thousands of jobs in their state.[54] Coal miners' union representatives were ignored by energy regulators, and as an influential fraction of labor, their losses through the natural gas transition were a loss to organized labor in general. By prioritizing cost and efficiency over employment, the FPC set a precedent of energy policy that weakened the power of labor while strengthening capital's grip over the energy supply.

John P. Busarello, of UMWA district five, wrote a letter to Pennsylvania's governor asking, "in the name of humanity," for Harrisburg to resist natural gas's intrusion into the state.[55]

> Any project that will result in the elimination of the use of coal for consumption will be to the detriment of every citizen of the state of Pennsylvania. In the name of humanity use your good offices to protect the miners' jobs and to stop this dastardly move on the part of selfish interests whose only purpose is to feather their own nests at the expense of the coal operators and miners. The miners want no relief – they want work. The gasification of homes and industries will produce hardships, poverty and even starvation. (Ibid.)

In speeches and editorials, union officials referred to natural gas sales to industries and electrical utilities as fuel "dumping" that wasted a relatively scarce resource compared to coal (Landsberg and Schurr 1968, 149) and threatened "one of the Nation's great industries" (see Figure 11).[56] UMWA director of research and marketing, Michael Widman, spoke out against fuel dumping in a statement to a U.S. Senate committee on unemployment.

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[54] UMWA. 1944. Economic Outlook for Coal—Future Wage Policies—First Concern of Delegates. United Mine Workers Journal 55 (17): 3-4. UMWA. 1948a. Kennedy Opposes Gas Pipeline to East as Harming Coal on Which Many Depend. United Mine Workers Journal 59 (5): 10.

[55] UMWA. 1947a. Busarello Protests Canal and Pipelines as Threat to Pennsylvania Coal Industry. United Mine Workers Journal 58 (5): 8.

[56] UMWA. 1947b. Engineer Urges Natural Gas Control. United Mine Workers Journal 58 (13): 4. UMWA. 1954. Statement by the UMWA to the Coal States Governors' Conference. General Files of the UMWA Journal Office. Box 7. Folder 36. The Pennsylvania State University Special Collections. UMWA. 1954. Minutes of the First Session of the Governor's Commonwealth Fuel Conference. General Files of the UMWA Journal Office. Box 7. Folder 38. The Pennsylvania State University Special Collections. UMWA. 1954. Natural Gas as Boiler Fuel Imperils Coal, Railroads and Reserves, FPC Told. United Mine Workers Journal 65 (29): 6. UMWA. 1962. Cartoon, Upstuff. UMWA Journal. Box 60. Folder 6. The Pennsylvania State University Special Collections.

We are going to ask that the government of the United Statees (sic) help the citizens of our great republic who live in depressed areas. These men and women do not seek charity. They demand the right to provide for their families by useful labor. We do not feel that it is too much to ask our own government to help people help themselves. After all, billions have been spent to help other depressed areas of the world. Our money has built roads, factories, mines and the like in Laos, Germany, Poland, Egypt, and other nations. The list is endless. In every instance we stood to lose not only our money but even the friendship of their governments. But the citizens of West Virginia, Pennsylvania, Kentucky and other coal states are loyal and true Americans. Is it too much to ask a little help for them in their hour of need? Or is the stranger to be fed while the son goes begging at the door? Thus, we would like to propose certain remedies for the severe unemployment in the coal mining areas. If the Congress sees fit to inaugurate some of them we are sure a positive step forward will be taken in our economy.[57]

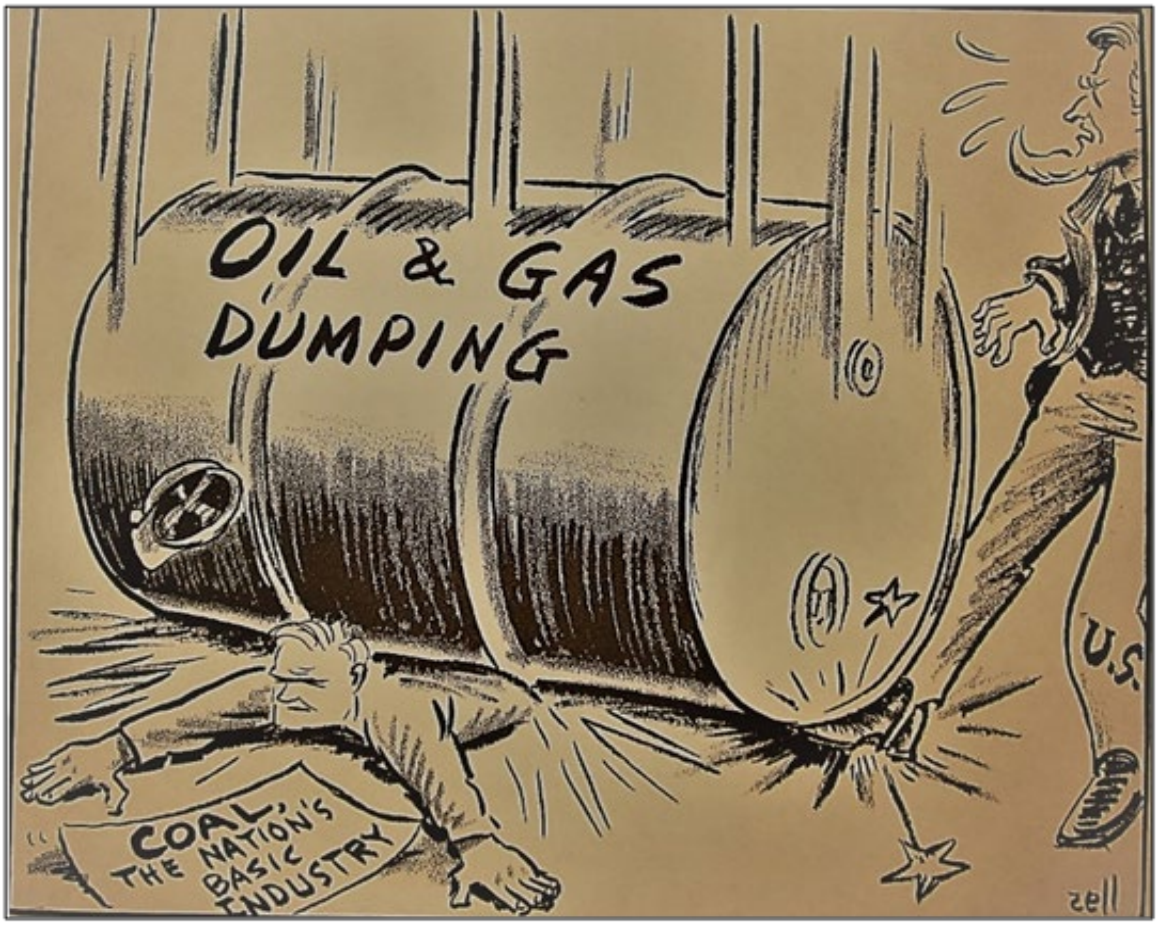

Figure 11: oil and gas dumping crushes coal, the nation's basic industry (UMWA 1962).

[57] UMWA. 1959. A Festering Cancer: Poverty in the Midst of Plenty. United Mine Workers Journal 70 (20): 5-7.

Replacing coal with natural gas also was a strategy to weaken the militant class politics of organized coal mining labor like the UMWA. By the onset of WWI, coal was one of the most strike-prone industries in both the U.S. energy sector and the overall economy (Podobnik 2006). Coal miners staged repeated strike waves in 1919, 1922, and the period of 1941 to 1946 that shut down most of the industry and won them some of the highest wages in any U.S. industry (Ibid., 71, 88). Coal miners were leaders of workforce revolt, striking much more often than other industries and for longer periods (Mitchell 2011, 19-20). Even though coal miners represented less than two out of every 100 persons in non-agricultural employment (Landsberg and Schurr 1968, 26), they could disrupt the whole U.S. economy to call attention to their demands. Miners also led strikes throughout the early-20th century that paralyzed Britain, Belgium, and Turkey (Mitchell 2011, 21-24). Coal capital retaliated by automating labor (Podobnik 2006, 83-4) and relocating mining out of traditional strongholds of organized coal mining in the Appalachians (see Figure 12).[58]

[58] UMWA. 1964. Impact of Coal on the Nation's Economy. UMWA Research Department records. Box 25. Folder 43. The Pennsylvania State University Special Collections.

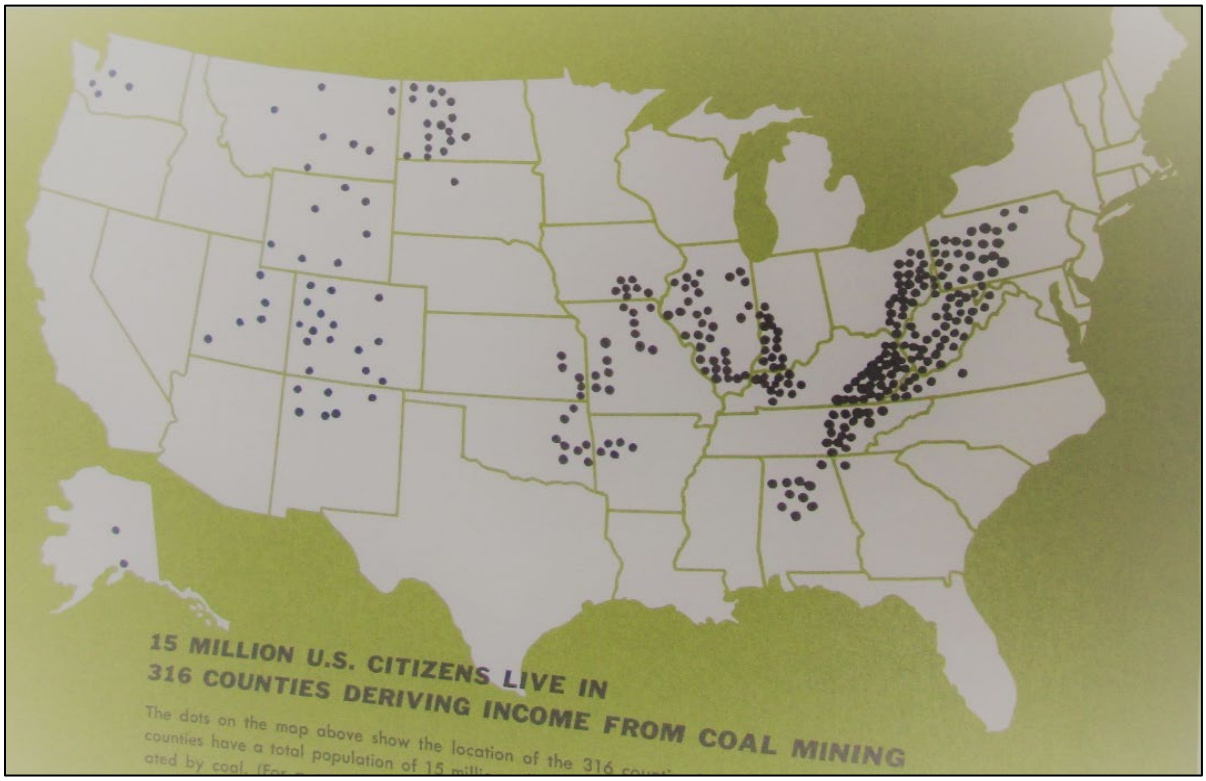

Figure 12: Map of counties deriving income from coal mining (UMWA 1964).

Miners' power to stop every part of the economy also provided "compelling reason" for capital in other sectors and the state to support a transition to natural gas (Yergin 1991, 525). "There was yet another compelling reason to switch to oil: labor strife in America's coal fields. Strikes by coal miners, led by John L. Lewis, the combative president of the United Mine Workers, were virtually an annual ritual" (Yergin 1991, 525).[59] Following the postwar wave of miners' strikes, an important number of real-estate developers and property owners installed natural gas heating systems in new homes (Podobnik 2006, 101). Public opinion turned against

[59] Oil was also used to weaken coal miners' power in Europe when U.S. aid under the Marshall Plan was directed towards the building of pipelines, oil refineries, and factories and power plants that used fuel oil instead of coal (Painter 1984, 361).

the UMWA's president John L. Lewis following the 1943 strikes (Brinkley 1995, 216), which also inspired anti-labor sentiment across the nation (Schulman 1994, 81). The WAA decided to sell oil pipelines built during WWII to natural gas companies for shipping gas from the Sunbelt to the eastern U.S. after "strident demands" were made that fuel shortages following the "last work stoppage" in coal mines be avoided in the future (U.S. Congress 1947, 360). The WAA claimed, "the use of the pipelines for natural gas would keep the Nation from being cold, prevent industry from shutting down and *punish the coal miner for striking*."[60] New Deal administrator Harold Ickes wrote that natural gas would end the UMWA's "stranglehold" on the economy (Castaneda 1993, 81), and according to one New York business writer, gas from the Sunbelt would reduce "dependence on bituminous coal and the United Mine Workers" (Ibid., 124). The impetus to abandon coal, then, was a political strategy, but more importantly, it was strategy by a specifically *capitalist* state upset with workers' ability to disrupt the flow of a critical means of production.

What Type of Class Politics for Future ETs?

The capitalist state used natural gas policy to weaken the UMWA by undercutting coal markets with cheap natural gas. Waves of coal miners' strikes following WWII motivated capital and the state to seek out alternatives to coal. Increasing use of natural gas also allowed oil and gas capital in the Sunbelt to finance a distinctly anti-union, pro-free market political platform. When natural gas replaced coal it hurt miners and weakened their ability to organize for their demands against capital. In the context of the state's goals for reducing organized labor's power over the economy's operation, replacing coal's market share with natural gas stabilized the provisioning of a critical means of production.

[60] UMWA. 1948b. 80th Congress Knifed Labor at Every Turn in Serving Powerful Interests in Reaction. United Mine Workers Journal 59 (22): 6 and 11-13.

In the 1970s, as labor unions in the Rustbelt were under assault by industrial relocation, offshoring, and outright repression by employers and the state, the UMWA was organizing tribe members of the Navajo nation to resist unrestricted energy development (Markusen 1978). (Despite the use of coal to generate electricity on certain other Native American reservations as documented by Needham [2014].) Even in their decline, the UMWA allied themselves in solidarity with ranchers, environmentalists, Native Americans, and workers struggling to stop or control the incursions of capital against the needs of marginalized communities (Markusen 1978, 59). Geographers interested in historical "counterfactuals" that would have made different energy futures (cf. Pooley 2010) should take note of the UMWA's strength of solidarity and perseverance.

Decarbonization would gain more public support if it were bundled with attractive visions of alternative futures that included economic survival for the majority of people. A just transition also must include a radical democratization of the economy where human and planetary needs are primary and "market forces should not be the ones to decide *what* ought to be produced, and *how*" (Stevis and Felli 2015, 38). Labor unions have suffered many defeats over the past 40 years, but they are still some of the largest, best-organized power centers for class struggle, and their support is needed in social movements seeking to address climate change.

A just ET can avoid enriching the capitalist class, e.g., technology entrepreneurs like Elon Musk and Bill Gates, who offer individualized and expensive technofixes to what is at base a social malfunction. A just ET would redistribute wealth away from elites and toward the greater mass of society, attacking the pernicious socio-political challenge of inequality (Heffron and McCauley 2018, 75). Any ET will be geographically uneven, as investment flows out of

fossil fuel extraction and into new regions that provide clean energy. This would require not different types of policy from a capitalist state but a different type of state. A democracy that placed people's needs above the needs of the capitalist class could craft a just ET that consigns capitalist exploitation to the dustbin of history. By undermining the UMWA with cheap natural gas, the capitalist state undercut a locus of social justice organizing. Ensuring that future ETs are just and equitable requires democratic, socialist state energy policy to prevent further erosion of democratic power in the workplace and civil society.

Chapter 5

Igniting the Crucible: Natural Gas Deregulation and The Contradictions of Fordist-Keynesianism

Introduction

In the mid-2000s, television ads in Pennsylvania were promising that natural gas from fracking would revolutionize transportation by allowing natural-gas powered cars and trucks to displace gasoline-powered vehicles (McGraw 2011, 86). Fracking is a drilling technique that has allowed oil and gas production to increase dramatically in states like Pennsylvania, Louisiana, Texas, and North Dakota over the last decade (Zuckerman 2013). The promised transportation revolution never happened, and the vast majority of the transportation sector is still completely dependent on gasoline from petroleum (U.S. EIA 2018b, 38). However, cheap natural gas was a boon for *other sectors* that weren't mentioned in the TV ads: industry and commercial enterprises (Weinstein 2016). The ads exemplify a more general neglect of industry's energy consumption, a silence which is unwarranted given that the industrial sector consumes 52% of all energy globally (Huber 2017a, 154). In this chapter I will explain how the US capitalist state facilitated natural gas becoming a much more important fuel for industries and the commercial sector in the 20th century.

During the postwar, Fordist-Keynesian, period of capitalism natural gas became a much more widely-available, and indispensable, means of production. Between 1935 and 1980, US natural gas consumption grew from 1.9 trillion cubic feet to 19.8 trillion cubic feet (Schurr and Netschert 1960, 130; U.S. EIA 2018b, 85). Over the same period the US natural gas pipeline "grid" expanded more than 600%; from 167,400 miles (Schurr and Netschert 1960, 127) to 1,051,774 (U.S. DOT 2016, 33). Following World War II, natural gas displaced coal and heating oil as a source of energy for commercial spaces (U.S. EIA 2018b, 34) and overtook coal's

position as an energy source in industrial manufacturing (Ibid., 36). For a brief period from 1960 until the shortages of 1973, natural gas provided more energy to the US industrial sector than any other energy source (Ibid.), and gas's dominance persisted in the commercial sector until 1986 (Ibid., 34).[61]

As discussed in Chapter 1, gas is used in the industrial sector to produce steel and glass and to heat-process food and other commodities into finished form (Busby 1999). It is less clear how gas functions as a means of production in the *commercial* sector, which Darmstadter et al. define as "schools, offices, restaurants, apartment buildings, artisans' shops, department stores, small-scale construction sites, government buildings, street lighting and also some military uses" (1977, 61). If we agree with Moody that commercial spaces, transport, and logistics are an extension of the sphere of value production (2017), then the gas consumed in them should also be considered a means of production. Gas is essential in the generation of electricity and heating of commercial spaces where commodities are bought or moved to places where they will be exchanged for their money equivalents. If we accept Moody's holistic view of commercial spaces as extensions of the productive sphere, then gas is an essential input in producing the commodity up until the moment when it stops being valorized and not-yet-realized value. Once the commodity is sold and its surplus value is realized in money form then the commodity has served its purpose as a bearer of private surplus value appropriated by a capitalist. The means of producing commodities in this sense should therefore include the inputs necessary to run shops, warehouses, docks and trainyards, which include large amounts of natural gas. Although separate from the point of production, capital circulates through commercial spaces on its way through

[61] I should mention that gas's lead on oil in the industrial sector was slight, albeit persistent. Also, both sectors depended on growing amounts of electricity throughout these time periods, most of which was generated from burning coal (U.S. EIA 2018b, 40).

the moment of realization and the money and commodities stages of capital. Without commercial fractions of capital it is difficult to imagine a functioning productive stage of capital, at least for very long. In the commercial sector, gas is used to heat warehouses, office buildings, and retail stores (among others) and to heat water for laundromats, beauty salons, restaurants (for dishwashing) (Busby 1999, 77).

The remainder of this chapter proceeds as follows. I introduce the notion of Fordist-Keynesian natures and suggest a production-led (as opposed to consumer- and demand-led) conception of Fordist-Keynesian natures. In the main empirical section, I dive into the 40-year period of regulation that greatly expanded the provisioning of natural gas to all users, but especially to capital. In that narrative, I explain how the contradictions of Fordist-Keynesian gas policy caused a shortage and how capital clamored for the neoliberalization of the U.S. gas industry. I argue that exploring Fordist-Keynesianism's contradictions brings some needed synthesis to the neoliberal natures literatures by comparing and contrasting the socionatural relations of these different periods of capitalism.

Fordist-Keynesian Natures

> *Nonetheless, without the heavy lifting of the Keynesian state over the last two generations – including everything from government-organized and subsidized research and development on the far frontiers of science and technology to the humdrum provision of power, water, and the means of transportation – born again contemporary capitalism might not have been born again. (Fraser 2016, 215)*

Critical nature-society geography frequently examines socionatural process, contestation, and change happening in the present. One subfield of political ecology in particular, "neoliberal natures," emerged a decade ago to explain new processes of commodification, accumulation by dispossession, marketization, and privatization (among others) in contemporary settings (Bakker

2009; 2010b; Castree 2008a, 2008b; 2009; Heynen et al. 2007; Mansfield 2009). In recent years, interventions in that subfield have questioned how neoliberal natures research can be articulated with "post-neoliberal" political shifts as well as its applicability to "not-quite-neoliberal" places (Marston 2015; De Freitas et al. 2015). Despite these few modifications, the subfield's basic premise, as Bakker described it, has been preserved, i.e., examinations of the "commodification of new types of socio-natures" and "the search to convert environmental externalities into sources of profit" conducted as "a global project, mediated by international financial institutions" (2010b, 726). Scholarship has proceeded in this vein, and the great bulk of neoliberal natures research is still adequately described by Castree as a body of nuanced, multi-scaled investigations of ongoing, discontinuous, and interrupted processes of neoliberalization (2008a, 142).[62] However, the rapid expansion of neoliberal natures scholarship – into new areas, new resources, and using different methodologies – has not resolved one of the subfield's main criticisms.

A decade ago, Noel Castree and Karen Bakker debated the synergy of neoliberal natures as a subfield. Castree suggested that "this literature is, currently, less than the sum of its many excellent parts" and further, that "only through a loose, generic form of synthesis can the literature be made sense of as a whole" (Castree 2008b, 171). Bakker responded that the diversity of case studies reflects the heterogeneity of nature's biophysical, sociocultural, and symbolic dimensions, which have "enormous implications for how socioeconomic projects of resource exploitation play out" (2009, 1785). Castree and Bakker agreed that neither their

[62] A search through the Scopus database gives us a glimpse into the popularity of the neoliberal natures concept. Results for the terms "neoliberal natures" or "neoliberal environments" and "geography" reveals 676 articles since 2005 that relate nature-society relations to processes of deregulation, privatization, marketization, and replacement of state institutions with non-governmental organizations, among others.

interchange nor the literature itself helped answer the question of "*why* the neoliberalization of nature has intensified in scale and scope" (Bakker 2009, 1790; Castree 2009, 1791). Answering that question would require, as Castree said, "a systematic attempt to conduct multiscalar, grounded, empirical analysis with some historical depth" (2009, 1791). In this chapter, I aim to situate the neoliberalization of natural gas as a response to the contradictions of a previous period of capitalism: Fordist-Keynesianism.[63]

The period of capitalism before neoliberalism was "Fordist-Keynesianism" (Harvey 1990, 124).[64] It is rarely mentioned in neoliberal natures literatures except as a passing reference. Bakker notes the "irony" that neoliberalization – itself a capitalist "political and economic project" – is purported to solve crises that "capitalism has played a role in creating" (2010b, 727). According to Bakker, the preceding period of capitalism that "played a role" in creating the crises that neoliberalism solved (or, more accurately, displaced and postponed) was Fordist-Keynesianism. McCarthy and Prudham more clearly stake out how the neoliberal revolution arose in large part because Fordist-Keynesianism fell into stagnation in the 1970s (2004, 276). Excepting some informal writings by Robertson (2013a; 2013b), most neoliberal natures literatures don't trace the historical origins of neoliberal environmental policy, preferring to focus on the contemporary moment. Goldstein and Tyfield (2018) critique Bina (2013) for a

[63] Critical nature-society scholars have recently developed an interest in Keynesianism (De Lara 2018; Goldstein and Tyfield 2018; Huber 2013b), which was primarily of interest to economic geographers before (Mann 2017).
[64] In this chapter, I will be using the periodization method from the regulation school of political economy and economic geography (Aglietta 1979; Boyer and Saillard 2002; Tickell and Peck 1992). The strength of periodization is not its delineation of history into separate and distinct containers. Indeed, lived history in its infinite heterogeneity and multitudinous forms defies such simple categorization (Huber 2013b, 177). Rather, the goal of periodization is to establish "long-term patterns of capitalist development" that clarify specific "pathdependent patterns of capitalist social life" (Ibid.).

limited understanding of the ecological dimensions of Keynesianism. I echo their critique and argue that it applies to most neoliberal nature literature too.

I agree that neoliberal natures lack cohesion and synthesis (Castree 2008b), and I suggest that what sets them apart from other political ecological studies is neoliberalism's relation to Fordist-Keynesianism. Deregulation – the quintessential process of neoliberalization – occurred in reaction to previously existing regulatory, institutional forms built around irreconcilable social and economic imperatives. Fordist-Keynesianism tried to raise the standards of living of the working class and provide them with public services, but within a market-organized capitalist economy geared towards the production of surplus value as its one irreducible law (Marx 1867a, 618). Without examining how neoliberalism emerged from the contradictions of Fordist-Keynesianism, neoliberal natures gloss over the *profound* problems of postwar capitalism. Neoliberalism has had terrible impacts through its processes of deregulation, but deregulation happened because Fordist-Keynesianism was collapsing.

By the 1970s, it was clear that Fordist-Keynesian policies were failing to attain the growth rates that followed World War II for two decades (Brenner 2010). Fordist-Keynesianism refers to a historical period between the end of WWII and the 1970s marked by high levels of economic growth and by state-interventionist programs like the Marshall Plan, and the growth of the military-industrial complex (Clarke 1988b, 77).[65] Cyclically adjusted net profits, after deducting stock appreciation and based on net capital stock, remained steady between 11.2 and 12.1% from 1950 to 1969 (Harman 1980, 48). Between 1950 and 1973, the GDP of capitalist

[65] Webber and Rigby rightfully point out that the rise and fall of Fordist-Keynesianism did not proceed evenly across the global economy (1996). Economies in Southeast Asia maintained high levels of GDP growth, and cities within more slowly growing nation-states (Los Angeles) experienced rapid growth amid the wider decline (6). Yet even Webber and Rigby point out that under capitalism, all periods of rapid economic growth, including the postwar "golden age," eventually peter out (11).

countries grew at 4.9%, which is more than double the average rate of growth between 1820 and 1950 and from 1973 to 1985 (Harvey 1990, 132). Harvey's original analysis has been basically consistent since *Condition of Postmodernity*; between 1985 and 2016, average U.S. GDP growth was 2.6% (WB 2018). The U.S. economy tripled in size between 1940 and 1980 (Peet et al. 2011, 19). Automated mass production was stabilized through the expansion of mass consumption via new "wants, needs and desires" (Harvey 2014, 275), new social institutions, and a settlement between capital and labor (Harvey 1990, 124). Organized labor's power grew during the 1920s and was a "major force" by the end of the decade (Gold 1977, 134). The Taft-Hartley Act of 1947 institutionalized a "capital-labor accord" that assured the reproduction of labor power, while codifying its subservience to capital (Bowles et al. 1986, 132).

The growth of the global economy proceeded in "lock step" with energy use, and despite periodic slowdowns when energy use declined, the overall trend was unprecedented growth of energy use tied to the long boom (McNeill and Engelke 2014, 132). Fordist-Keynesianism demanded massive supplies of raw materials and energy to be "torn from the farthest regions of nature" (Altvater 1993, 226). Organized labor under Fordist-Keynesianism experienced a qualitative leap in the degree of wealth and material comfort available to union members (Cohen 2003). This "capital-labor accord" in the post-World War II era depended on oil for fueling suburban geographies and as a raw material for vital chemicals, plastics, and other materials (Huber 2013a, 179). The period between WWII and the 1970s witnessed unprecedented automobile production and housing stock increases (Worster 2016, 142). A cartoon from the end of the period shows Jimmy Carter giving a televised speech about energy conservation to a worried-looking couch potato swaddled in energy-consuming appliances (see Figure 13). The irony was not lost that Carter was telling the public to use less energy after the postwar boom had

set up society such that everyday reproduction of life was dependent on unprecedented amounts of energy consumption. Alongside GDP growth came enormous growth in the consumption of energy, "surface area of settlements, volume of garbage and pollution of air, water and soil" (Worster 2016, 142). In the words of environmental historian John McNeill,

> To sustain the new social arrangements, fields, factories, and offices needed more fuels, fertilizers, water, wood, paper, cement, ores – more of almost everything except horses, oats, whalebone, and a handful of other raw materials consigned to the dustbin of history. All these inputs were converted into energy, foods, goods, pollution and garbage. Without Fordism, without mass consumption, the environmental history of the twentieth century would have been much calmer. (2000, 318)

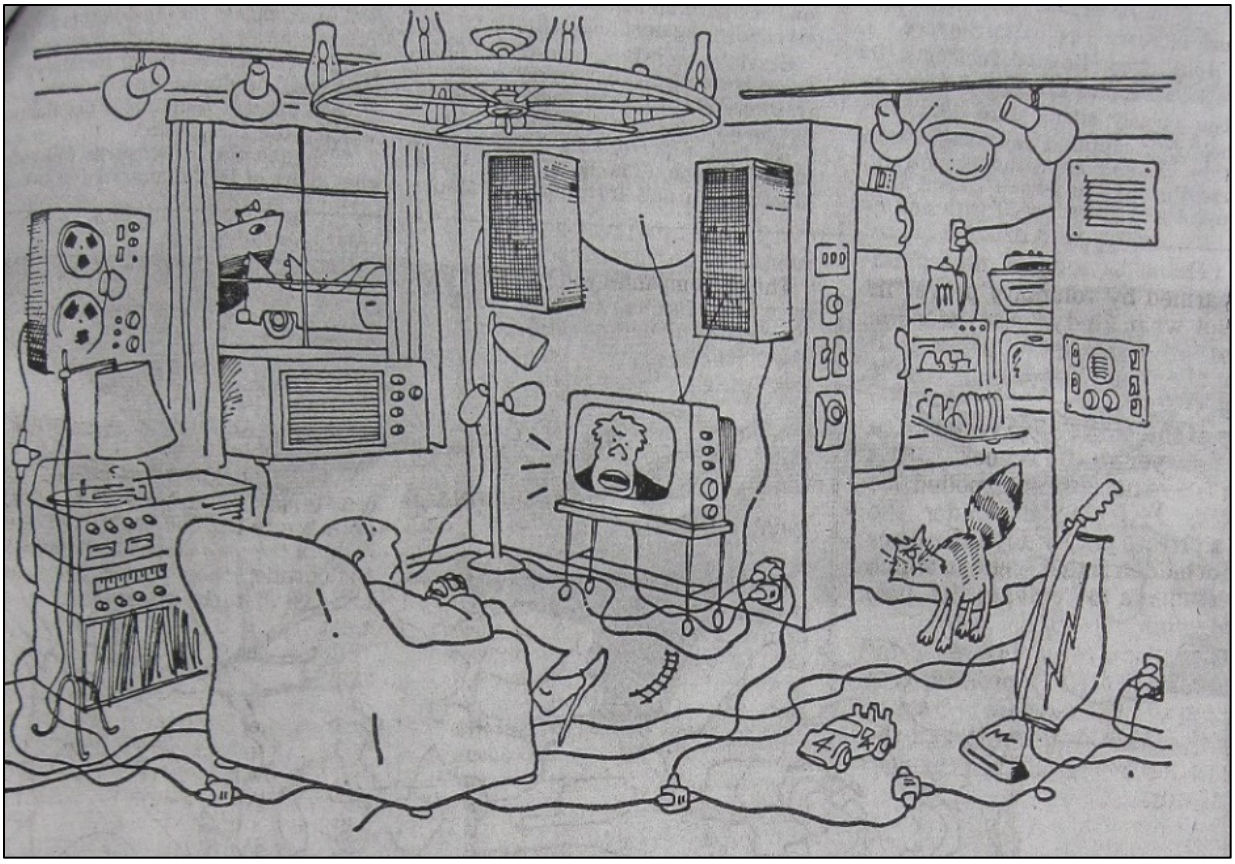

Figure 13: Published in The Philadelphia Inquirer*, from the Jimmy Carter Presidential Library.*

Worster and McNeill are right to call attention to capital's absorption of greater quantities of raw materials during the Fordist-Keynesian period, but mass *consumption* was not the engine driving this change. The 1920s saw major gains in manufacturing productivity without a concurrent rise in effective demand, as the proletariat was not paid enough to buy back the fruit of its labor (Block 2011). Postwar policies like the GI Bill, the Taft-Hartley Act, the Marshall Plan, and "military Keynesianism" were part of a state strategy to absorb the unprecedented levels of industrial output set during World War II (Ibid., 37). Mass *production* created the huge industrial complexes that gobbled resources at one end and polluted air, water, and soil at the other (Peet et al. 2011, 19-20). As Harvey relays it, "core regions of the world economy drew in

massive supplies of raw materials from the rest of the non-communist world" (1990, 132). But this vacuuming up of resources wasn't caused by greedy workers drunk with power and high wages, at least not at first, and not primarily. Rather, Fordist-Keynesian state policies and the capital-labor compromise were designed to avoid sending the global economy back into a depression following World War II (Harvey 2005, 21). Fordist-Keynesianism was, in broad strokes, an attempt to avoid depression by "mass production for mass consumption" (Peck 2000, 63), which was facilitated through state incentives, technological innovation, and institutional supports. Further production, and Fordist-Keynesian methods for absorbing products, depended on many resources, energy foremost among them.

Fordist-Keynesianism depended on "accelerated (and unsustainable) super-exploitation of nature (especially raw materials and non-renewable resources laid down over millennia, such as fossil fuels)" (Jessop 2002, 80). Scholars studying the Fordist-Keynesian period have noted particular rules and patterns of regulation – called "institutional forms" – that maintained economic and social stability throughout the Fordist-Keynesian period (Boyer and Saillard 2002, 339-40; Lipietz 1987, 19; Peck 2000, 62). These included policies that maintained a steady supply of energy at prices that would guarantee profits for producers of all types and sizes, including oil companies (Huber 2013b). Institutional forms set production levels at high-enough rates that energy was made affordable to many more homes, businesses, and massive industrial operations than before.

Fordist-Keynesian institutional forms made natural gas a crucial means of production between the 1930s and 1970s. Huber emphasizes oil's importance as an ecological foundation for suburban, auto-centric, social reproduction in U.S. capitalism (2013a). Natural gas also was foundational to social reproduction in the postwar period, and it was also a vital raw material

consumed in industrial crucibles as a source of heat energy. Energy is a crucial "means of production" in the Marxian sense (Christie 1980), and during the postwar period the FPC kept prices for natural gas low, which kept the industrial crucibles well fueled, cheaply. When yearly shortages began in the 1970s, factories began to shutter their docks, aggravating unemployment and sending industrial consumers of gas into a panicked mode. To understand how these shortages occurred in a tightly controlled, regulated market, we must first understand how and For Whom Natural Gas Markets Worked.

Fordist-Keynesian Gas Provisioning

Fordist-Keynesianism in the U.S. included massive state-facilitated infrastructure construction. Although the U.S. state in this period is usually associated with Keynesian monetary and fiscal policies, the welfare state, and the military-industrial complex (Harvey 1990), it also included "mass regulative bureaucracies" devoted to facilitating the "commodity-form of social relations" (Hirsch 1991, 143). Natural gas was overseen by a commission, the FPC, which reviewed, approved, and regulated the construction, cessation of service, and major contracts of interstate natural gas pipelines between 1938 and 1978. The FPC was composed of five leading commissioners and a staff of seven hundred and operated under the authority of the NGA (Vietor 1994, 103). The NGA was part of a wave of New Deal programs and legislation intended to defend consumers' economic rights for the specific purpose of saving the capitalist class system without changing its basic structure (Cohen 2003, 24; Jacobs 2005). When the NGA was passed, gas producers and pipeline companies acquiesced to regulation in exchange for stability in the face of a volatile, deflationary, Depression-era economy (Sanders 1981, 58).

Natural gas regulation was broadly similar to other Fordist-Keynesian institutional forms. Aglietta refers, generically, to "commissions" that oversaw particular industries e.g., land and

water transport, airlines, electricity supply, and telecommunications (1979, 322). Swyngedouw is one of the few contributors to the neoliberal natures literature to mention how "Fordist-Keynesian state-led social and economic policy" in the U.K. included regulation, control, and investment in water infrastructure (2007, 53). Commissions were designed to limit the market power of industries with prohibitive entrance costs. Pipelines, and most forms of infrastructure, are very expensive to build, and when unregulated private capital organizes their production, monopolies can result (Castaneda 1999). Harvey notes how Fordism included state-directed public investment toward utilities, including electricity, waste and sewage, water, and natural gas (1990, 135), for the purposes of ensuring stable economic growth through rising material living standards. Jessop also mentions how Fordist-Keynesianism promoted the development of "the general infrastructural conditions for nationwide diffusion of mass consumption" (2002, 77).

Pipeline Grid Expands

Natural gas departs from Harvey's and Jessop's general descriptions of state-facilitated Fordist-Keynesian infrastructure provisioning in two important respects: it was never managed as a public utility, and the expansion of its pipeline infrastructure facilitated mass consumption and mass *production*. The FPC expedited an order-of-magnitude scale expansion in natural gas provisioning to industries and the commercial sector during this period. As mentioned above, between 1935 and 1980, U.S. natural gas consumption grew from 1.9 trillion cubic feet to 19.8 trillion cubic feet (Schurr and Netschert 1960, 130; U.S. EIA 2018b, 85), and the U.S. natural gas pipeline "grid" expanded more than 600%, from 167,400 miles (Schurr and Netschert 1960, 127) to 1,051,774 (U.S. DOT 2016, 33).[66] (See Figure 14). Enormous demand came from

[66] Unlike most other forms of linear infrastructure with nodular connections, the U.S. pipeline system is more like a "grid" than a network. As Makholm discusses, "it is a misnomer to call a nation's or continent's pipeline system a *network* as one used the term for telecommunications networks or electricity transmission networks (where electrons

factories and other businesses, where natural gas was always a desirable fuel because of its cleanliness, ease-of-use, convenience, and price (Landsberg and Schurr 1968, 47). Within the first 10 years of the implementation of the NGA, nominal prices for gas declined, while wartime consumption drove prices for coal and oil up 70% and 80%, respectively (Sanders 1981, 61). War created demand for gas in hundreds of steel mills, chemical, metallurgical, and rubber factories in Ohio, New York, Pennsylvania, Virginia, Maryland, and Appalachia (Castaneda and Smith 1996, 123). In the 1930s and 1940s, a third or more of natural gas consumption came from manufacturing (Schurr and Netschert 1960, 551), and between 1960 and the shortages of 1973, natural gas became the single most important source of power for industrial and commercial users in the U.S. (U.S. EIA 2018b).

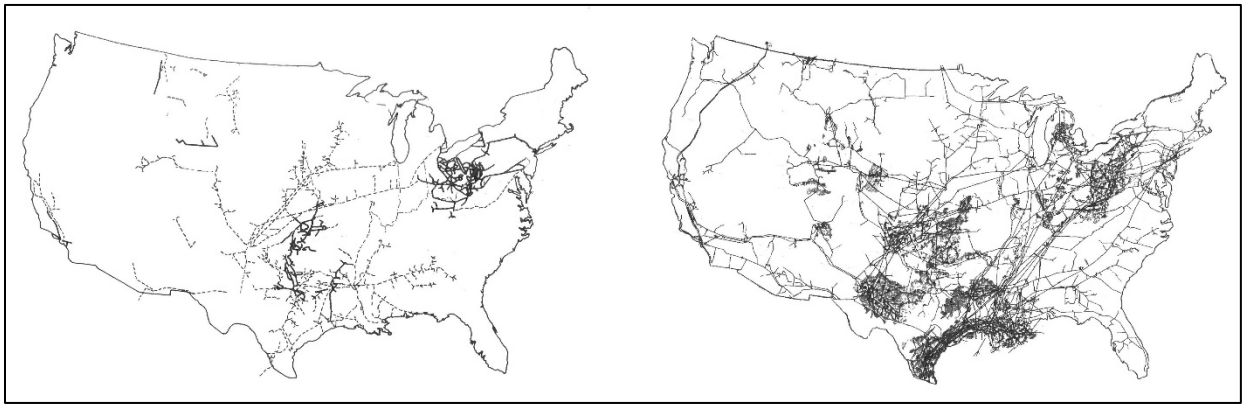

Figure 14 Major natural gas pipelines in 1932 (left), and in 1980 (right). Adapted from Sanders 1981.

Shifts in technology, and the growing availability of gas, allowed for more gas to be used to heat interior space. Beyond air and water heating, natural gas fueled the crucibles used to heat, treat, and smelt raw materials in the production of ferrous and non-ferrous metals, glass, chemicals, paper, and food (Busby 1999, 81-87). Natural gas was an essential fuel for steel manufacturing, as a supplement to coke in steel furnaces, and in the annealing process: a method

flow at the speed of light in unpredictable ways). Pipelines are really no more networks than the collection of ropes on a square-rigged ship is a network" (2012, 17).

of strengthening steel by using heat to maintain an even temperature across gradually cooling, newly rolled steel. Gas also was used to melt and temper glass at temperatures of 1540°C, dry automobile finish, and process dry plastic resin into polyester and nylon (Busby 1999, 84). Natural gas is indispensable for fertilizer production (Huber 2017a; 2017c) and is used for cleaning, cooking, boiling, baking, drying, and canning unprocessed food crops into consumables. The FPC's policies made much more gas available to many more industries during the Fordist-Keynesian period but also contributed to the shortages that emerged in the 1970s. During the period of regulation the infrastructure for provisioning natural gas expanded massively.

Contradictions Emerge

In the winters of 1971-1972 and 1973-1974, interstate pipeline companies were not able to deliver the gas they had promised their customers. The situation worsened throughout the decade and by the winter of 1976-1977, there were widespread gas shortages, especially in the Northeast U.S. (Richardson and Nordhaus 1995, 63). The resulting scarcity was not one of real, physical scarcity, as gas supplies in unregulated *intra*-state pipelines were plentiful and cheap. Northeastern consumers were deprived of gas because Southwestern producers could get higher prices by selling locally in more "lucrative" intrastate markets (Sanders 1981, 153).

Government-set prices were not allowed to rise in response to the increased demand. The shortages of natural gas through interstate pipelines signaled an unwillingness on behalf of gas producers and pipeline companies to accept the low prices set by the state. As Lee C. White, former FPC chairman, said, "You've got to understand these guys we're dealing with in the gas industry, they're not bad guys, but just guys who follow the rules of the game – to maximize profits" (Phillips 1974, 764). When ABC's 20/20 blamed oil companies for half a million in job

losses, Mobil Oil took out full-page ads in the *New York Times*, *Wall Street Journal*, *Los Angeles Times*, and *Washington Post* countering that shortages were the fault of the government-set prices that were not incentivizing production (Mobil 1978). When L.F. Laird attended an energy conference in Washington, D.C., he solicited comments from oil and gas companies on their explanation for the shortages. The CEO of an independent oil company in New York explained how prices set by the FPC disincentivized exploration for the firm. "Our company was the second most active gas explorer in the Northern Appalachian Basin in the late 50s and early 60s, but when costs rose it became obvious to us that the 1954 frozen prices simply didn't justify continuing, so we actually stopped all exploration in the basin."[67]

The shortages were caused by FPC pricing policies that affected oil and gas firms' profits. The FPC fixed the maximum rate of profit that could be garnered by interstate natural gas sales to prevent "exploitation of customers" and ensure "fair and reasonable" prices for consumers (Makholm 2012, 127; Sherrill 1983, 540). The FPC judged prices to be fair and reasonable if they covered the production costs and provided a 5.7 to 6.5% return on investment (Castaneda 1993, 31). Without the incentives of a greater-than-6% return on investment, gas companies didn't make the necessary investment to explore and produce new reservoirs (Tussing and Barlow 1984, 106). Under capitalism, the replacement of old production techniques and equipment, as well as technical innovation, is driven forward by individual capitalists seeking a competitive advantage over each other.

This process is what Marx called the pursuit of "relative surplus value" and was achieved by lowering the amount of value required to produce a given amount of value *relative* to the

[67] Walker, L. 1974. Letter to W. F. Laird. August 21. Glenn R. Schleede Files. Natural Gas folder. Box 23. Gerald R. Ford Presidential Library.

general rate of productivity of all capitalists (1867a, 434). In practice, it is achieved through some combination of lowering the cost of the reproduction of labor power or increasing the productivity of labor power through new technologies. By capping the profit rate, the FPC eliminated the possibility that gas companies could earn excess profits – over and above the 5-7% limit – relative to their competitors, thereby stifling gas exploration and production innovation (Tussing and Barlow 1984, 106). Instead of being used to find and produce more gas, the charges customers paid went to paying off old equipment, gas field leases, or administrative expenses. Rather than paying for all the labor required to produce more gas in different places using more productive technologies, gas customers were paying for all the "past labor" that went into developing older gas fields with less-productive technologies.

Industries Become Dependent

Another unintended consequence of limiting the rate of profit was that it incentivized the expansion of natural gas service into new areas. What seemed like a failure of regulated enterprise to bring gas to market in the 1970s was really a success of government-regulated oil and gas capital to create massive demand for gas. In the preceding decades, the FPC limited the profit rate of transmission companies (pipelines) to a "fairly uniform percentage of the depreciated rate base" (Peebles 1980, 63; Tussing and Barlow 1984, 60). Without the power to raise prices on individual sales and under a fiduciary responsibility to their share owners to maximize profit, pipeline companies aggressively pursued a strategy of increasing overall sales by increasing their customer base (Makholm 2012, 132). Eventually, transmission companies grew well beyond the anticipated demand in pursuit of increased earnings (Peebles 1980, 63; Tussing and Barlow 1984, 113). Regulated natural gas commerce produced a situation where

capacity far outstripped demand, making gas an extremely attractive fuel for utilities and industrial users.

The "compulsive need for expansion" on the part of the pipelines brought down prices and created new customers for gas, replacing coal or heating oil (Peebles 1980, 63). However, the system went into crisis as soon as the abundant supply of natural gas sold at lower prices than competing fuels ran out (Ibid., 62). Regulation forced natural gas companies to pursue profit by increasing their number of customers instead of increasing the price on each unit of gas sold. This made natural gas supply cheap, but it also failed to provide the high prices that brought exploration and production of new gas fields (Tussing and Barlow 1984, 104-105). When supplies of cheap gas ran short, the newly expanded customer base – including a panoply of industries – reacted with visceral persistence in their demand for more gas.

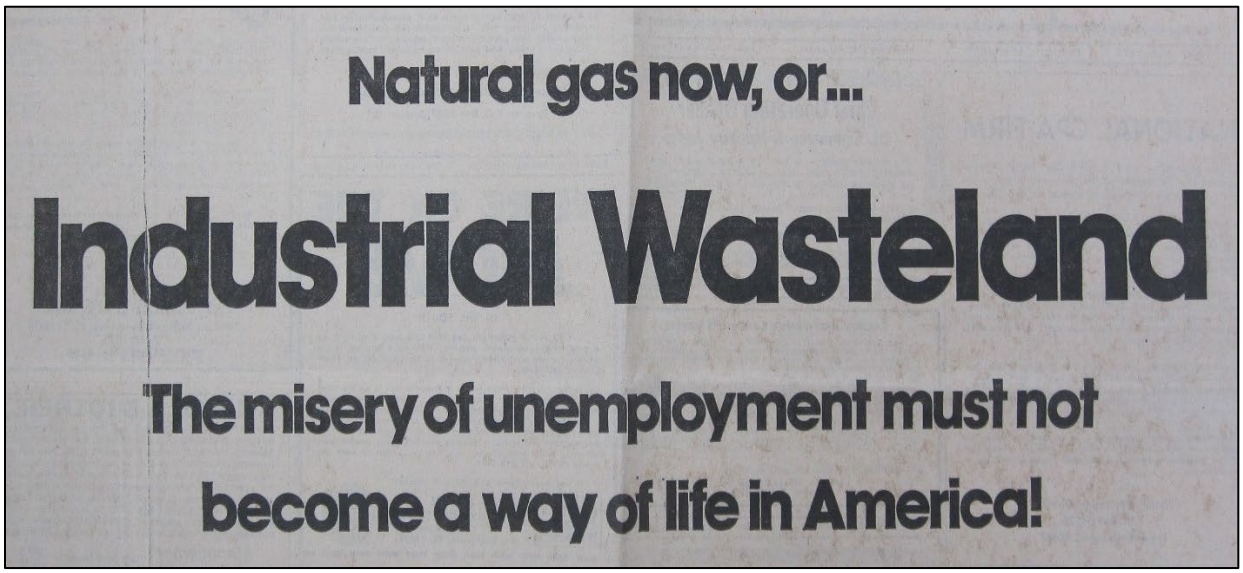

Figure 15: Wall Street Journal advertisement paid for by the Ohio Governor's Office

In 1975, Ohio governor James Rhodes sponsored a full-page advertisement in the *Wall Street Journal* that proclaimed, "Natural gas now, or… Industrial Wasteland, The Misery of

unemployment must not become a way of life in America!" (Rhodes 1975) (see Figure 15). Reports on unemployment caused by gas shortages had been reaching the White House before and during Gerald Ford's presidency. In 1974, Pennsylvania congressman Bud Shuster sent a telegram to President Ford decrying the "critical situation" in Pennsylvania, where gas shortages led to 2,000 workers losing their jobs.[68] The plant manager of Ohio Brass sent a telegram to the White House asserting "Gas is essential to the economy" and protesting the "government inflicted depression" that risked putting 800 workers out of work.[69] A year later, Pennsylvania governor Milton Sharp reported in another telegram to the president that 15,000 workers were at risk of unemployment.[70] In New Jersey, it was even worse – there, 17,000 workers in the glass-making industries were facing pink slips (Hurley 1975).[71]

In a series of letters between the owner of a steel plant and White House staff person Roland Elliott, the capitalist wrote, "Mr. Elliot, are you sure that industry can usually switch to alternate fuels? Prove it!!! It costs like hell to do so."[72] In 1975, Alaska Senator Ted Stevens sent a letter to his colleagues in Congress naming 103 businesses and corporations, including Jeep Corporation, R.J. Reynolds, and Heinz, that supported immediate deregulation of natural gas prices.[73] On November 24, 1976, National Steel presented President-elect Carter with pricing

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[68] Shuster, E. 1974. Telegram to the President. White House Central Files Subject File. Folder NR 6 Oil-Natural Gas. Box 9. Gerald R. Ford Presidential Library.
[69] Boyd, G. 1974. Telegram to John O. March Jr., 12/19/74. White House Central Files Subject File. Folder NR 6 Oil-Natural Gas. Box 9. Gerald R. Ford Presidential Library.
[70] Sharp, M. 1975. Telegram to the President, 1/2/75. White House Central Files Subject File. Folder NR 6 Oil-Natural Gas. Box 9. Gerald R. Ford Presidential Library.
[71] Hurley, J. 1975. Letter to the President, 2/12/75. White House Central Files Subject File. Folder NR 6 Oil-Natural Gas. Box 9. Gerald R. Ford Presidential Library.
[72] Brown, T. 1975. Letter to Roland Elliott, 8/8/1975. White House Central Files Subject File. Folder NR 6 Oil-Natural Gas. Box 9. Gerald R. Ford Presidential Library.
[73] Stevens, T. 1975. Letter to Colleagues. Glenn R. Schleede Files. Natural Gas folder. Box 23. Gerald R. Ford Presidential Library.

data showing 100% increases between 1971 and 1976 and also informed him, "Currently, our steel division is operating at a loss."[74]

Precise estimates of unemployment caused by natural gas shortages are difficult to pin down; perhaps the best source for these comes from Energy Secretary James Schlesinger's daily natural gas status reports. These reports compared unemployment data from three different sources: The Department of Commerce, State Governments, and natural gas distribution companies. In 1977, a year before natural gas was deregulated, shortages were causing as many as 1,567,000 workers to be furloughed or laid off.[75] Schlesinger claimed that 15 states were affected by the shortages, all east of the Mississippi and including major centers of industrial manufacturing like Ohio, New York, Pennsylvania, North Carolina, and Kentucky (see Figure 16).[76] Disruptions in gas supply caused unemployment to spike because many industries and smaller businesses started using gas as an input because of its low price, which was an effect of government regulation that kept prices low directly and indirectly. Without gas to fire their furnaces, melt raw materials or heat interior space, many businesses could not operate and had no need of labor power so they fired workers temporarily or permanently.

[74] Stinson, G. 1976. Memo to William Lilley III, 11/24/76. Office of the Staff Secretary, Handwriting file, 1976 Campaign Transition file. Steel Price Increase, 11/76-12/76 Folder. Box 2. Jimmy Carter Presidential Library and Museum.
[75] O'Leary, J. 1977. Memorandum for Dr. James R. Schlesinger, 2/7/1977. William Nordhaus Files. Daily Natural Gas and Alternative Fuels State Report Folder. Box 296. Jimmy Carter Presidential Library and Museum.
[76] Schlesinger, J. 1977. Press Briefing by James R. Schlesinger, 1/26/77. Jerry Rafshoon Files. Energy – Natural Gas Briefing by James Schlesinger Folder. Box 45. Jimmy Carter Presidential Library and Museum.

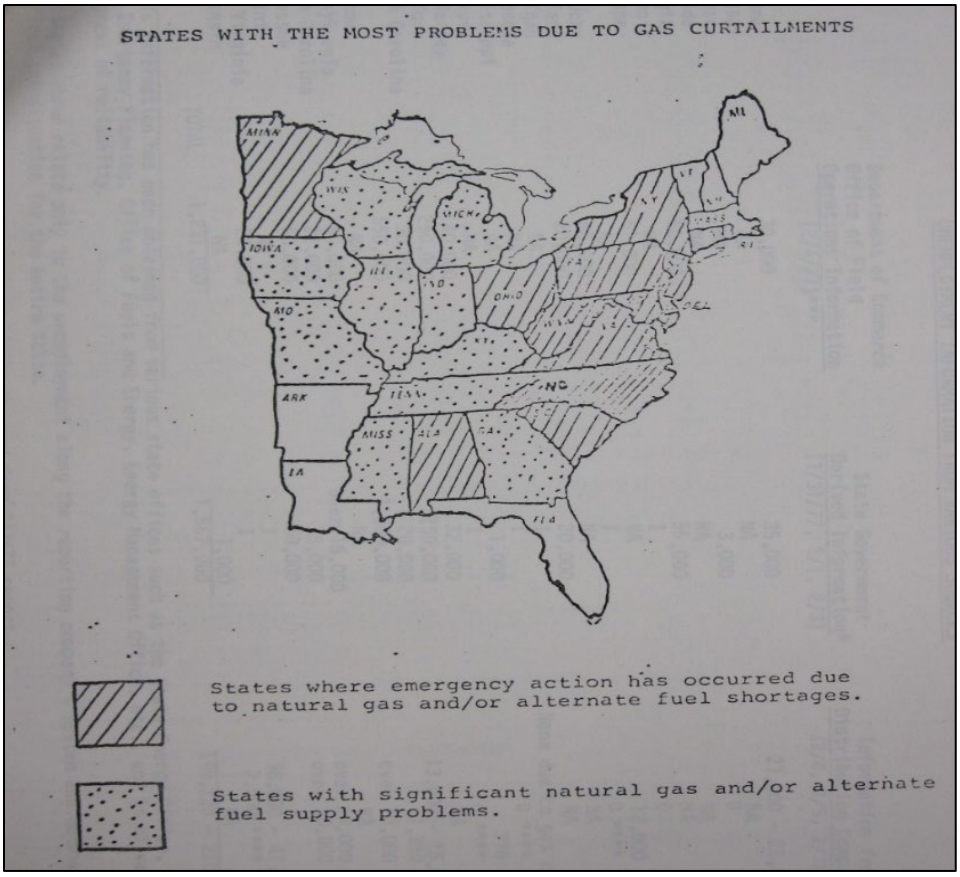

Figure 16: Map from the Jimmy Carter Library.

Era of Regulation Closes

The passage of the Natural Gas Policy Act (NGPA) on November 9, 1978 began a long, slow process of unwinding federal controls. After 18 months of debate (Richardson and Nordhaus 1995, 63), proponents of deregulation defeated senators from California, Nevada, and Iowa, whose consumers who had become dependent on cheap gas under FPC price controls (Sanders 1981, 134). An article in *National Journal* proclaimed that the passage depended on a coalition of "bartenders, bankers and bakers."[77] A more accurate explanation would be that the industries that consumed gas joined with gas producers to demand deregulation in the face of scarcity.

[77] Corrigan, R. 1978. Chalk One Up for the President's Energy Lobbyists. National Journal 9/30/78 1556-1559.

In September 1978, the White House compiled a list of corporate interests that supported the natural gas bill. They included 54 major corporations, from manufacturing to banking and insurance, and more than 20 agricultural associations.[78] Direct support came from the CEOs of Chrysler, 3M, Grumman (the defense contractor), and the textile manufacturer Burlington Industries, among others.[79] A month before the passage, Robert B. Keane, a food company executive, sent a telegram to a conglomerate of bakeries, telling them to "write their congressman immediately" in support of the bill and to have their union leadership join them in their message.[80] A group of 10 oil and gas producers from Houston sent telegrams to their senators and congressmen, entreating their support.[81] The manager of a cannery in Walla Walla, Washington, called on Congress to support the NGPA, saying "it assures a source of natural gas for agriculture and the food industry both of which are of vital importance to our stomachs."[82] In the end, the Carter administration succeeded in passing the NGPA by assembling an array of manufacturers, farmers, and producers who depended on natural gas for their operations and would voice support for any bill that held promise of boosting supply.

Although deregulation brought an end to the gas shortages, its long-lasting impact was to turn natural gas from a resource that had some state controls to a fully market-driven commodity. Between the mid-1980s and 2000, the FERC (the successor agency to the FPC) established new

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[78] Missal, M. 1978. Corporate supporters of natural gas compromise. Files of Anne Wexler. Natural Gas Bill – Energy Folder. Box 383. Jimmy Carter Presidential Library and Museum.
[79] Missal, M. 1978. Corporate Executives Who Have Recently Expressed Support to the President or Other Administration Officials in Connection with Natural Gas Bill. Files of Anne Wexler. Energy Signing Ceremony Folder. Box 381. Jimmy Carter Presidential Library and Museum.
[80] Keane, R. 1978. Telex to Gwaltney, C&C, Pearson, Wonder Snack, T.A. White, and Paniplus, 10/10/78. Files of Anne Wexler. Natural Gas – Agriculture Briefing Folder. Box 383. Jimmy Carter Presidential Library and Museum.
[81] One signatory was George Mitchell, the oil and gas entrepreneur credited with inventing the modern shale oil and gas industry by improving the hydraulic fracturing method of hydrocarbon extraction. Reeves, J. 1978. Copy of telegram to Ann (sic) Wexler. Files of Anne Wexler. Energy Signing Ceremony Folder. Box 381. Jimmy Carter Presidential Library and Museum.
[82] Hohweisner, H. 1978. Letter to Lloyd Meeds, 10/4/1978. Files of Anne Wexler. Natural Gas – Agriculture Briefing Folder. Box 383. Jimmy Carter Presidential Library and Museum.

regulations, which transformed gas markets into free exchanges that automatically functioned without direct government intervention. By 2000, natural gas was provisioned by a network of thousands of traders who were linked at various nodes of marketplace exchange and who communicated through the price signal. The price of gas in spot trades reflected the value of gas at any particular time, and with pipelines offering contracts in capacity, monopoly market control was no longer a concern (Tussing and Tippee 1995, 253). Government regulation, so influential in the formation of the massive market for gas in the postwar period, was drastically pared back, with the FERC downgrading its role to a "reactive" agency (Makholm 2012, 27).

Conclusion

Patterns of natural gas consumption set during the Fordist-Keynesian period paved the way for deregulation. Internal contradictions in the institutional form of gas regulation allowed whole sectors of the economy – 200,000 industrial firms, according to one count – to become dependent on natural gas for energy (Ellis 1978, 1). Capitalist relations of production became ecologically founded on fossil fuel use under Fordist-Keynesianism, which also was the case with regard to oil (Huber 2013b, 181). In the process, natural gas became vital as a means of production.

Contradictions emerged between Fordist-Keynesian regulations that kept gas cheap for industrial and commercial consumers while also limiting gas producers. These contradictions eventually led to shortages, which brought the era of regulation to a close. Assuring that industrial and commercial capital had adequate supplies of natural gas demanded the deconstruction of the Fordist-Keynesian institutions that placed great power in the state's hands. The NGA granted a publicly accountable institution authority to determine where, when, and how much gas was needed in particular places. With deregulation, state power over energy was

lost, while the legacy of state-facilitated patterns of high natural gas use remained. This has enormous repercussions for nature-society relations in the neoliberal period.

Institutional forms of Fordist-Keynesianism locked the U.S. into a mode of production and social reproduction that are dependent on burning fossil fuels. Ceaseless, compounding daily news of global sea level rise, drought, flood, hurricanes, and melting sea ice implore a transition toward renewable forms of energy. However, this would depend on a form of collective self-management by the great mass of society, which would force an economy-wide switch away from these fuels at unprecedented speed and expense. Calculations of the cost of abandoning fossil fuels, and the infrastructure associated with using them, and replacing them with renewable generating capacity range in the trillions of dollars (Smil 2010b, 142). Also, any transition would entail new rounds of primitive accumulation in rural areas to make way for millions of new wind turbines and thousands of solar, tidal, and wave energy generators (McCarthy 2015, 2492). Mitigating climate change fairly would, therefore, necessitate an economy-wide referendum on how, why, and for whom we burn fossil fuels. Unfortunately, the legacy of deregulation has been to eject collective forms of social control from natural gas governance. The FPC was a flawed institution, but at least it was answerable to social demands. Its replacement – the free market – is answerable to holders of private property who find profit in supplying social demands. As long as employment, standards of living, and economic survival are wedded to burning fossil fuels, demand will never cease. If it's profitable, capital will never stop pumping our economy full of fossil fuels and our atmosphere full of climate-changing gases.

Looking back on Fordist-Keynesianism from an environmentalist's position, it's easy to condemn this period for locking the U.S. into habits of high resource consumption. However, it's

also inspiring to imagine a world where masses of working people held a greater measure of democratic power over the U.S. energy system. One of neoliberalism's great ironies is that although it is sold as a system that provides greater freedom, less of humanity shares in those freedoms than under the previous ideology of Fordist-Keynesianism. Under Fordist-Keynesianism, the state and capital complied with the demands of organized workers much more so than they do today. As Simon Clarke explained, "While Keynesianism was the ideological expression of the attempt of capital and the state to respond to the generalized aspirations of the working class in the post-war boom, neoliberalism is the ideological expression of the subordination of working class aspirations to the valorization of capital" (1988b, 86).

Under neoliberalism, state-managed provisioning has been exchanged for market-managed provisioning: state planning, rationalization, and standardization in exchange for their private-sector equivalents (Harvey 2014, 136). At the precise historical moment when society must confront a system of energy production that required decades of state intervention and organization to construct, we have rejected decision-making structures that extend beyond the profit imperatives of private owners. As Birch and Siemiatycki point out, we are living in a world where "systemic planning is constrained, as are systemic solutions to critical problems that we face" (2016, 19). Fordist-Keynesianism's use of natural gas to support the capital-labor accord left us with an economic metabolism that consumes massive amounts of cheap energy. An alternative system of energy use should be less concerned with perpetuating capital and more concerned with fulfilling social needs now and in the future.

Conclusion

Energy is an essential means of production within capitalism, and because of that, capitalist states use energy policy as a brake on capitalists' tendencies to either monopolize energy markets or engage in ruinous competition. I make this argument by examining the decades of U.S. gas regulation that took this resource from a fringe source of energy to a mainstream one. I show how the state reestablished conditions for successful circulation of capital through moments of valorization and realization in natural gas markets during the Great Depression. I explain how in the postwar period, the state governed natural gas for capital as a whole instead of fractions of capital. I argue that the state allowed gas into markets previously served by coal because it strengthened capital's control over the means of production. Finally I show how state gas law throughout the Fordist-Keynesian period locked industrial and commercial capital into patterns of high natural gas consumption.

These case studies matter because the threat of climate change demands new explanations for how energy policy emerges. In the 1930s U.S., a set of social forces and crises pushed forward state energy regulation. However, the state's primary objective in regulating natural gas was to serve capital with an essential means of production. Climate policy that stops and reverses climate change will most likely destroy fractions of capital that produce fossil fuels and drastically upset capitalism as a whole, which is dependent on fossil fuels in a multitude of ways. It is important that civil society push actors within the state to delink energy production and consumption from the profit motive. Doing so would change the character of the state's relation to energy from a capitalist one to a socialist one and that is required for continued human flourishing.

Many cannot explain why it is so difficult to shift away from fossil fuels in an era of climate change because they misidentify the subject of "fossil fuel addiction." Commentators say that the addicted subject is all of humanity (Clark 2013; Thompson 2014; Saxifrage 2017; Tollefson 2018) or some wide cross-section of the human species, like the developed world (Suranovic 2013; Klare 2014) or the developing world (Akshat 2017). Some narrow the blame to China, conveniently forgetting that decisions to locate industrial production in China were made by capitalists seeking cheaper labor costs and looser environmental restrictions (Leather 2017). Also, as the "chimney of the world," China can't be made to shoulder all the blame for emitting GHGs through the production of goods consumed by the entire world (Malm 2016, 327). A more accurate assessment wouldn't seek blame in one particular polities, despite the fact that some *do* have more responsibility than others (offshoring industrialists foremost among them). More than any grouping of people, the subject of fossil fuel addiction is *capital*: a social and socionatural relationship geared toward the production, realization, and reproduction of surplus value.

In this dissertation, I have shown how the state facilitated the formation of the U.S. natural gas system to reproduce capital. Energy policy was not primarily a response to the needs or demands of "humanity" or "its citizens" for energy. The state used energy policy to save the capital form (M-C-M'), which depended on gas as a crucial means of production. Energy policy serves a process (capital) rather than social needs, but that can change, and it must change, soon. To have a 75% chance of not warming the planet by 2°C, humanity would have to avoid emitting 540 gigatons of CO_2 (or 25 gigatons of its equivalent in CH_4) between now and 2050 (Smith 2016, 45). Burning all the fossil fuel reserves currently appraised by energy companies would release 3,000 gigatons of CO_2 (Ibid.). Essentially, there is enough coal, oil, and natural gas buried in the ground to raise Earth's average temperature between 16 and 25°C (Malm 2016,

361). However, leaving it buried in the ground, as Smil reminds us, would deprive humanity of 86% of its energy supply (2015a, 206). An entirely new energy infrastructure is needed, comparable to the creation of the railroads, the interstate highway system, personal computers, the Internet, and the space program – a wholesale technological revolution (Shellenberger et al. 2008).

Mitigating climate change demands a state response because only states can force the planned redistribution of resources that will be required (Battistoni 2015). "Climate change will bring extreme weather and attendant emergencies of a scale that are too large, chaotic, and destructive to be addressed primarily by the private sector, community-based volunteerism, or assembly-style horizontal social movements like Occupy" (Parenti 2015a, 829). Absent some form of state regulation limiting markets, the best forms of addressing climate change under a market system are for non-owners to lobby left-leaning institutional shareholders and pension funds ('owners,' in publicly traded energy companies) to divest from fossil fuels (Klein 2014, 353-358). These efforts to win more public control over the fossil fuel economy should not be dismissed, but they also are purely voluntary and reversible, creating moralizing public relations moments for institutions (universities, churches, etc.) while leaving fossil capital intact (Parenti 2012).

To solve climate change, levels of state intervention in energy markets will have to meet and very possibly exceed those of 20th century U.S. natural gas regulation. Future models of energy regulation will have to not only intervene in markets to make them function but make them function in such a way that (1) meets growing energy demand while (2) keeping Earth's climate habitable for vast swaths of humanity. Considerable public funding for energy projects on levels not seen since the postwar period would have to be made available (Malm 2015, 183).

The physical, financial, and organizational infrastructure of fossil capital will have to be destroyed, or at least allowed to wither and fade, at levels seen only during war or economic depression (Malm 2016, 359). Annual cuts in GHG emissions may require rationing, requisitioning, and punishment of transgressors that threaten annual emissions targets (Malm 2015, 187). Decisions about the economy may have to be withdrawn from the market and democratically planned, more in line with socialist or social-democratic forms of government (Phillips 2015, 227). It could be that energy companies will be nationalized in the process, a situation already in place in many countries, including the liberal-capitalist Norway. Or, energy companies will have to be renationalized following neoliberal deregulation, as is currently under discussion by the U.K.'s Labour Party (Gowan 2018).

Energy is essential for any type of production, capitalist or not. Future states will have to craft policies that facilitate energy production for different forms of political economy after capitalism ends. If capitalism is about "production for production's sake" (Marx 1867a, 595) and if energy is a critical means of production, then capitalist societies use energy for the sake of using energy. Obviously, this cannot continue when so much of our energy comes from fossil fuels, and fossil fuels are dangerously destabilizing the global climate. State energy policy in a post-capitalist world should prioritize consuming energy to produce goods needed for people, not for capital. Whatever direction future energy policy will take should ultimately be up to more people than just capitalists and the capitalist state. Here are some suggestions to aid in that public decision-making process.

Under capitalism, energy policy is directed toward the production of profit. Under Fordist-Keynesianism, social democracies like France and the U.K. preserved the profit motive in the wider economy while nationalizing energy, resulting in bureaucratic and oppressive state

apparatuses (CSE 1979, 32). Non-capitalist state energy policy could provision energy according to social need and bypass the profit imperative altogether. A planned energy economy that is not run by entrepreneurs competing in chaotic markets would be a saner way to provision a resource that is incredibly necessary but is altering our global climate significantly. In the near- to medium-term, national-level planning and nationalization of the energy sector could seriously slow climate change and could be a good option, if it had a firm end-date enforced by the coercive branches of the state. Federal energy planning should end as soon as the worst impacts of climate change are avoided because state direction is not a good long-term replacement for market provisioning. Socialist energy policies must become democratic in nature so that energy needs can be planned in line with social needs.

Statization is not much of a replacement for capitalism, if the statists in charge of energy start operating like capitalists, i.e., by dumping carbon into the atmosphere to cut corners and enrich themselves. Poulantzas distinguished between statization and socialization in his discussion of nationalization.

> Now, however much one differentiates between statization and nationalization, the nobility of the second term should not make us forget that, in a capitalist regime, all nationalization is distinct from effective socialization, and that this constitutes the really fundamental distinction. By transferring the means of production from the possession and economic ownership of capital to the real control of the workers, socialization entails not only a change in state power, but also substantial modifications in the relations of production and the state apparatus. In the long run, only socialization can be a genuine alternative to statization. (1978, 175)

In the long term, the goal of energy policy should be a radical democratization of energy. Such a scheme fits with Block's suggestion that energy (and transportation, communications, and housing) be taken out of the market and coordinated by *many more people* than it currently is under capitalism (energy company executives and utility company managers). "In order to make

reasonable decisions about production and consumption in these areas, it is necessary to have greater citizen input and develop new forms of coordination among management, employees, consumers and various levels of government" (Block 1987, 140). Democratizing energy provisioning may sound vague at a national level, but it could take the form of an everyday, mundane, local government institution. We could turn the energy sector into a federally funded, locally run board of commissioners like the department of parks and recreation or the local school board. Except these institutions would have the actual power and resources they need to build power plants, power lines, and other expensive construction projects.

Only history will tell how humanity will respond to climate change, but state intervention in private markets will be essential. Humanity can be better prepared for the coming changes by familiarizing ourselves with how energy governance for key resources like natural gas operated in the past. If we choose, past experiences can be our guide to improving upon the state-energy relation under capitalism, or whatever form of political economy follows it. As I have shown, the state regulated natural gas to serve capital with an essential means of production at prices that allowed for profit maximization. Climate change demands the destabilization of many fractions of capital that are currently profitable because they burn fossil fuels. Therefore, to stop, and begin reversing climate change, civil society must push actors within the state to prioritize planetary survival and social needs for energy over capitalists' need for profit. With the aid of our states, our species may be able to create a more stable future – not for capital – but for all humans, flourishing, in a habitable climate.

Bibliography

Adkin, L. 2016. *First World Petro-Politics: The Political Ecology and Governance of Alberta.* Toronto: University of Toronto Press.

Aglietta, M. 1979 (2000). *A Theory of Capitalist Regulation: The U.S. Experience*. London: Verso.

Agnew, J. 1994. The Territorial Trap: The Geographical Assumptions of International Relations Theory. *Review of International Political Economy* 1 (1): 53-80.

Akshat, R. 2017. The World's Astonishing Dependence on Fossil Fuels Hasn't Changed in 40 years. https://qz.com/1144207/the-worlds-astonishing-dependence-on-fossil-fuels-hasnt-changed-in-40-years/ (accessed June 23, 2018).

Altvater, E. 1978. Some Problems of State Interventionism. In *State and Capital: A Marxist Debate*, eds. J. Holloway and S. Picciotto, 40-42. London: Edward Arnold.

---. 1993. *The Future of The Market: An Essay on the Regulation of Money and Nature After the Collapse of 'Actually Existing Socialism.'* London: Verso.

---. 2006. The Social and Natural Environment of Fossil Capitalism. In *Socialist Register 2007: Coming to Terms with Nature*, eds. L. Panitch and C. Leys, 37-59. London: Merlin.

Amariglio, J. and D. Ruccio. 1994. Postmodernism, Marxism, and the Critique of Modern Economic Thought. *Rethinking Marxism* 7 (3): 7-35.

Amarillo Daily News. 1934. Farmers Seek Ratable Take, Uniform Price. 11 April.

Amarillo Sunday News-Globe. 1934. Quarter of million expansion program by Shamrock Company. 18 February.

Andreucci, Diego. 2017. Resources, Regulation and the State: Struggles Over Gas Extraction and Passive Revolution in Evo Morales' Bolivia. *Political Geography* 61: 170-180.

Andrews, E. and J. McCarthy. 2014. Scale, Shale, and the State: Political Ecologies and Legal Geographies of Shale Gas development in Pennsylvania. *Journal of Environmental Studies and Sciences* 4 (1): 7-16.

Angel, J. 2017. Towards an Energy Politics In-Against-and-Beyond the State: Berlin's Struggle for Energy Democracy. *Antipode* 49 (3): 557-576.

Araújo, K. 2014. The Emerging Field of Energy Transitions: Progress, Challenges, and Opportunities. *Energy Research & Social Science* 1: 112-121.

Arent, D., C. Arndt, M. Miller, F. Tarp, and O. Zinaman. 2017. *The Political Economy of Energy Transitions.* Oxford: Oxford University Press

Aronoff, K. 2017. Green Tea Party. https://harpers.org/blog/2017/05/green-tea-party/ (accessed September 7, 2017).

Avelino, F. and J. Wittmayer. 2016. Shifting Power Relations in Sustainability Transitions: A Multi-Actor Perspective. *Journal of Environmental Policy and Planning* 18 (5): 628-649.

Avelino, F., J. Grin, B. Pel and S. Jhagroe. 2016. The Politics of Sustainability Transitions. *Journal of Environmental Policy and Planning* 18 (5): 557-567.

Associated Press. 1934. Attorney of Texoma Firm Makes Charge. *Pampa Daily News* 11 April.

Baker, L., P. Newell and J. Phillips. 2014. The Political Economy of Energy Transitions: The Case of South Africa. *New Political Economy* 19 (6): 791-818.

Bakker, K. 2003. *An Uncooperative Commodity: Privatizing Water in England and Wales*. Oxford: Oxford University Press.

---. 2009. Neoliberal Nature, Ecological Fixes, And the Pitfalls of Comparative Research. *Environment and Planning A* 41 (8): 1781-1787.

---. 2010a. *Privatizing Water: Governance Failure and the World's Urban Water Crisis*. Ithaca: Cornell University Press.

---. 2010b. The Limits of 'Neoliberal Natures': Debating Green Neoliberalism. *Progress in Human Geography* 34 (6): 715-735.

Balmaceda, M. 2018. Differentiation, Materiality, and Power: Towards a Political Economy of Fossil Fuels. *Energy Research & Social Science* 39: 130-140.

Barba, A. and G. de Vivo. 2012. An 'Unproductive Labour' View of Finance. *Cambridge Journal of Economics* 36 (6): 1479-1496.

Barber, W. 1981. The Eisenhower Energy Policy: Reluctant Intervention. In *Energy Policy in Perspective: Today's Problems, Yesterday's Solutions*, eds. C. Goodwin, W. Barber, J. Cochrane, N. de Marchi and J. Yage, 205-286. Washington: The Brookings Institution.

Barca, S. 2016. Labor in the Age of Climate Change. https://www.jacobinmag.com/2016/03/climate-labor-just-transition-green-jobs/ (accessed July 28, 2017).

Barrow, C. 1993. *Critical Theories of the State: Marxist, Neo-Marxist, Post-Marxist*. Madison: University of Wisconsin.

Battistoni, A. 2015. How to Change Everything. https://www.jacobinmag.com/2015/12/naomi-klein-climate-change-this-changes-everything-cop21/ (accessed August 16, 2018).

Bayulgen, O. and J. Ladewig. 2017. Vetoing the future: Political constraints and renewable energy. *Environmental politics* 26 (1): 49-70.

Bebbington, A. and J. Bury. 2013. *Subterranean Struggles: New Dynamics of Mining, Oil, and Gas in Latin America*. Austin: UT Press.

Becker, S., T. Moss and M. Naumann. 2016. The Importance of Space: Towards a Socio-Material and Political Geography of Energy Transitions. In *Conceptualizing Germany's*

Energy Transition: Institutions, Materiality, Power, Space, 93-108. London: Palgrave Macmillan.

Benton, T. 1984. *The Rise and Fall of Structural Marxism: Althusser and His Influence*. New York: St. Martin's.

Betsill, M. and D. Stevis. 2016. The Politics and Dynamics of Energy Transitions: Lessons From Colorado's (USA) 'New Energy Economy.' *Environment and Planning C: Government and Policy* 34: 381-396.

Bina, O. 2013. The Green Economy and Sustainable Development: An Uneven Balance? *Environment and Planning C: Government and Policy* 31 (6): 1023-1047.

Birch, K. and M. Siemiatycki. 2016. Neoliberalism and the Geographies of Marketization: the Entangling of State and Markets. *Progress in Human Geography* 40 (2): 177-198.

Black, B. 2000. *Petrolia: The Landscape of America's First Oil Boom*. Baltimore: Johns Hopkins.

Blaikie, P. 1985. *The Political Economy of Soil Erosion in Developing Countries*. New York: Longman.

Blaikie, P. and Brookfield, H. 1987. Defining and Debating the Problem. In *Land Degradation and Society*, eds. P. Blaikie and H. Brookfield, 1-26. London: Methuen.

Block, F. 1987. *Revising State Theory: Essays in Politics and Postindustrialism*. Philadelphia: Temple University Press.

---. 2011. Crisis and Renewal: the Outlines of a Twenty-First Century New Deal. *Socio-Economic Review* 9: 31-57.

Boddy, R., and J. Crotty. 1976. Wages, prices, and the profit squeeze. *Review of Radical Political Economics* 8 (2): 63-67.

Boersma, T. and S. Jordaan. 2017. Whatever Happened to the Golden Age of Natural Gas? *Energy Transitions* 1 (5): 1-8.

Bonds, E. and Downey, L. 2012 "Green Technology" and Ecologically Unequal Exchange: the Environmental and Social Consequences of Ecological Modernization in the World-System. *Journal of World-Systems Research* 18 (2): 167-186.

Bouzarovski, S., M. Bradshaw and A. Wochnik 2015. Making Territory Through Infrastructure: The Governance of Natural Gas Transit in Europe. *Geoforum* 64: 217-228.

Bouzarovski, S., S. Herrero, S. Petrova, J. Frankowski, R. Matoušek, and T. Maltby. 2017. Multiple Transformations: Theorizing Energy Vulnerability as a Socio-Spatial Phenomenon. *Geografiska annaler: Series B* 99 (1): 20-41.

Bouzarovski, S. and M. Konieczny. 2010. Landscapes of Paradox: Public Discourses and Policies in Poland's Relationship with the Nord Stream Pipeline. *Geopolitics* 15 (1): 1-21.

Bowles, S., D. Gordon and T. Weisskopf. 1986. Power and Profits: The Social Structure of Accumulation and the Profitability of the Postwar U.S. Economy. *Review of Radical Political Economics* 18 (1/2): 132-167.

Boyd, W., W. Prudham and R. Schurman. 2001. Industrial Dynamics and the Problem of Nature. *Society & Natural Resources* 14 (7): 555-570.

Boyer, R. and Y. Saillard. 2002. *Régulation Theory: The State of the Art.* London: Routledge.

Bradshaw, M. 2014. *Global Energy Dilemmas: Energy Security, Globalization, and Climate Change*. Cambridge: Polity.

Bradshaw, M., J. Dutton and G. Bridge. 2015. The Geopolitical Economy of a Globalizing Gas Market. In *Global Energy: Issues, Potentials, and Policy Implications*, eds. P. Ekins, M. Bradshaw and J. Watson, 291-305. Oxford: Oxford University Press.

Braml, J. 2007. Can the United States Shed its Oil Addiction? *The Washington Quarterly* 30 (4): 117-130.

Brand, U., C. Görg and M. Wissen. 2011. Second-Order Condensations of Societal Power Relations: Environmental Politics and the Internationalization of the State from a Neo-Poulantzian Perspective. *Antipode* 43 (1): 149-175.

Brandt, A., G. Heath, E. Kort, F. O'Sullivan, G. Pétron, S. Jordaan, P. Tans, J. Wilcox, A. Gopstein, D. Arent, S. Wofsy, N. Brown, R. Bradley, G. Stucky, D. Eardley and R. Harriss. 2014. Methane Leaks from North American Natural Gas Systems. *Nature* 343 (6172): 733-735.

Braun, B. 2002. *The Intemperate Rainforest: Nature, Culture, and Power on Canada's West Coast*. Minneapolis: University of Minnesota Press.

Brenner, R. 2010. The Political Economy of the Rank-and-File Rebellion. In *Rebel, Rank and File: Labor Militancy and Revolt from Below During the Long 1970s*, eds. A. Brenner, R. Brenner and C. Winslow, 37-74. London: Verso.

Bridge, G. 2000. The Social Regulation of Resource Access and Environmental Impact: Production, Nature and Contradiction in the U.S. Copper Industry. *Geoforum* 31 (2): 237-256.

---. 2002. Grounding Globalization: The Prospects and Perils of Linking Economic Processes of Globalization to Environmental Outcomes. *Economic Geography* 78 (3): 361-386.

---. 2004. Gas, and How to Get it. *Geoforum* 35: 395-397.

---. 2008. Global Production Networks and the Extractive Sector. *Journal of Economic Geography* 8: 389-419.

---. 2014. Resource Geographies II: The Resource-State Nexus. *Progress in Human Geography* 38 (1): 118-130.

Bridge, G., S. Bouzarovski, M. Bradshaw and N. Eyre. 2013. Geographies of Energy Transition: Space, Place and the Low-Carbon Economy. *Energy Policy* 53: 331-340.

Bridge, G. and M. Bradshaw. 2017. Making a Global Gas Market: Territoriality and Production Networks in Liquified Natural Gas. *Economic Geography* 93 (3): 215-240.

Bridge, G. and A. Jonas. 2002. Governing Nature: The Reregulation of Resource Access, Production, and Consumption. *Environment and Planning A* 34: 759-766.

Bridge, G. and T. Perreault. 2009. Environmental Governance. In *A Companion to Environmental Geography*, eds. N. Castree, D. Demeritt, D. Liverman and B. Rhoads, 475-497. Chichester: Wiley-Blackwell.

Brinkley, A. 1995. *The End of Reform: New Deal Liberalism in Recession and War.* New York: Vintage.

Broto, V. 2016. Innovation Territories and Energy Transitions: Energy, Water and Modernity in Spain, 1939-1975. *Journal of Environmental Policy & Planning* 18 (5): 712-729.

Bulkeley, H., V. Broto and A. Maassen. 2011. Governing Urban Low Carbon Transitions. In *Cities and Low Carbon Transitions*, eds. H. Bulkeley, V. Broto, M. Hodson and S. Marvin, 29-41. London: Routledge.

Burke, E. 2009. The Big Story: Human History, Energy Regimes, and the Environment. In *The Environment and World History*, eds. E. Burke and K. Pomeranz, 33-53. Berkeley: University of California Press.

Busby, R. 1999. *Natural Gas in Nontechnical Language*. Tulsa: PennWell.

Butler, C. and K. Parkhill. 2017. Governing Transitions in Energy Demand. In *The Routledge Research Companion to Energy Geographies*, eds. S. Bouzarovski, M. Pasqualetti and V. Broto, 253-264. London: Routledge.

Butler, N. 2018. How to Make Sense of the Volatile Natural Gas Market. https://www.ft.com/content/de9094a2-5286-11e8-b3ee-41e0209208ec (accessed May 22, 2018).

Byington, C. 2017. Remember that Catastrophic Natural Gas Leak in California? Yeah, That Could Happen Again. https://blog.nature.org/science/2017/05/23/catastrophic-natural-gas-leak-california-could-happen-again/ (accessed July 27, 2018).

California, State of. 2017. Differences Between Publicly and Investor-Owned Utilities. http://www.energy.ca.gov/pou_reporting/background/difference_pou_iou.html (accessed September 28, 2017).

Calvert, K. 2016. From 'Energy Geography' to 'Energy Geographies': Perspectives on a Fertile Academic Borderland. *Progress in Human Geography* 40 (1): 105-125.

Calvert, K. and Şimandan, D. 2010. Energy, Space, Society: A Reassessment of the Changing Landscape of Energy Production, Distribution and Use. *Journal of Economics and Business Research* 26 (1): 13-37.

Calvert, K., P. Kedron, J. Baka and K. Birch. 2017. Geographical Perspectives on Sociotechnical Transitions and Emerging Bio-Economies: Introduction to a Special Issue. *Technology Analysis & Strategic Management* 29 (5): 477-485.

The Canton Herald. 1935. Waste of gas resources in Texas attacked as flagrant injustice. 5 April.

Carter, A. and A. Zalik. 2016. Fossil Capitalism and the Rentier State: Towards a Political Ecology of Alberta's Oil Economy. In *First World Petro-Politics: The Political Ecology and Governance of Alberta*, ed. L. Adkin, 51-77. Toronto: University of Toronto Press.

Carton, W. 2017. Dancing to the Rhythms of the Fossil Fuel Landscape: Landscape Inertia and the Temporal Limits to Market-Based Climate Policy. *Antipode* 49 (1): 43-6.

Castaneda, C. 1993. *Regulated Enterprise: Natural Gas Pipelines and Northeastern Markets, 1938-1954.* Columbus: Ohio State University Press.

---. 1999. *Invisible Fuel: Manufactured and Natural Gas in America, 1800-2000*. New York: Twayne Publishers.

Castaneda, C. and J. Pratt. 1993. *From Texas to the East: A Strategic History of Texas Eastern Corporation*. College Station: Texas A&M University Press.

Castaneda, C. and C. Smith. 1996. *Gas Pipelines and the Emergence of America's Regulatory State: A History of Panhandle Eastern Corporation, 1928-1993.* Cambridge: Cambridge University Press.

Castree, N. 2008a. Neoliberalising Nature: The Logics of Deregulation and Reregulation. *Environment and Planning A* 40 (1): 131-152.

---. 2008b. Neoliberalising Nature: Processes, Effects, and Evaluations. *Environment and Planning A* 40 (1): 153-173.

---. 2009. Researching Neoliberal Environmental Governance: A Reply to Karen Bakker. *Environment and Planning A* 41 (8): 1788-1794.

Cavanagh, C. and T. Benjaminsen. 2014. Virtual Nature, Violent Accumulation: The 'Spectacular Failure' Of Carbon Offsetting at a Ugandan National Park. *Geoforum* 56: 55-65.

Cederlöf, G. 2015. Thermodynamics Revisited: The Political Ecology of Energy Systems in Historical Perspective. In *The International Handbook of Political Ecology*, eds. R. Bryant, 646-658. Cheltenham: Edward Elgar.

Christie, R. 1980. Why Does Capital Need Energy? In *Oil & Class Struggle*, eds. P. Nore and T. Turner, 10-25. London: Zed.

---. 1984. *Electricity, Industry, and Class in South Africa*. Albany: SUNY-Albany Press.

Christophers, B. 2013. *Banking Across Boundaries: Placing Finance in Capitalism*. Chichester: John Wiley & Sons.

---. 2014. The Territorial Fix: Price, Power and Profit in the Geographies of Markets. *Progress in Human Geography* 38 (6): 754-770.

---. 2016. *The Great Leveler: Capitalism and Competition in The Court of Law*. Cambridge, MA: Harvard University Press.

Clark, D. 2013. What Can't We Quit Fossil Fuels? https://www.theguardian.com/environment/2013/apr/17/why-cant-we-give-up-fossil-fuels (accessed June 23, 2018).

Clark, J. 1987. *Energy and the Federal Government: Fossil Fuel Policies, 1900-1946*. Urbana: University of Illinois Press.

Clarke, S. 1977. Marxism, Sociology and Poulantzas' Theory of the State. *Capital & Class* 1 (2): 1-31.

---. 1978. Capital, Fractions of Capital and the State: 'Neo-Marxist' Analysis of the South African State. *Capital & Class* 2 (2): 32-77.

---. 1983. State, Class Struggle, and the Reproduction of Capital. *Kapitalistate* 10/11: 113-130.

---. 1988a. *Keynesianism, Monetarism and the Crisis of the State*. Aldershot, U.K.: Edward Elgar.

---. 1988b. Overaccumulation, Class Struggle and the Regulation Approach. *Capital & Class* 12 (3): 59-92.

---. 1994. *Marx's Theory of Crisis*. London: Palgrave MacMillan.

Cock, J. 2014. The 'Green Economy': A Just and Sustainable Development Path or a 'Wolf in Sheep's Clothing'? *Global Labour Journal* 5 (1): 23-44.

Cohen, L. 2003. *A Consumers' Republic: The Politics of Mass Consumption in Postwar America*. New York: Knopf.

Cooper, R. 2018. The Myth of Clean Natural Gas. http://theweek.com/articles/785309/myth-clean-natural-gas (accessed July 27, 2018).

CSE (Conference of Socialist Economists). 1979. *In and Against the State.* London: Black Rose.

Coronil, F. 1997. *The Magical State: Nature, Money, and Modernity in Venezuela*. Chicago: The University of Chicago Press.

Cottrell, F. 1955. *Energy & Society: The Relation Between Energy, Social Change, and Economic Development*. New York: McGraw.

Coutard, O. and J. Rutherford. 2010. Energy Transition and City-Region Planning: Understanding the Spatial Politics of Systemic Change. *Technology Analysis & Strategic Management* 22 (6): 711-727.

Crespino, J. 2011. Strom Thurmond's Sunbelt: Rethinking Regional Politics and the Rise of the Right. In *Sunbelt Rising: The Politics of Space, Place and Region*, eds. M. Nickerson and D. Dochuk, 58-81. Philadelphia: University of Pennsylvania Press.

Crooks, E. 2018a. Think-Tank Warns on U.S. Gas Plant Investment Costs. https://www.ft.com/content/84aa3ab6-5d16-11e8-9334-2218e7146b04 (accessed May 22, 2018).

---. 2018b. US Green Group to Launch Methane Detection Satellite. https://www.ft.com/content/311d4f4a-3df5-11e8-b7e0-52972418fec4 (accessed May 22, 2018).

Crosby, A. 2006. *Children of The Sun: A History of Humanity's Unappeasable Appetite for Energy*. New York: WW Norton.

Curtin, J. 2015. *Climate Hero or Villain? An Analysis of China's Plans for Low Carbon Transition* http://www.iiea.com/ftp/Podcasts/Podcasts%20and%20PDFs%202015%20Temp/Climate_Hero_Paper_Layout_online.pdf (accessed August 31, 2017)

Cutlip, S. 1994. *The Unseen Power: Public Relations, A History*. Hillsdale, NJ: Lawrence Erlbaum.

D'Alisa, G. and G. Kallis. 2016. A Political Ecology of Maladaptation: Insights from a Gramscian Theory of the State. *Global Environmental Change* 38: 230-242.

Darby, S. 2017. Coal Fires, Steel Houses and the Man In the Moon: Local Experiences of Energy Transition. *Energy Research & Social Science* 31: 120-127.

Darmstadter, J., J. Dunkerley and J. Alterman. 1977. *How Industrial Societies Use Energy: A Comparative Analysis.* Baltimore: Resources for the Future.

Das, R. 1996. State Theories: A Critical Analysis. *Science & Society* 60 (1): 27-57.

---. 2006. Marxist Theories of the State. In *Alternative Theories of the State*, ed. S. Pressman, 64-90. New York: Palgrave Macmillan.

---. 2017a. *Marxist Class Theory for a Skeptical World*. Leiden: Brill.

---. 2017b. David Harvey's Theory of Accumulation by Dispossession: A Marxist Critique. *World Review of Political Economy* 8 (4): 590-616.

David, P. and G. Wright. 1997. Increasing Returns and the Genesis of American Resource Abundance. *Industrial and Corporate Change* 6 (2): 203-245.

Davis, J. 1984. *Blue Gold: The Political Economy of Natural Gas*. Boston: George Allen & Unwin.

Davis, M. 1986. *Prisoners of the American Dream: Politics and Economy in the History of the U.S. Working Class.* London: Verso.

Dawson, A. 1937. *Columbia System: A History.* New York: J.J. Little and Ives.

De Freitas, C., A. Marston and K. Bakker. 2015. Not-Quite-Neoliberal Natures in Latin America: An Introduction. *Geoforum* 64: 239-245.

De Lara, J. 2018. "This Port Is Killing People": Sustainability Without Justice in the Neo-Keynesian Green City. *Annals of the American Association of Geographers* 108 (2): 538-548.

Dempsey, J. and M. Robertson. 2012. Ecosystem services: Tensions, impurities, and points of engagement within neoliberalism. *Progress in Human Geography* 36 (6): 758-779.

Deutz, P. 2014. A Class-Based Analysis of Sustainable Development: Developing a Radical Perspective on Environmental Justice. *Sustainable Development* 22 (4): 243-252.

Deutz, P. and G. Ioppolo. 2015. From Theory to Practice: Enhancing the Potential Policy Impact of Industrial Ecology. *Sustainability* 7: 2259-2273.

Eaton, E. 2013. *Growing Resistance: Canadian Farmers and the Politics of Genetically Modified Wheat*. Winnipeg: University of Manitoba Press.

Eckstein, O. 1958. Natural Gas and Patterns of Regulation. *Harvard Business Review* 36 (2): 126-136.

Ellis, H. 1978. Congress may omit carter energy taxes. *The Christian Science Monitor* 5/25/78.

Elson, D. 1979. *Value: The Representation of Labour in Capitalism.* London: CSE Books.

---. 1988. Market Socialism or Socialization of the Market? *New Left Review* 172: 3-44.

Emel, J. and M. Huber. 2008. A Risky Business: Mining, Rent, and the Neoliberalization of "Risk" *Geoforum* 39 (3): 1393-1407.

Emel, J. and H. Neo. 2015. *Political Ecologies of Meat*. Oxfordshire: Routledge.

Engels, F. 1845 (1975). The Condition of The Working-Class in England. In *Karl Marx and Frederick Engels Collected Works Volume 4,* 295-596. New York: International Publishers.

---. 1884 (2010). *The Origin of the Family, Private Property, and the State*. London: Penguin.

EC (European Commission). 2018. Renewable Energy: Moving Towards a Low Carbon Economy.https://ec.europa.eu/energy/en/topics/renewable-energy (accessed April 24, 2018).

Feagin, J. 1988. *Free Enterprise City: Houston in Political and Economic Perspective.* New Brunswick: Rutgers University Press.

Ferguson, T. and J. Rogers. 1986. *Right Turn: The Decline of the Democrats and the Future of American Politics*. New York: Hill and Wang.

Fouquet, R. 2010. The Slow Search for Solutions: Lessons from Historical Energy Transitions. *Energy Policy* 38 (11): 6586-6596.

Fransman, M. and R. Davies. 1977. The South African Social Formation in the Early Capitalist Period, Circa 1870-1939. In *Perspectives on South Africa*, ed. T. Adler, 263-268. Johannesburg: University of Witwatersrand.

Frase, P. 2016. *Four Futures: Life after Capitalism*. London: Verso.

Fraser, S. 2016. *The Limousine Liberal: How an Incendiary Image United the Right and Fractured America.* New York: Basic Books.

Fry, M. 2013. Cement, Carbon Dioxide, and the 'Necessity' Narrative: A Case Study of Mexico. *Geoforum* 49: 127-138.

Fuller, S. 2017. Embedding Energy Transitions in the Community. In *The Routledge Research Companion to Energy Geographies*, eds. S. Bouzarovski, M. Pasqualetti and V. Broto, 265-276. London: Routledge.

Gidwani, V. 2008. Capitalism's Anxious Whole: Fear, Capture and Escape in *The Grundrisse*. *Antipode* 40 (5): 857-878.

---. 2012. Waste/Value. In *The Wiley-Blackwell Companion to Economic Geography*, eds. T. Barnes, J. Peck and E. Sheppard, 275-288. Chichester: John Wiley & Sons.

---. 2013. Six Theses on Waste, Value, and Commons. *Social & Cultural Geography* 14 (7): 773-783.

---. 2015. The Work of Waste: Inside India's Infra-Economy. *Transactions of the Institute of British Geographers* 40 (4): 575-595.

Gidwani, V. and A. Maringanti. 2016. The Waste-Value Dialectic Lumpen Urbanization in Contemporary India. *Comparative Studies of South Asia, Africa and the Middle East* 36 (1): 112-133.

Gimon, E., R. Orvis and S. Aggarwal. 2015. Renewables Curtailment: What We Can Learn from Gird Operations in California and the Midwest. https://www.greentechmedia.com/articles/read/renewables-curtailment-in-california-and-the-midwest-what-can-we-learn-from#gs.=tGT6Yg (accessed September 28, 2017).

Gold, D. 1977. The Rise and Decline of the Keynesian Coalition. *Kapitalistate* 6 129-161.

Golden, R. and B. Paulos. 2015. Curtailment of Renewable Energy in California and Beyond. *The Electricity Journal* 28 (6): 36-50.

Goldman, M. 2010. *Petrostate: Putin, Power, and the New Russia*. Oxford: Oxford University Press.

Goldstein, J. and D. Tyfield. 2018. Green Keynesianism: Bringing the Entrepreneurial State Back In (To Question)? *Science as Culture* 27 (1): 74-97.

Goldthau, A. and B. Sovacool. 2012. The Uniqueness of the Energy Security, Justice and Governance Problem. *Energy Policy* 41: 232-240.

Goswami, D. 2006. Eliminating America's Addiction to Oil: Can a Hydrogen Economy be Created in a Decade? *Fuel Cell* 6 (5): 30-40.

Gowan, P. 2018. A Plan to Nationalize Fossil-Fuel Companies. https://www.jacobinmag.com/2018/03/nationalize-fossil-fuel-companies-climate-change (accessed August 11, 2018).

Greenberger, M. 1983. *Caught Unawares: The Energy Decade in Retrospect*. Cambridge, MA: Ballinger Publishing Co.

Grigas, A. 2017. *The New Geopolitics of Natural Gas*. Cambridge: Harvard University Press.

Grossman, L. 2000. *The Political Ecology of Bananas: Contract Farming, Peasants, and Agrarian Change in the Eastern Caribbean*. Chapel Hill: UNC Press.

Guthman, J. 2004. *Agrarian Dreams: The Paradox of Organic Farming in California.* Berkeley: University of California Press.

---. 2011. *Weighing In: Obesity, Food Justice, and the Limits of Capitalism.* Berkeley: UC Press.

Haggerty, J. 2017. A Horse That Has Left the Barn: Expanding Geographies of Natural Gas. In *Handbook on the Geographies of Energy*, eds. B. Solomon and K. Calbert, 57-71. Cheltenham: Edward Elgar.

Harris, L., A. Clarke-Sather, S. Kelly-Richards, J. Banister and N. Theriault. 2017. Special Issue: Political Ecologies of the State. *Political Geography* 58: 90-127.

Harrison, B. 2008. Offshore Threats: Liquefied Natural Gas, Terrorism, and Environmental Debate in Connecticut. *Annals of the Association of American Geographers* 98 (1): 135-159.

Harrison, C. 2013. Accomplished by Means which are Indefensible: Electric Utilities, Finance, and the Natural Barriers to Accumulation. *Geoforum* 49: 173-183.

Harman, C. 1980. Theories of the Crisis. *International Socialism* 2 (9): 45-80.

---. 1999. *A People's History of the World*. London: Verso.

Harvey, D. 1982 (2006). *The Limits to Capital.* London: Verso.

---. 1990 *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change.* Malden, MA: Blackwell Publishers.

---. 1996. *Justice, Nature & the Geography of Difference*. Malden, MA: Blackwell.

---. 2003. *The New Imperialism*. Oxford: Oxford University Press.

---. 2005. *A Brief History of Neoliberalism.* Oxford: Oxford University Press.

---. 2010a. *The Enigma of Capital and the Crises of Capitalism*. Oxford: Oxford University Press.

---. 2010b. *A Companion to Marx's Capital.* New York: Verso.

---. 2013. *A Companion to Marx's Capital Volume 2.* New York: Verso.

---. 2014. *Seventeen Contradictions and the End of Capitalism*. Oxford: Oxford University Press.

---. 2017. *Marx, Capital and the Madness of Economic Reason*. London: Profile Books.

Healey, R. 2015. Railroads, Factor Channeling and Increasing Returns: Cleveland and the Emergence of the American Manufacturing Belt. *Journal of Economic Geography* 15: 499-538.

Healy, N. and J. Barry. 2017. Politicizing Energy Justice and Energy System Transitions: Fossil Fuel Divestment and a 'Just Transition.' *Energy Policy* 108: 451-459.

Heffron, R. and D. McCauley. 2018. What is the 'Just Transition'? *Geoforum* 88: 74-77.

Heil, B. 1978. Sunbelt Migration. In *U.S. Capitalism in Crisis,* 87-102. New York: Union for Radical Political Economics.

Hein, E. 2006. Money, Interest and Capital Accumulation in Karl Marx's Economics: A Monetary Interpretation and Some Similarities to Post-Keynesian Approaches. *European Journal of the History of Economic Thought* 13 (1): 113-140.

Heinrich, M. 2012. *An Introduction to the Three Volumes of Karl Marx's Capital*. New York: Monthly Review Press.

Henderson, G. 1999. *California and the Fictions of Capital*. New York: Oxford University Press.

---. 2004. 'Free' Food, the Local Production of Worth, and the Circuit of Decommodification: A Value Theory of The Surplus. *Environment and Planning D: Society and Space* 22 (4): 485-512.

---. 2009. Marxist Political Economy and the Environment. In *A Companion to Environmental Geography*, eds. N. Castree, D. Demeritt, D. Liverman and B. Rhoads, 266-293. Oxford: Wiley-Blackwell.

---. 2011. What was *Fight Club*? Theses on the Value Worlds of Trash Capitalism. *cultural geographies* 18 (2): 143-170.

---. 2013. *Value in Marx: The Persistence of Value in a More-Than-Capitalist World.* Minneapolis, MN: University of Minnesota Press.

Henwood, D. 2016. The American Right: From Margins to Mainstream. In *Socialist Register 2016*, eds. L. Panitch and G. Albo, 272-295. London: Merlin.

Herbert, J. 1992. *Clean Cheap Heat: The Development of Residential Markets for Natural Gas in the United States.* New York: Praeger.

Herod, A., G. Pickren, A. Rainnie and S. McGrath-Champ. 2013. Waste, Commodity Fetishism and The Ongoingness Of Economic Life. *Area* 45 (3): 376-382.

---. 2014. Global Destruction Networks, Labour and Waste. *Journal of Economic Geography* 14: 421-441.

Heynen, N., J. McCarthy, S. Prudham and P. Robbins. 2007. *Neoliberal Environments: False Promises and Unnatural Consequences*. London: Routledge.

Hilyard, J. 2012. *The Oil & Gas Industry: A Nontechnical Guide*. Tulsa: Pennwell.

Himley, M. 2008. Geographies of Environmental Governance: The Nexus of Nature and Neoliberalism. *Geography Compass* 2 (2): 433-451.

Hirsch, J. 1978. The State Apparatus and Social Reproduction: Elements of a Theory of the Bourgeois State. In *State and Capital: a Marxist Debate*, eds. J. Holloway and S. Picciotto, 57-107. London: Edward Arnold.

---. 1991. The Fordist Security State and New Social Movements. In *The State Debate*, ed. S. Clarke, 142-156. London: Macmillan.

Hiteva, R. 2017. Geographies of Energy Intermediation and Governance in the Contest of Low Carbon Transitions. In *The Routledge Research Companion to Energy Geographies,* eds. S. Bouzarovski, M. Pasqualetti and V. Broto, 121-132. London: Routledge.

Holloway J. and Picciotto, S. 1978. Introduction: Towards a Materialist Theory of the State. In *State and Capital: A Marxist Debate* eds. J. Holloway and S. Picciotto, 1-31. London: Edward Arnold.

Huber, M. 2009a. Energizing Historical Materialism: Fossil Fuels, Space and the Capitalist Mode of Production. *Geoforum* 40 (1): 105-115.

---. 2009b. The Use of Gasoline: Value, Oil, and the "American Way of Life." *Antipode* 41 (3): 465-486.

---. 2011a. Oil, Life and the Fetishism of Geopolitics. *Capitalism Nature Socialism* 22 (3): 32-48.

---. 2011b. Enforcing Scarcity: Oil, Violence, and the Making of the Market. *Annals of the Association of American Geographers* 101 (4): 816-826.

---. 2012. Energy, Environment and The Geopolitical Imagination. *Political Geography* 31: 402-403.

---. 2013a. *Lifeblood: Oil, Freedom, and the Forces of Capital.* Minneapolis: University of Minnesota Press.

---. 2013b. Fueling Capitalism: Oil, the Regulation Approach, and the Ecology of Capital. *Economic Geography* 89 (2): 171-194.

--- 2015. Energy and Social Power: From Political Ecology to the Ecology of Politics. In *The Routledge Handbook of Political Ecology,* eds. T. Perreault, G. Bridge and J. McCarthy, 481-492. Oxford: Routledge.

---. 2017a. Hidden Abodes: Industrializing Political Ecology. *The Annals of the American Association of Geographers* 107 (1): 151-166.

---. 2017b. Political Economy of Environment and Resources. In *The International Encyclopedia of Geography: People, the Earth, Environment, and Technology*, eds. D. Richardson, N. Castree, M. Goodchild, A. Kobayashi, W. Liu, and R. Marston, 1849-1858. Chichester: Wiley-Blackwell.

---. 2017c. Value, Nature, and Labor: A Defense of Marx. *Capitalism Nature Socialism* 28 (1): 39-52.

---. 2017d. Reinvigorating Class in Political Ecology: Nitrogen Capital and the Means of Degradation. *Geoforum* 85: 345-352.

---. 2018. Resource Geographies I: Valuing Nature (Or Not). *Progress in Human Geography* 42 (1): 148-159.

Huber, M. and J. McCarthy. 2017. Beyond the Subterranean Energy Regime? Fuel, Land Use and the Production of Space. *Transactions of the Institute of British Geographers* 42: 655-668.

Hudson, R. 2012. Critical Political Economy and Material Transformation. *New Political Economy* 17 (4): 373-397.

Ioris, A. 2014. *The Political Ecology of the State: The Basis and the Evolution of Environmental Statehood*. London: Routledge.

---. 2015. Theorizing State-Environment Relationships: Antinomies of Flexibility and Legitimacy. *Progress in Human Geography* 39 (2): 167-184.

---. 2016. Rent of Agribusiness in the Amazon: A Case Study from Mato Grosso. *Land Use Policy* 59: 456-466.

IEA (International Energy Agency). 2018a. Renewable Energy. https://www.iea.org/about/faqs/renewableenergy/ (accessed April 24, 2018).

---. 2018b. China, People's Republic of: Electricity and Heat for 2015. http://www.iea.org/statistics/statisticssearch/report/?country=China&product=electricityandheat (accessed April 24, 2018).

Isoaho, K., A. Goritz and N. Schulz. 2016. Governing Clean Energy Transitions in China and India: A Comparative Political Economy Analysis. *United Nations World Institute for Development Economics Research Working Paper* 28

Jacobs, J. 1963. Public Control of the Natural Gas Industry. In *The Dynamic Natural Gas Industry: The Description of an American Industry From the Historical, Technical, Legal, Financial, and Economic Standpoints*, eds. A. Leeston, J. Crichton and J. Jacobs, 260-308. Norman: University of Oklahoma Press.

Jacobs, M. 2005. *Pocketbook Politics: Economic Citizenship in Twentieth-Century America*. Princeton: Princeton University Press.

Jaglin, S. and É. Verdeil. 2017. Emerging Countries, Cities and Energy: Questioning Transitions. In *The Routledge Research Companion to Energy Geographies*, eds. S. Bouzarovski, M. Pasqualetti and V. Broto, 106-120. London: Routledge.

Jessop, B. 1982. *The Capitalist State: Marxist Theories and Methods*. New York: NYU Press.

---. 1985. *Nicos Poulantzas: Marxist Theory and Political Strategy*. London: Macmillan.

---. 1990. *State Theory: Putting the Capitalist State in its Place.* University Park, PA: Penn State Press.

---. 1997. A Neo-Gramscian Approach to the Regulation of Urban Regimes: Accumulation Strategies, Hegemonic Projects and Governance. In *Reconstructing Urban Regime Theory: Regulating Urban Politics in a Global Economy*, ed. M. Lauria, 51-76. Thousand Oaks: SAGE.

---. 2002 *The Future of the Capitalist State.* Cambridge: Polity.

---. 2008. *State Power: A Strategic-Relational Approach.* Cambridge: Polity.

---. 2017. Poulantzas on Political Economy, Political Ecology, and Democratic Socialism. *Journal of Political Ecology* 24: 186-199.

Johnson, L. 2014. Geographies of Securitized Catastrophe Risk and the Implications of Climate Change. *Economic Geography* 90 (2): 155-185.

Jones, C. 2016. Petromyopia: Oil and the Energy Humanities. *Humanities* 5 (36): 1-10.

Jones, T. 2010. *Desert Kingdom: How Oil and Water Forged Modern Saudi Arabia*. Cambridge, MA: Harvard University Press.

Juisto, S. 2009. Energy Transformations and Geographic Research. In *A Companion to Environmental Geography*, eds. N. Castree, D. Demeritt, D. Liverman and B. Rhoads, 533-551. Malden: Wiley-Blackwell.

Kaplan, D. 1976. An Analysis of the South African State in the 'Fusion' Period, 1932-1939. In *The Societies of Southern Africa in the 19th and 20th Centuries*, Institute of Commonwealth Studies, 149-159. London: University of London.

Kaplan, D., M. Morris, R. Davies and D. O'Meara. 1977. Class Struggle and the Periodisation of The State in South Africa. *Review of African Political Economy* 3 (7): 3-40.

Karatani, K. and J. Wainwright. 2012. 'Critique is Impossible Without Moves': An Interview of Kojin Karatani by Joel Wainwright. *Dialogues in Human Geography* 2 (1): 30-52.

Karl, T. 1997. *The Paradox of Plenty: Oil Booms and Petro-States*. Berkeley: University of California Press.

Kashi, E. and M. Watts. 2008. *Curse of the Black Gold: 50 Years of Oil in the Niger Delta*. New York: Powerhouse.

Kaup, B. 2008. Negotiating Through Nature: The Resistant Materiality and Materiality of Resistance in Bolivia's Natural Gas Sector. *Geoforum* 39 (5): 1734-1742.

Kennedy, E. 2014. From Petro-States To 'New Realities': Perspectives on the Geographies of Oil. *Geography Compass* 8 (4): 262-276.

Kenney-Lazar, M. and K. Kay. 2017. Value in Capitalist Natures. *Capitalism Nature Socialism* 28 (1): 33-38.

Kenway, P. 1990. Realization problem. In *The New Palgrave: Marxian Economics*, eds. J. Eatwell, M. Milgate and P. Newman, 326-330. New York: Palgrave Macmillan.

Kern, F. and J. Markard. 2016. Analysing Energy Transitions: Combining Insights from Transitions Studies and International Political Economy. In *The Palgrave Handbook of the International Political Economy of Energy*, eds. T. Van de Graaf, B. Sovacool, A. Ghosh, F. Kern and M. Klare, 291-318. London: Palgrave-Macmillan.

Keul, A. 2014. Tourism Neoliberalism and the Swamp as Enterprise. *Area* 46 (3): 235-241.

Kirshner, J. 2017. *A Luta Continua*: Contending High and Low Carbon Energy Transitions in Mozambique. In *The Routledge Research Companion to Energy Geographies*, eds. S. Bouzarovski, M. Pasqualetti and V. Broto, 347-361. London: Routledge.

Klare, M. 2014. We Are Now in the Terminal Stage of our Fossil-Fuel Addiction. https://www.thenation.com/article/we-are-now-terminal-stage-our-fossil-fuel-addiction/ (accessed June 23, 2018).

Klein, N. 2014. *This Changes Everything: Capitalism vs. The Climate*. New York: Simon and Schuster.

Kohlmeier, L. 1969. *The Regulators: Watchdog Agencies and the Public Interest.* New York: Harper & Row.

Kolasi, E. 2018. The Physics of Capitalism. *Monthly Review* 70 (1): 29-43.

Kolbert, E. 2017. Going Negative: Can Carbon Dioxide Removal Save the World? *The New Yorker* November 20: 64-73.

Krauss, C. 2017. Exxon Tries to cut Methane Leaks, A Culprit in Warming. *The New York Times*. September 26.

Labban, M. 2008. *Space, Oil, Capital*. London: Routledge.

---. 2010. Oil in Parallax: Scarcity, Markets, and the Financialization of Accumulation. *Geoforum* 41 (4): 541-52.

---. 2013. Review of *Carbon Democracy* by Timothy Mitchell. https://radicalantipode.files.wordpress.com/2013/03/book-review_labban-on-mitchell2.pdf (Accessed June 12, 2017).

---. 2014. Against ~~shareholder~~ value: Accumulation in the oil industry and the biopolitics of labour under finance. *Antipode* 46 (2): 477-496.

Landsberg, H. and S. Schurr. 1968. *Energy in the United States: Sources, Uses & Policy Issues.* New York: Random House.

Lansing, D. 2011. Realizing Carbon's Value: Discourse and Calculation in the Production of Carbon Forestry Offsets in Costa Rica. *Antipode* 43 (3): 731-753.

Lash, S. and J. Urry. 1987. *The End of Organized Capitalism.* Madison: University of Wisconsin Press.

Lave, R. and B. Lutz. 2014. Hydraulic Fracturing: A Critical Physical Geography Review. *Geography Compass* 8 (10): 739-754.

Lawhon, M. and J. Murphy. 2011. Socio-Technical Regimes and Sustainability Transitions: Insights From Political Ecology. *Progress in Human Geography* 36 (3): 354-378.

Leather, A. 2017. Why is Capitalism Addicted to Fossil Fuels? http://isj.org.uk/why-is-capitalism-addicted-to-fossil-fuels/ (accessed June 23, 2018).

Le Billon, P. 2015. *The Geopolitics of Resource Wars: Resource Dependence, Governance and Violence*. New York: Routledge.

Le Billon, P. and F. El Khatib. 2004. From Freedom Oil To 'Freedom Oil': Terrorism, War and U.S. Geopolitics in the Persian Gulf. *Geopolitics* 9 (1): 109-137.

Leeston, A. 1963. A Glance at Natural Gas Companies. In *The Dynamic Natural Gas Industry: The Description of an American Industry From the Historical, Technical, Legal, Financial, and Economic Standpoints*, eds. A. Leeston, J. Crichton and J. Jacobs, 128-170. Norman: University of Oklahoma Press.

Levant, E. 2015. *Groundswell: The Case for Fracking*. Toronto: Signal Books.

Lilley, S. 2011. *Capital and its Discontents: Conversations with Radical Thinkers in a Time of Tumult*. Oakland: PM Press.

Lindblom, C. 1977. *Politics and Markets: The World's Political-Economic Systems*. New York: Basic Books.

---. 2001. *The Market System: What it is, how it Works and What to Make of it*. New Haven: Yale.

Lipietz, Alain. 1987. *Mirages and Miracles: The Crisis in Global Fordism.* London: Verso.

Lockwood, M., C. Kuzemko, C. Mitchell and R. Hoggett. 2017. Historical Institutionalism and the Politics of Sustainable Energy Transitions: A Research Agenda. *Environment and Planning C: Politics and Space* 35 (2): 312-333.

Loria, K. 2018. Nine Noteworthy Environmental Protections Scott Pruitt Was Working to Roll Back at the EPA Before His Departure. https://www.businessinsider.com/epa-chief-scott-pruitt-resigns-regulations-eliminate-2018-7 (accessed July 27, 2018).

MacAvoy, P. 2000. *The Natural Gas Market: Sixty Years of Regulation and Deregulation*. New Haven: Yale University Press.

MacKay, D. 2008. *Sustainable Energy Without the Hot Air*. Cambridge: UIT Cambridge.

Makholm, J. 2012. *The Political Economy of Pipelines: A Century of Comparative Institutional Development*. Chicago: University of Chicago Press.

Malm, A. 2015. Socialism or Barbeque, War Communism or Geoengineering. In *The Politics of Ecosocialism: Transforming Welfare*, eds. K. Borgnäs, T. Eskelinen, J. Perkiö and R. Warlenius, 180-194. New York: Routledge.

---. 2016. *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming*. London: Verso.

---. 2018. *The Progress of this Storm: Nature and Society in a Warming World*. London: Verso.

Mann, G. 2017. *In the Long Run We Are All Dead: Keynesianism, Political Economy, and Revolution.* London: Verso.

Mann, G. and J. Wainwright. 2018. *Climate Leviathan: A Political Theory of Our Planetary Future*. London: Verso.

Mansfield, B. 2004. Neoliberalism in the Oceans: 'Rationalization,' Property Rights, and the Commons Question. *Geoforum* 35 (3): 313-326.

---. 2009. *Privatization: Property and the Remaking of Nature-Society Relations.* Malden, MA: Wiley.

Markusen, A. 1978. Regionalism and the Capitalist State: The case of the United States. *Kapitalistate* 7: 39-62.

Markusen, A., P. Hall, S. Campbell, and S. Deitrick. 1991. *The Rise of the Gunbelt: The Military Remapping of Industrial America*. New York: Oxford University Press.

Marston, A. 2015. Autonomy in a Post-Neoliberal Era: Community Water Governance in Cochabamba, Bolivia. *Geoforum* 64: 246-256.

Marx, K. 1867a (1967). *Capital: A Critique of Political Economy, Volume 1: The Process of Capitalist Production*. New York: International Publishers.

---. 1867b (1990). *Capital: A Critique of Political Economy, Volume 1: The Process of Capitalist Production*. London: Penguin.

---. 1885a (1978). *Capital: A Critique of Political Economy, Volume 2: The Process of Circulation of Capital*. London: Penguin.

---. 1885b (1967). *Capital: A Critique of Political Economy, Volume 2: The Process of Circulation of Capital*. New York: International Publishers.

---. 1894a (1981). *Capital: A Critique of Political Economy, Volume 3: The Process of Capitalist Production as a Whole*. London: Penguin.

---. 1894b (1967). *Capital: A Critique of Political Economy, Volume 3: The Process of Capitalist Production as a Whole*. New York: International Publishers.

Marx, K. and F. Engels. 1846 (1947). *The German Ideology*. New York: International Publishers.

---. 1848a (2005) *The Communist Manifesto*. New York: Barnes & Noble Classics.

---. 1848b (2010). The June Revolution, *Neue Rheinische Zeitung*. In *The Revolutions of 1848: Political Writings Vol. 1*, ed. D. Fernbach, 129-134. London: Verso.

Mazzucato, M. 2013. *The Entrepreneurial State: Debunking Public Vs. Private Sector Myths.* London: Anthem Press.

McCarthy, J. 2005. Scale, Sovereignty, and Strategy in Environmental Governance. *Antipode* 37 (4): 731-753.

---. 2007. States of Nature: Theorizing the State in Environmental Governance. *Review of International Political Economy* 14 (1) 176-194.

---. 2015. A Socioecological Fix to Capitalist Crisis and Climate Change? The Possibilities and Limits of Renewable Energy. *Environment and Planning A* 47 (12): 2485-2502.

McCarthy, J. and S. Prudham. 2004. Neoliberal Nature and the Nature of Neoliberalism. *Geoforum* 35 (3): 275-283.

McElwee, P. 2012. Payments for Environmental Services as Neoliberal Market-Based Forest Conservation in Vietnam: Panacea or Problem? *Geoforum* 43 (3): 412-426.

McGirr, L. 2001. *Suburban Warriors: The Origins of the New American Right.* Princeton: Princeton University Press.

McGraw, S. 2011. *The End of Country*. New York: Random House.

McNally, D. 2011a. *Monsters of the Market: Zombies, Vampires and Global Capitalism*. Chicago: Haymarket Books.

---. 2011b. *Global Slump: The Economics and Politics of Crisis and Resistance*. Oakland: PM Press.

McNary, S. 2016. Sorting Out Porter Ranch Facts Versus Rumors. http://www.scpr.org/news/2016/02/10/57348/sorting-out-porter-ranch-facts-vs-rumors/ (accessed July 27, 2018).

McNeill, J. 2000. *Something New Under the Sun: An Environmental History of the Twentieth-Century World*. New York: WW Norton.

McNeill, J. and P. Engelke. 2014. *The Great Acceleration: An Environmental History of the Anthropocene Since 1945.* Cambridge, MA: Harvard University Press.

Meadowcroft, J. 2009. What About the Politics? Sustainable Development, Transition Management, and Long Term Energy Transitions. *Policy Sciences* 42 (4): 323-340.

Medina, D. 2016. Dakota Access Pipeline: Unions Call on Obama to 'Stand Up for American Workers' https://www.nbcnews.com/storyline/dakota-pipeline-protests/dakota-access-pipeline-unions-call-obama-stand-american-workers-n658971 (accessed April 25, 2018).

Meehan, K. and O. Molden. 2015. Political Ecologies of the State. In *The Wiley Blackwell Companion to Political Geography,* eds. J. Agnew, V. Mamadouh, A. Secor and J. Sharp, 438-450. Oxford: John Wiley & Sons.

Meek, R. 1956. *Studies in the Labour Theory of Value*. New York: Monthly Review Press.

Melosi, M. 2001. *Effluent America: Cities, Industry, Energy and the Environment.* Pittsburgh: University of Pittsburgh Press.

Methane Leaks: A Dirty Little Secret. *The Economist*. 2016a. 23 July: 49-50.

Methane Leaks: Even Natural Gas Needs to Clean Up Its Act. *The Economist*. 2016b. 23 July: 9-10.

Miliband, R. 1969. *The State in Capitalist Society: The Analysis of the Western System of Power*. London: Quartet.

---. 1977 (2014). *Marxism and Politics*. London: Merlin.

Miller, D. 1935. Gas Wastage Orgy Near End in Texas. *The New York Times* 12 May: 3E.

Miller, E. 2015. *Nut Country: Right-wing Dallas and the Birth of the Southern Strategy*. Chicago: University of Chicago Press.

Mišík, M. and V. Prachárová. 2016. Before 'Independence' Arrived: Interdependence in Energy Relations Between Lithuania and Russia. *Geopolitics* 21 (3): 579-604.

Mitchell, T. 2011. *Carbon Democracy: Political Power in the Age of Oil.* London: Verso.

Mobil Oil. 1978. ABC-TV's '20/20' Needs Its Eyes Examined. *Wall Street Journal.* Aug. 31 p.15F.

Moody, K. 2017. *On New Terrain: How Capital Is Reshaping the Battleground of Class War*. Chicago: Haymarket.

Moore, J. 2011. Transcending the Metabolic Rift: A Theory of Crises in the Capitalist World-Ecology. *The Journal of Peasant Studies* 38 (1): 1-46.

Morris, M. 1976. Class Struggle and the Periodisation of the State in South Africa. *Review of African Political Economy* 3 (7): 4-30.

Moseley, W. 2005. Global cotton and local environmental management: the political ecology of rich and poor small-hold farmers in southern Mali. *The Geographical Journal* 171 (1): 36-55.

Mulvaney, D. 2013. Opening the Black Box of Solar Energy Technologies: Exploring Tensions Between Innovation and Environmental Justice. *Science as Culture* 22: 214-221.

Murphy, T., C. Brannstrom, M. Fry and M. Ewers. 2018. Economic-Development Stakeholder Perspectives on Boomtown Dynamics in the Eagle Ford Shale, Texas. *Geographical Review* 108 (1): 24-44.

NASA (National Aeronautics and Space Administration). 2018. How Climate is Changing. https://climate.nasa.gov/effects/ (accessed October 5, 2018).

NGSA (Natural Gas Supply Association). 2013. Uses in Industry. http://naturalgas.org/overview/uses-industrial/ (accessed July 27, 2018).

Needham, A. 2014. *Power Lines: Phoenix and the Making of the Modern Southwest*. Princeton: Princeton University Press.

Nemec, R. 2012. U.S. Reindustrialization an Offshoot of Natural Gas Boom. *Pipeline and Gas Journal* 239 (7): 18-19.

Nevins, J. 2009. Embedded Empire: Structural Violence and the Pursuit of Justice in East Timor. *Annals of the Association of American Geographers* 99 (5): 914-921.

Newell, P. and D. Mulvaney. 2013. The Political Economy of the 'Just Transition.' *The Geographical Journal* 179 (2): 132-140.

Nickerson, M. and D. Dockhuk. 2011. *Sunbelt Rising: The Politics of Space, Place, and Region.* Philadelphia: University of Pennsylvania Press.

Nikiforuk, A. 2012. *The Energy of Slaves: Oil and New Servitude*. Vancouver: Greystone.

Nyden, P. 2010. Rank-And-File Movements in the United Mine Workers of America, Early 1960s-Early 1980s. In *Rebel Rank and File: Labor Militancy and Revolt from Below During the Long 1970s*, eds. A. Brenner, R. Brenner and C. Winslow, 173-197. London: Verso.

O'Connor, J. 1973. *The Fiscal Crisis of the State*. New York: St. Martin's Press.

Offe, C. 1984. *Contradictions of the Welfare State*. Cambridge: MIT Press.

Olien, R. and D. Hinton. 2000. *Oil and Ideology: The Cultural Creation of the American Petroleum Industry.* Chapel Hill: University of North Carolina Press.

Olds, L. and C. Draper. 1948. Docket No. G-580: Report on the Natural Gas Investigation. Washington: Federal Power Commission.

Ollman, B. 1971. *Alienation: Marx's Conception of Man in Capitalist Society*. Cambridge: Cambridge University Press.

---. 1993. *Dialectical Investigations*. New York: Routledge.

Osborne, T. 2015. Tradeoffs in Carbon Commodification: A Political Ecology of Common Property Forest Governance. *Geoforum* 67: 64-77.

Pager, T. 2017. Donald Trump Claims to Remake GOP as Party of 'the American Worker' https://www.bostonglobe.com/news/politics/2017/02/24/donald-trump-claims-remake-gop-party-american-worker/PeF6IjybU9C77idKYgIshK/story.html (accessed August 16, 2018)

Painter, D. 1984. Oil and the Marshall Plan. *Business History Review* 58: 359-383.

Parenti, C. 2011. *Tropic of Chaos: Climate Change and the New Geography of Violence*. New York: Nation Books.

---. 2012. Problems with the Math: Is 350's Carbon Divestment Campaign Complete? https://www.huffingtonpost.com/christian-parenti/carbon-divestment-_b_2213124.html (accessed July 28, 2018).

---. 2015a. The Environment Making State: Territory, Nature, and Value. *Antipode* 47 (4): 829-848.

---. 2015b. Why the State Matters. https://www.jacobinmag.com/2015/10/developmentalism-neoliberalism-climate-change-hamilton (accessed August 2, 2018).

---. 2016. Environment-Making in the Capitalocene: Political Ecology of the State. In *Anthropocene or Capitalocene: Nature, History, and the Crisis of Capitalism*, ed. J. Moore, 166-209. Oakland: PM Press.

---. 2017. If we fail. *Jacobin* 26: 114-131.

Parsons, J. 1950. The Geography of Natural Gas in the United States. *Economic Geography* 23 (3): 162-178.

Paul, F. 2018. Deep Entanglements: History, Space and (Energy) Struggle in the German *Energiewende*. *Geoforum* 91: 1-9.

Peck, J. 2000. Doing Regulation. In *The Oxford Handbook of Economic Geography*, eds. G. Clark, M. Gertler, M. Feldman and K. Williams, 61-80. Oxford: Oxford University Press.

---. 2001. Neoliberalizing State: Thin Policies/Hard Outcomes. *Progress in Human Geography* 25 (3): 445-455.

---. 2016. The Right to Work, and the Right at Work. *Economic Geography* 92 (1): 4-30.

Peebles, M. 1980. *Evolution of the Gas Industry*. New York: NYU Press.

Peet, R. and M. Watts. 1996. Liberation Ecology: Development, Sustainability, and Environment in An Age of Market Triumphalism. In *Liberation Ecologies: Environment, Development and Social Movements*, eds. R. Peet and M. Watts, 1-45. London: Routledge.

Peet, R., P. Robbins and M. Watts. 2011. *Global Political Ecology*. London: Routledge.

Penn, I. 2017. Energy Goes to Waste as State Power Glut Grows. http://www.latimes.com/projects/la-fi-electricity-solar/ (accessed September 29, 2017).

Perelman, M. 2000. *The Invention of Capitalism: Classical Political Economy and the Secret History of Primitive Accumulation*. Durham: Duke University Press.

Perera, F. 2008. Children Are Likely to Suffer Most from Our Fossil Fuel Addiction. *Environmental Health Perspectives* 116 (8): 987-990.

Perreault, T. 2006. From the Guerra Del Agua to the Guerra Del Gas: Resource Governance, Neoliberalism and Popular Protest in Bolivia. *Antipode* 38 (1): 150-172.

Perreault, T. 2013. Dispossession by Accumulation? Mining, Water and the Nature of Enclosure on the Bolivian Altiplano. *Antipode* 45 (5): 1050-1069.

Perreault, T. and G. Valdivia. 2010. Hydrocarbons, Popular Protest and National Imaginaries: Ecuador and Bolivia in Comparative Context. *Geoforum* 41 (5): 689-699.

Pfeifer, S. 2018. Rising Energy Demand Fuels Increase in Global Carbon Emissions. https://www.ft.com/content/c9454688-2d10-11e8-9b4b-bc4b9f08f381 (accessed May 22, 2018).

Phillips, J. 1974. Energy Report/Congress Nears Showdown on Proposal to Decontrol Gas Prices. *National Journal* May 25 761-9.

Phillips, L. 2015. *Austerity Ecology & the Collapse-Porn Addicts: A Defence of Growth, Progress, Industry and Stuff*. Alresford, U.K.: Zero Books.

Phillips-Fein, K. 2009. *Invisible Hands: The Making of the Conservative Movement from the New Deal to Reagan.* New York: WW Norton.

Podobnik, B. 2002. Global Energy Inequalities: Exploring the Long-Term Implications. *Journal of World-Systems Research* 8 (2): 252-274.

---. 2006. *Global Energy Shifts: Fostering Sustainability in a Turbulent Age.* Philadelphia: Temple University Press.

Pooley, C. 2010. Landscapes Without the Car: A Counterfactual Historical Geography of Twentieth-Century Britain. *Journal of Historical Geography* 36: 266-275.

Postone, M. 1993. *Time, Labor, and Social Domination: A Reinterpretation of Marx's Critical Theory.* Cambridge: Cambridge University Press.

Poulantzas, N. 1965 (2008). Preliminaries to the Study of Hegemony in the State. In *The Poulantzas Reader: Marxism, Law, and the State*, ed. J. Martin, 74-119. London: Verso.

---. 1973 (1982). *Political Power and Social Classes*. London: Verso.

---. 1974. *Fascism and Dictatorship: The Third International and the Problem of Fascism*. London: Verso.

---. 1975. *Classes in Contemporary Capitalism*. London: Verso.

---. 1978 (2014). *State, Power, Socialism*. London: Verso.

PCI (Powder Coating Institute). 2016. Powder Coating: A Better Type of Paint. https://www.powdercoating.org/page/ABetterKindOfPaint (accessed July 27, 2018).

Prudham, W. 2005. *Knock on Wood: Nature as Commodity in Douglas-fir Country*. New York: Routledge.

---. 2009. Pimping Climate Change: Richard Branson, Global Warming, and the Performance of Green Capitalism. *Environment and Planning A* 41 (7): 1594-1613.

Ramirez, M. 2012. Is the Falling Rate of Profit the Driving Force Behind Globalization? *Contributions to Political Economy* 31 (1): 91-102.

Reed, S. 2017. On Future of Energy, From U.S. 'Renaissance' to the Rise of Renewables. *The New York Times*. November 14.

Residential Solar. 2015. List of Solar Panel Makers in the US by Residential Market Share and Country of Manufacture. https://news.energysage.com/where-solar-panels-are-manufactured/ (accessed April 25, 2018).

Rhodes, J. 1975. Advertisement. *The Wall Street Journal.* May 29 p.13.

Richardson, J. and R. Nordhaus. 1995. The National Energy Act of 1978. *Natural Resources & Environment* 10 (1): 62-88.

Robbins, P. 2003. Political ecology in political geography. *Political Geography* 22 (6): 641-645.

---. 2008. The State in Political Ecology: A Postcard to Political Geography from the Field. In *The Sage Handbook of Political Geography*, eds. K. Cox, M. Low and J. Robinson, 205-218. London: SAGE.

Roberts, M. 2016. *The Long Depression: How it Happened, Why it Happened, and What Happens Next*. Chicago: Haymarket.

Robertson, M. 2012. Measurement and Alienation: Making a World of Ecosystem Services. *Transactions of the Institute of British Geographers* 37 (3): 386-401.

---. 2013a. Jimmy Carter and The Archaeology of Market Environmentalism, part I. Personal blog July 30.

---. 2013b. Jimmy Carter and the Archaeology of Market Environmentalism, part II. Personal blog August 15.

---. 2015. Environmental Governance: Political Ecology and the State. In *The Routledge Handbook of Political Ecology*, eds. T. Perreault, G. Bridge and J. McCarthy, 457-466. London: Routledge.

Robertson, M. and J. Wainwright. 2013. The Value of Nature to the State. *Annals of the Association of American Geographers* 103 (4): 890-905.

Robin, C. 2011. *The Reactionary Mind: Conservativism from Edmund Burke to Sarah Palin.* Oxford: Oxford University Press.

Rogers, D. 2015. *The Depths of Russia: Oil, Power, and Culture after Socialism*. Ithaca: Cornell University Press.

Ross, M. 2012. *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations.* Princeton: Princeton University Press.

Sale, K. 1975. *Power Shift: The Rise of the Southern Rim and its Challenge to the Eastern Establishment*. New York: Vintage.

Sanders, M. 1981. *The Regulation of Natural Gas: Policy and Politics, 1938-1978*. Philadelphia: Temple University Press.

Saxifrage, B. 2017. These 'Missing Charts' May Change the Way You Think About Fossil Fuel Addiction. https://www.nationalobserver.com/2017/07/13/analysis/these-missing-charts-may-change-way-you-think-about-fossil-fuel-addiction (accessed June 25, 2018).

Say, J. 1803 (1834). *A Treatise on Political Economy.* Philadelphia: Grigg and Elliott.

Sayer, A. and R. Walker. 1992. *The New Social Economy: Reworking the Division of Labor*. Cambridge: Blackwell.

Schmidt-Felzmann, A. 2011. E.U. Member States' Energy Relations with Russia: Conflicting Approaches to Securing Natural Gas Supplies. *Geopolitics* 16 (3): 574-599.

Schulman, B. 1994. *From Cotton Belt to Sunbelt: Federal Policy, Economic Development, and the Transformation of the South, 1938-1980*. Durham: Duke University Press.

Schulman, B. and J. Zelizer. 2008. *Rightward Bound: Making American Conservative in the 1970s.* Cambridge, MA: Harvard University Press.

Schurr, S. and B. Netschert. 1960. *Energy in the American Economy, 1850-1975*. Baltimore, MD: Johns Hopkins Press.

Schwarz, J. and B. Plumer. 2018. The Natural Gas Industry Has a Leak Problem. https://www.nytimes.com/2018/06/21/climate/methane-leaks.html (accessed June 23, 2018).

Scrase, I. and A. Smith. 2009. The (Non-) Politics of Managing Low Carbon Socio-Technical Transitions. *Environmental Politics* 18 (5): 707-726.

Shear, B. 2014. Making the Green Economy: Politics, Desire, and Economic Possibility. *Journal of Political Ecology* 21: 193-209.

Shellenberger, M., T. Nordhaus, J. Navin, T. Norris and A. Van Noppen. 2008. Fast, Clean & Cheap: Cutting Global Warming's Gordian Knot. *Harvard Law & Policy Review* 2: 93-118.

Sherman, H. 1983. Realization Crisis Theory and the Labor Theory of Value. *Science & Society* 47 (2): 205-213.

Sherrill, R. 1983. *Oil Follies of 1970-1980: How the Petroleum Industry Stole the Show (and Much More Besides).* New York: Anchor Press.

Shove, E. and G. Walker. 2007. Transitions Ahead: Politics, Practice, and Sustainable Transition Management. *Environment and Planning A* 39 (4): 763-770.

Sica, C. 2015. Stacked Scale Frames: Building Hegemony for Fracking Across Scales. *Area* 47 (4): 443-450.

---. 2018. Plugging the pipeline: Realizing the value of natural gas in the 1930s United States. *Annals of the American Association of Geographers*. Online ahead of print: https://www.tandfonline.com/doi/abs/10.1080/24694452.2018.1462140.

Sica, C. and M. Huber. 2017. "We can't be dependent on anybody": The rhetoric of "energy independence" and the legitimation of fracking in Pennsylvania. *The Extractive Industries and Society* 4 (2): 337-343.

Skocpol, T. 1985. Bringing the State Back In: Strategies of Analysis in Current Research. In *Bringing the State Back In*, eds. P. Evans, D. Rueschemeyer and T. Skocpol, 3-43. New York: Cambridge University Press.

Smil, V. 1999. *Energies: An Illustrated Guide to the Biosphere and Civilization*. Cambridge, MA: MIT Press.

---. 2010a. *Energy Transitions: History, Requirements, Prospects.* Santa Barbara: Praeger.

---. 2010b. *Energy Myths and Realities: Bringing Science to the Energy Policy Debate*. Washington: American Enterprise Institute.

---. 2015a. *Natural Gas: Fuel for the 21st Century*. Chichester: Wiley.

---. 2015b. Energy Revolution? More Like a Crawl. https://www.youtube.com/watch?v=5guXaWwQpe4&t=3188s (accessed May 30, 2018).

---. 2015c. *Power Density: A Key to Understanding Energy Sources and Uses*. Cambridge, MA: MIT Press.

Smith, L. 2016. Greenhouse Warming: Prepare for the Worst. *New York Review of Books* 63 (15) 44-46.

Smith, N. and W. Dennis. 1987. The Restructuring of Geographical Scale: Coalescence and Fragmentation of the Northern Core Region. *Economic Geography* 63 (2): 159-182.

Smits, M. 2015. *Southeast Asian Energy Transitions: Between Modernity and Sustainability.* Oxon, U.K.: Routledge.

Sneegas, G. 2016. Media Representations of Hydraulic Fracturing and Agriculture: A New York Case Study. *The Extractive Industries and Society* 3 (1): 95-102.

Snell, D. and P. Fairbrother. 2013. Just Transition and Labour Environmentalism in Australia. In *Trade Unions in the Green Economy: Working for the Environment*, eds. N. Räthzel and D. Uzzell, 146-161. London: Routledge.

Sovacool, B. 2017. The History and Politics of Energy Transitions. In *The Political Economy of Energy Transitions*, eds. D. Arent, C. Arndt, M. Miller, F. Tarp and O. Zinaman, 16-35. Oxford: Oxford University Press.

Statler-Throckmorton, A. 2016. Why No One Cares About Aliso Canyon and Climate Change. https://stanfordpolitics.org/2016/05/09/why-no-one-cares-about-aliso-canyon-climate-change/ (accessed July 27, 2018).

Stephenson, S. and J. Agnew. 2016. The Work of Networks: Embedding Firms, Transport, and the State in the Russian Arctic Oil and Gas Sector. *Environment and Planning A* 48 (3): 558-576.

Stevis, D. and R. Felli. 2015. Global Labour Unions and Just Transition to a Green Economy. *International Environmental Agreements* 15: 29-43.

Supreme Court of the United States. 1954. *347 US 672 Phillips Petroleum Co. v. State of Wisconsin* http://openjurist.org/347/us/672/phillips-petroleum-co-v-state-of-wisconsin-state-of-texas (accessed May 23, 2017).

Suranovic, S. 2013. Fossil Fuel Addiction and the Implications for Climate Change Policy. *Global Environmental Change* 23: 598-608.

Sweeney, S. 2013. US Trade Unions and the Challenge of 'Extreme Energy.' In *Trade Unions in the Green Economy: Working for the Environment*, eds. N. Räthzel and D. Uzzell, 196-213. London: Routledge.

Swilling, M., J. Musango and J. Wakeford. 2016. Developmental States and Sustainability Transitions: Prospects of a Just Transition in South Africa. *Journal of Environmental Policy & Planning* 18 (5): 650-672.

Swyngedouw, E. 2005. Dispossessing H2O: The Contested Terrain of Water Privatization. *Capitalism Nature Socialism* 16 (1): 81-98.

Szeman, I. and D. Boyer. 2017. *Energy Humanities: An Anthology*. Baltimore: Johns Hopkins University Press.

Thomas, A. 2014. How Energy Policy Enabled the Decline of Midwestern Cities, and How it Can Contribute to their Rehabilitation. In *The Road Through the Rust Belt: From Preeminence to Decline to Prosperity*, ed. W. Bowen, 147-189. Kalamazoo: Upjohn Institute for Employment Research.

Thompson, J. 2014. BP Energy Review Reveals Lingering Addiction to Fossil Fuels. https://www.hcn.org/blogs/goat/bp-yearly-energy-review-reveals-a-lingering-global-addiction-to-fossil-fuels (accessed June 23, 2018).

Tickell, A. and J. Peck. 1992. Accumulation, Regulation and the Geographies of Post-Fordism: Missing Links in Regulationist Research. *Progress in Human Geography* 16 (2): 190-218.

Tollefson, J. 2018. Carbon's Future in Black and White: There are Reasons to be Optimistic that the World will Break its Addiction to Fossil Fuels. *Nature* 556: 422-425.

Tomain, J. and R. Cudahy. 1992. *Energy Law in a Nutshell*. St. Paul: West Publishing.

Truffer, B. and L. Coenen. 2012. Environmental Innovation and Sustainability Transitions in Regional Studies. *Regional Studies* 46 (1): 1-21.

Turnheim, B. and F. Geels. 2012. Regime Destabilisation As the Flipside of Energy Transitions: Lessons from the History of the British Coal Industry (1913-1997). *Energy Policy* 50: 35-49.

Tussing, A. and C. Barlow. 1984. *The Natural Gas Industry: Evolution, Structure, and Economics*. Cambridge, MA: Ballinger.

Tussing, A. and B. Tippee. 1995. *The Natural Gas Industry: Evolution, Structure, and Economics*. Tulsa: Pennwell.

UCS (Union of Concerned Scientists). 2015. Uses of Natural Gas. https://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/uses-of-natural-gas#.W1tEitJKg2w (accessed July 27, 2018).

---. 2017. Benefits of Renewable Energy Use. https://www.ucsusa.org/clean-energy/renewable-energy/public-benefits-of-renewable-power#.W1ttVNJKg2w (accessed July 27, 2018).

Urry, J. 2014. The Problem of Energy. *Theory, Culture & Society* 31 (5): 3-20.

U.S. Congress. 1947. *Congressional Record: Proceedings and Debates of the 80th Congress* Volume 93. Part 1.

---. 1955. Amendments to the Natural Gas Act: Hearings Before the Committee on Interstate and Foreign Commerce, 84th Congress. Government Printing Office.

U.S. DOT (Department of Transportation). 2016. Appendix D: Modal Profiles, Natural Gas Pipeline Profile. Bureau of Transportation Statistics. *National Transportation Statistics* (quarterly report) https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/index.html (accessed February 9, 2017).

U.S. EIA (Energy Information Administration). 2017a. U.S. Natural Gas Gross Withdrawals. https://www.eia.gov/dnav/ng/hist/n9010us2A.htm (accessed July 18, 2017).

---. 2017b. Table 12.1 Carbon Dioxide Emissions from Energy Consumption by Source. *Monthly Energy Review* (August). Washington: US Department of Energy.

---. 2018a. Frequently Asked Questions: How Much of U.S. Energy Consumption and Electricity Generation Comes From Renewable Energy Sources? https://www.eia.gov/tools/faqs/faq.php?id=92&t=4 (accessed April 24, 2018).

---. 2018b. *Monthly Energy Review, July 2018.* https://www.eia.gov/totalenergy/data/monthly/previous.php (accessed August 13, 2018).

Valdivia, G. 2008. Governing Relations Between People and Things: Citizenship, Territory, and the Political Economy of Petroleum in Ecuador. *Political Geography* 27 (4): 456-477.

Valdivia, G. and M. Benavides. 2012. Mobilizing for the Petro-Nation: Labor and Petroleum in Ecuador. *Focaal* 63: 69-82.

Van den Berg, A. 1988. *The Immanent Utopia: From Marxism on the State to the State of Marxism*. Princeton: Princeton University Press.

Vietor, R. 1984. *Energy Policy in America Since 1945: A Study of Business-Government Relations.* Cambridge: Cambridge University Press.

---. 1994. *Contrived Competition: Regulation and Deregulation in America*. Cambridge, MA: Harvard University Press.

Vitalis, R. 2007 (2009). *America's Kingdom: Mythmaking on the Saudi Oil Frontier*. London: Verso.

Voosen, P. 2018. Meet Vaclav Smil, The Man Who Has Quietly Shaped How the World Thinks About Energy. http://www.sciencemag.org/news/2018/03/meet-vaclav-smil-man-who-has-quietly-shaped-how-world-thinks-about-energy (accessed May 30, 2018).

Wainwright, J. 2010. Was Gramsci a Marxist? *Rethinking Marxism* 22 (4): 617-626.

Wainwright, J., and G. Mann. 2015. Climate Change and the Adaptation of the Political. *Annals of the Association of American Geographers* 105 (2): 313-321.

Walker, R. 2004. California's Golden Road to Riches: Natural Resources and Regional Capitalism, 1848-1940. *Annals of the Association of American Geographers* 91 (1): 167-199.

Walker, T. 2016. California Methane Gas Leak 'More Damaging Than Deepwater Horizon Disaster.' https://www.independent.co.uk/news/world/americas/california-methane-gas-leak-more-damaging-than-deepwater-horizon-disaster-a6794251.html (accessed July 27, 2018).

Waples, D. 2012. *The Natural Gas Industry in Appalachia: A History from the First Discovery to the Tapping of the Marcellus Shale.* Jefferson, NC: McFarland.

Ward, A. 2018. Demand for Fossil-Fueled Power Remains Strong, Says Wärtsilä. https://www.ft.com/content/fb9e304e-3b08-11e8-b9f9-de94fa33a81e (accessed May 22, 2018).

Warrick, J. 2016. California Gas Leak Was the Worst Man-Made Greenhouse-Gas Disaster in U.S. History, Study Says. https://www.washingtonpost.com/news/energy-environment/wp/2016/02/25/california-gas-leak-was-the-worst-man-made-greenhouse-gas-disaster-in-u-s-history-study-says/?utm_term=.aa4804a77518 (accessed July 27, 2018).

Watts, M. 2004. Resource Curse? Governmentality, Oil and Power in the Niger Delta, Nigeria. *Geopolitics* 9 (1): 50-80.

Watts, M. and R. Peet. 2004. Liberating Political Ecology. In *Liberation Ecologies: Environment, Development, Social Movements*, eds. M. Watts and R. Peet, 3-43. London: Routledge.

Webber, M. and D. Rigby. 1996. *The Golden Age Illusion: Rethinking Postwar Capitalism*. New York: Guilford Press.

Weinstein, B. 2016. Thanks to Fracking, America is Undergoing a Manufacturing Revival. https://www.star-telegram.com/opinion/opn-columns-blogs/other-voices/article122763739.html (accessed August 13, 2018).

White, L. 1943. Energy and the Evolution of Culture. *American Anthropologist* 45 (3) 335-356.

White, R. 1995. Are You an Environmentalist or Do You Work for a Living? Work and Nature. In *Uncommon Ground: Rethinking the Human Place in Nature*, ed. W. Cronon, 175-185. New York: Norton.

Whitehead, M., R. Jones and M. Jones. 2007. *The Nature of the State: Excavating the Political Ecologies of the Modern State*. Oxford: Oxford University Press.

White House. 2012. Remarks by the President in State of the Union Address. https://obamawhitehouse.archives.gov/the-press-office/2012/01/24/remarks-president-state-union-address (accessed August 16, 2018).

Wilkinson, P. 1973. Neo-Marxist Theory of Imperialism. *Political Studies* 21 (3): 388-393.

Wolff, R. 1978. Marxian Crisis Theory: Structure and Implications. *Review of Radical Political Economics* 10 (1): 47-57.

Wood, E. 1986. *The Retreat from Class: A New 'True' Socialism*. London: Verso.

Woods, R. 1995. *Fulbright: A Biography*. Cambridge, UK: Cambridge University Press.

WB (World Bank). 2018. World Bank Data -- United States -- GDP growth (annual %). https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=US&view=chart (accessed April 21, 2018).

Worster, D. 2016. *Shrinking the Earth: The Rise and Decline of American Abundance*. Oxford: Oxford University Press.

Wright, E. 1978. *Class, Crisis and the State*. London: New Left Books.

Wright, G. and J. Czelusta. 2007. Resource-Based Growth Past and Present. In *Natural Resources: Neither Curse nor Destiny*, eds. D. Lederman and W. Maloney, 183-211. Palo Alto: Stanford University Press.

Wylie, S. 2015. Securing the Natural Gas Boom: Oil Field Service Companies and Hydraulic Fracturing's Regulatory Exemptions. In *Subterranean Estates: Life Worlds of Oil & Gas* eds. H. Apel, A. Mason and M. Watts, 108-125. Ithaca: Cornell University Press.

Yergin, D. 1978. The real meaning of the energy crunch. *New York Times Magazine* (June 4).

---. 1991. *The Prize: The Epic Quest for Oil, Money & Power*. New York: Free Press.

---. 2011. *The Quest: Energy, Security, and the Remaking of the Modern World*. New York: Penguin.

Yeselson, R. 2017. At Labor's Crossroads. https://www.thenation.com/article/at-labors-crossroads/ (accessed September 2, 2017).

Zalik, A. 2008. Liquified Natural Gas and Fossil Capitalism. *Monthly Review* 60 (6): 41-53.

---. 2010. Oil 'Futures': Shell's Scenarios and the Social Constitution of the Global Oil Market. *Geoforum* 41 (4): 553-564.

---. 2012. The Race to the Bottom and the Demise of the Landlord: The Struggle Over Petroleum Revenues Historically and Comparatively. In *Flammable Societies: Studies on the Socio-Economics of Oil and Gas*, eds. J. McNeish and O. Logan, 267-286. London: Pluto Press.

Zimmerer, K. and D. Douches. 1991. Geographical Approaches to Crop Conservation: The Partitioning of Genetic Diversity in Andean Potatoes. *Economic Botany* 45 (2): 176-189.

Zimmermann, E. 1957. *Conservation in the Production of Petroleum: A Study in Industrial Control*. New Haven: Yale University Press.

Zuckerman, G. 2013. *The Frackers: The Outrageous Inside Story of the New Billionaire Wildcatters*. New York: Penguin.

Curriculum Vitae

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EDUCATION

Ph.D., Department of Geography, Syracuse University, 2018
Dissertation: Gaseous State: A Historical Geography of Natural Gas and the Capitalist State in an Age of Climate Change
Dissertation Adviser: Matt Huber
M.A., Department of Geography, Syracuse University, 2013
Post-Baccalaureate Certificate in GIS, The Pennsylvania State University, 2013
B.S., Department of Geography, The Pennsylvania State University, 2011

PROFESSIONAL APPOINTMENTS

Syracuse University, Department of Geography, Part-Time Faculty (2018)

PUBLICATIONS

Refereed Journal Articles

In Press Plugging the Pipeline: Realizing the Value of Natural Gas in the 1930s US *The Annals of the American Association of Geographers* (online at Taylor & Francis)

2017 "We Can't Be Dependent on Anybody": The Rhetoric of "Energy Independence" and the Legitimation of Fracking in Pennsylvania *The Extractive Industries and Society* 4 (2) 337-43 (with Matt Huber)

2015 Stacked Scale Frames: Building Hegemony for Fracking Across Scales *Area* 47 (4) 443-50

Book Chapters

Accepted, Forthcoming "Landscape and Labor" in *The SAGE Handbook of Historical Geography* (with Don Mitchell)

Book Reviews

2013 Anthony Bebbington and Jeffrey Bury, *Subterranean Struggles: New Dynamics of Mining, Oil, and Gas in Latin America* (University of Texas, 2013) *Contemporary Sociology: A Journal of Reviews* 43 (3) 436-437

2013 Melissa Bass, *The Politics and Civics of National Service: Lessons from the Civilian Conservation Corps, VISTA, and AmeriCorps* (Brookings Institution, 2013) *Contemporary Sociology: A Journal of Reviews* 42 (6) 884

2012 Tom Wilber, *Under the Surface: Fracking, Fortunes, and the Fate of the Marcellus Shale* (Cornell University Press, 2012) *Contemporary Sociology: A Journal of Reviews* 41 (5) 696-697

Manuscripts in Submission

Fanning the flame: energy, the means of production, and the capitalist state *Capitalism Nature Socialism*

Manuscripts in Preparation

The "laborless fuel": coal, natural gas, and the capitalist state in energy transitions
Igniting the crucible: natural gas deregulation and the contradictions of Fordist-Keynesianism
Beyond the fractured environmental state: capital, labor, and natural gas

GRANTS, AWARDS & HONORS

2017 Work, Labor and Citizenship research grant, Syracuse University Maxwell School, $3000
2016 Gerald R. Ford Presidential Foundation research grant, Gerald R. Ford Library, $1400
2015 Roscoe-Martin Award for dissertation research, Syracuse University's Maxwell School, $1000
2010 E. Willard Millar Award for Writing in Geography, Penn State $250
2008 Admission to Schreyer Honors College, Penn State

INVITED TALKS

2015 The livelihood of the capital circuit in Pennsylvanian shale gas development, Nature-Society Workshop, Cornell University

CONFERENCE ACTIVITY/PARTICIPATION

Sessions Organized

2018 Locating socially-just energy transitions, AAG Annual Meeting
2016 The geography of infrastructure: state, nature and capital, session organizer, AAG Annual Meeting

2014 Theorizing neoliberalism from the inside out, AAG Annual Meeting

Papers Presented

2018 A class geography of the U.S. coal-to-natural gas transition, AAG Annual Meeting
2017 Natural gas and the decline of the UMWA in the postwar U.S., Nature-Society Workshop
2017 Monopoly power and the realization problem in 1930s U.S. gas markets, AAG Annual Meeting
2016 Stacked scale frames: building hegemony for fracking across scales, AAG Annual Meeting
2015 Educating consensus for fracking in Pennsylvania, AAG Annual Meeting
2014 Energizing neoliberalism: freeing gas and capital in the 1970s, AAG Annual Meeting
2013 Scales over shale: producing Pennsylvania in another geography of energy, AAG Annual Meeting
2012 Nature in eco-Marxism, AAG Annual Meeting

Panel Participation

2018 Critically interrogating the environmental regulatory state: methodological and ethical challenges, AAG Annual Meeting
2014 Geographical research on the fracking frontier: Understanding the social and environmental dimensions of developing shale fossil fuels, AAG Annual Meeting

CAMPUS/DEPARTMENTAL TALKS

2017 The political ecology of natural gas in the 20th century U.S., Geography Colloquium, Syracuse University

TEACHING EXPERIENCE

As Instructor of Record

Human Geography (Syracuse University, Fall 2018)
Environment and Society (Syracuse University, Summer 2017 and Summer 2016)

As Teaching Assistant

Climate Change, Communications, and Policy (Syracuse University, Fall 2013)
America and the Global Environment (Syracuse University, Fall 2012)
The Natural Environment (Syracuse University, Fall 2011 and Spring 2012)

As Grader

The European City (Syracuse University, Spring 2013)
Georesources, Poverty, and Power: A Close Look at Africa (The Pennsylvania State University, Fall

2008 and Fall 2009)

RESEARCH EXPERIENCE

2017-2018 Research assistant, High performance work systems and labor relations in the Canadian automotive industry (with Tod Rutherford)

2015-2016 Research assistant, The nitrogen fertilizer industry: integrating industrial ecology and political ecology approaches (with Matt Huber)

SERVICE TO DISCIPLINE

Manuscript Review

Edward Elgar Publishing (1 book chapter)
Geoforum (2 articles)
ACME: An International Journal for Critical Geographies (1 article)

AAG

Outreach coordinator, Energy & Environment Specialty Group (2013-2015)

DEPARTMENTAL SERVICE

Graduate coordinator, Future professoriate program (Syracuse, 2014-2015)

COMMUNITY INVOLVEMENT/OUTREACH

Corps-member, AmeriCorps National Civilian Community Corps (2007)

NONACADEMIC WORK

Editorial assistant, alumni magazine "The Maxwell Perspective" (Syracuse University, 2014-15 and 2017-2018)

Program analyst trainee, student career experience program, U.S. Environmental Protection Agency (2009-2010)

COURSES PREPARED TO TEACH

Survey Level

Environmental studies, Geography (physical, human and nature-society)

200-400 Level

Environmental politics & policy, Water resources & management, Energy & the environment

Graduate Level

Political economy of nature, Political ecology, State theory

PROFESSIONAL MEMBERSHIPS

American Association of Geographers (2009-present)

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