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Scales over Shale: How Pennsylvania Got Fracked

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Abstract

Shale gas has become one of Pennsylvania's major resources in recent years and the gas boom has proceeded in spite of uncertainty over the environmental risks of its production process. This thesis argues that location alone cannot explain why shale gas boomed in Pennsylvania. Using interviews with corporate and state executives, I argue that the scalar dimensions of the neoliberal environmental governance of shale gas were critical to understanding why shale gas boomed in Pennsylvania. These actors supported the preemption of local scales of governance by the state as a scalar fix for capital accumulation from shale gas development. They also legitimated the scalar fix by assembling a neat stack of scale frames that made shale gas seem to benefit everyone. These scale frames made shale gas appear as if it would provide local employment, regional supplies of cheap gas, national energy security, abundant gas for tight global markets, and a mitigating strategy for global climate change. In arguing this point, I present a history of how shale gas became a resource that outlines the critical role of the state in that process.

Scales over Shale:
How Pennsylvania Got Fracked

By

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Chapter One: Introduction

I undertook this study in Pennsylvania, a state in the Northeastern United States, and a place with a rich history of energy resource booms. The story begins with two Drakes. Edwin L. Drake was a drifter who assumed the identity of a military officer and eventually died a pauper. Drake might have simply faded into the footnotes of history except that in 1859 he became the first American to intentionally strike oil (Black 2003, 68). Drake struck oil on a spot in Northwestern Pennsylvania near the small town of Titusville. Following Drake's discovery, prospectors and veterans from the Civil War flooded in to stake their claims in the oil field. The oil they found was sold in Pittsburgh, where it replaced whale oil used for illumination (ibid., 19-20). With steady markets for oil in urban centers and plenty of available labor, an oil rush ensued.

Pennsylvania's first oil rush was an environmental disaster. Oil drillers clear-cut the sylvan landscape and used the wood to build a forest of oil derricks. Their leaky barrels turned the creeks and tributaries into oil slicks. Oil drilling was so disastrous to the environment that the oil field around Titusville became known as a "sacrificial" zone (ibid., 61). Six years after Drake's discovery, the oil stopped flowing and what was left of the deposit was abandoned to the depths. Prospectors and capital fled, and only rotting oil derricks and muddy hills remained (ibid., 66). Edwin Drake had touched off the first energy boom and bust in Pennsylvania's history. A century and a half later, another Drake watched as a new energy boom unfolded across his own Pennsylvanian backyard.

Drake Saxton has intimate experience with Pennsylvania's recent natural gas rush. Drake and his wife Andrea have spent twenty-five years building their life in the bucolic hill-and-valley topography of Northeastern Pennsylvania. Their rustic bed-and- breakfast, which they designed

and partially built themselves, sits alongside a calmly meandering creek. To Drake and Andrea, their business is not just some investment, but a symbol of their life together. Soon after natural gas drilling began in the fields around their home, gases began migrating from below the surface. Methane, which is explosive in large concentrations, now gathers in the headspace of their water well. Fortunately, Drake and Andrea had the foresight to test for methane before drilling began. The results had come back negative for methane contamination in their home. Following the drilling, the gas company responsible for the development also tested Drake and Andrea's home for fugitive methane. When the company's results showed no contamination, Drake and Andrea insisted that more tests be undertaken. They were recommended to pay for more testing out of their own pockets (interview with Drake Saxton and Andrea Young, 7/13/12). Drake and Andrea's life in the countryside has been held captive by natural gas drilling in the Marcellus shale.

I interviewed Drake in the summer of 2012, approximately four years after the boom in shale gas development began in Pennsylvania. Already the nearby drilling had severely disrupted their quality of life. Drake told me how methane now collects in their water well, percolates into their tap water, and bubbles up in the creek behind their home. Mr. Saxton has written letters, protested, sat for interviews, and led a grassroots organization that demands the gas industry be more accountable to people living nearby. Drake wasted no time in speaking to Act 13, Pennsylvania's latest legislation governing shale gas development. Drake felt that Act 13 was just one symptom of a broken political system that had made him "sacrificial" (interview, 7/13/12). Drake Saxton summoned up the same word that was used to describe Edwin Drake's Titusville from a century and a half ago, to describe his contemporary predicament (interview, 7/13/12). From my seat in Drake and Andrea's living room I began to wonder: "Why had their

life in rural Pennsylvania been sacrificed like the environment around Titusville in Edwin Drake's day?" The most obvious answer is that their home was in the wrong place, because gas was in the right one.

Location of Pennsylvania Relative to Northeastern Markets

Drake and Andrea's home in rural Pennsylvania is one site within a wider US geography of increasing natural gas production. In 2006, gross withdrawals of natural gas in the US began rising after a decades-long production plateau (US Energy Information Administration 2013a). The rise reversed a downturn turn that began in 1971 and persisted, through fits and starts, for thirty-five years. The respite from decline can be credited exclusively to increased extraction of gas from shale formations (US Energy Information Administration 2013b, 2). Early media coverage attributed the rise to innovative drilling techniques that allowed economical gas extraction from shale strata below Texas, Louisiana, and Pennsylvania (Krauss 2008). However, the engineers and roughnecks who used these techniques could have only been employed after enormous investment in the business of gas drilling followed the economic downturn of 2007.

The rise in natural gas production in 2006 coincided with a decline in US housing prices, a precursor to the subprime mortgage and financial crisis of 2007 (Tully 2006). As industries, home-building and consumer spending slowed down, investment in shale gas extraction increased. The threats of resource and raw material shortage that preceded the financial crisis, brought on by speculation and rising demand, were replaced with the looming shortage of available credit (Bridge 2009, 1238). With the housing market collapsing around them, wealth managers scrambled for profitable investments and found a safe harbor in shale gas extraction projects. Between 2006 and 2012, oil and gas companies raised billions for shale gas extraction (Krauss and Lipton 2012). In one case, a Chinese oil company (who opted for confidentiality)

single-handedly dumped a few billion dollars' worth of US Treasury bonds into Chesapeake Energy, a natural gas company with a large stake in the Marcellus (ibid.). In the wake of the economic recession, CEOs of natural gas companies were trumpeting investment in natural gas, telling investors it was "time to get bullish" about drilling the stuff (Urbina 2011a). In particular, investments in shale gas were pouring into rural parts of Pennsylvania.

Pennsylvania has become the indisputable hub of shale gas production in the Northeastern US. Between 2004 and 2011, Pennsylvania's natural gas production increased to more than the production from Kentucky, Maryland, New York, Ohio, Tennessee, West Virginia and Virginia combined (US Energy Information Administration 2011a). In 2001, the Pennsylvania Department of Environmental Protection (PA DEP) permitted one gas company to drill an unconventional gas well, in keeping with the broader historical trend of little-to-no unconventional well drilling (PA Department of Environmental Protection 2013a). But between 2008 and 2012 the PA DEP issued more than eleven thousand unconventional well permits to the gas industry (PA Department of Environmental Protection 2013a). Why the sudden increase? One of the most basic geographical concepts could explain the boom in Pennsylvania: location.

Pennsylvanian gas producers are often in a favorable location relative to their surroundings. Markets for natural gas are located in areas where winter temperatures are frigid and natural gas can be used for heating. Natural gas is also sold in industrialized zones, as manufacturing can absorb a large amount of supply. Pennsylvania's location in the vicinity of urban and industrial areas in the Northeastern US makes its natural gas cheaper than the gas from Texas, Louisiana and the other major state suppliers (US Energy Information Administration 2013c). The reason for the cheaper price has to do with the cost of compressing and transporting gas through pipelines - a considerable slice of the total price of gas (Natural Gas Supply

Association 2011a). Consequently, gas from rural Pennsylvania costs less in cities along the East Coast than gas piped from the Gulf Coast. Finding a supply of natural gas so close to the Northeastern markets was like, as Bill McKibben said, "…discovering an underground deposit of beer directly beneath Yankee Stadium" (McKibben 2012). However, Pennsylvania's location cannot fully explain the recent explosion in drilling activity.

Location alone does not explain why it is that shale gas boomed in Pennsylvania. The following figures explain this argument visually. Figure one shows the geographic extent of the Marcellus shale, the geological basis of shale gas development in Pennsylvania and surrounding states. Figure two shows the average drilling-rig count over the past twenty-five years in Pennsylvania and the four other states that are delineated above the Marcellus. The steep rise in drilling in figure two corresponds to an increase in drilling for unconventional gas deposits in the commonwealth between 2007 and 2012, which was not matched in the other four states (PA Department of Environmental Protection 2013a). This is a curious spatial pattern. All five states share a physical geography that allows for shale gas development but only Pennsylvanians rushed to drill into the rock layer for gas, while the other four delayed. The disparity in drilling activity could be explained by the environmental risks that came to be associated with shale gas.

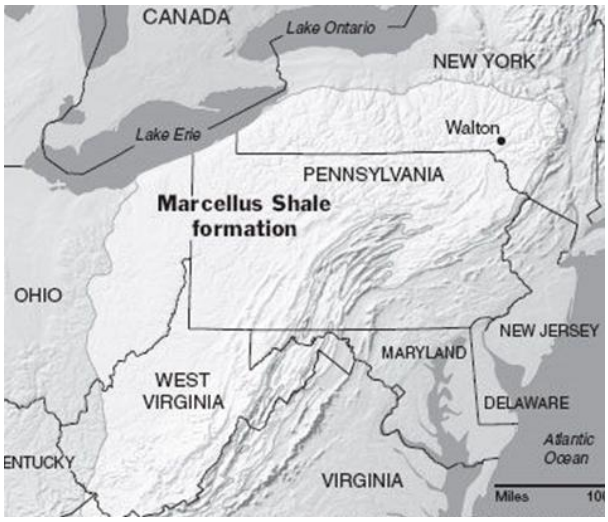

Figure 1: Location of the Marcellus shale (Source: American Association of Petroleum Geologists).

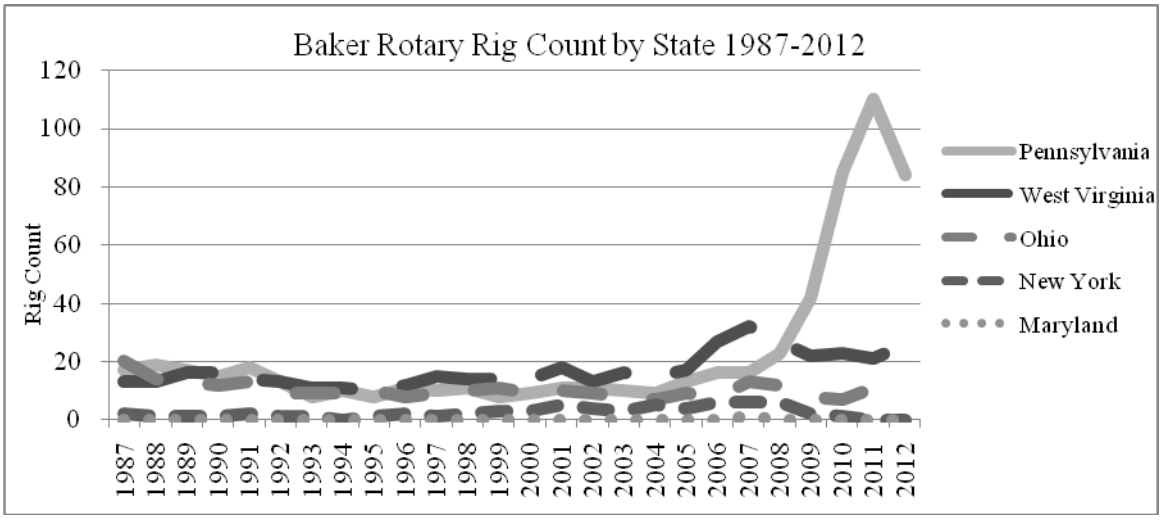

Figure 2: Number of drilling rigs in operating above the Marcellus formation, 1987-2012 (Baker Hughes 2013)

As Drake and Andrea discovered firsthand, the recent increase in natural gas production has been plagued by controversy over the environmental impacts of gas extraction from shale. Environmentalists have targeted the production method for shale gas: hydraulic fracturing, also known as fracking. In Dimock, Pennsylvania, residents complained that methane had gathered in their water wells following fracking (McGraw 2011; Wilber 2012). Methane was causing explosions and methane migration into water supplies (Fox 2010). During the process of completing shale gas wells, an enormous amount of wastewater is produced that cannot be cleaned (Henry and Galbraith 2013). The chemicals that permeate produced water are a hazard to human health (Colborn et al. 2011). Shale gas drilling also raises air pollution, a lesser evil of a water-intensive industry, but one that poses risks to respiratory health (Wolfgang 2012). Although the impacts of shale gas drilling on aquifers, water quality, and human health are not conclusive, they pose risks that are not fully understood. These uncertainties have moved politicians to halt shale gas development in other states.

In 2008, former Governor of New York David Paterson put a halt to Marcellus development because of doubts concerning the safety of hydraulic fracturing (Wilber 2012, 64–

68). Two years later the New York State assembly passed a moratorium on fracking, pending further review of its potential environmental impacts by the NY State Department of Environmental Conservation (Navarro 2010). The moratorium on fracking was not made permanent, and if the reported lobbying efforts of drilling companies succeed in Albany (Kaplan 2011), fracking may ensue in the Empire State. Meanwhile, the environmental risks of the shale gas boom have elicited a muted response from the federal government.

Development has proceeded without immediate regulatory interference on the part of the federal government, including the Environmental Protection Agency (EPA). In his 2012 State of the Union address, President Obama touted the potential for shale to provide a century's worth of gas. He made no special mention of the potential risks to the environment and public health from such large-scale implementation of shale gas development (Obama 2012b). Studies have been initiated, and agreements for interagency cooperation have been made, but no regulatory actions have been taken (Lustgarten 2010; Obama 2012a). Overall, uncertainty over the health and environmental effects of shale gas development has been met with calls for further study while drilling proceeds apace. This thesis will attempt to explain why drilling in Pennsylvania occurred in light of the environmental uncertainties of shale gas extraction.

Argument

Shale gas development in Pennsylvania proceeded in spite of its environmental risks for two reasons. Capital required a "scalar fix" following the 2007 financial crisis for profitable accumulation of capital to continue (Smith 1995; Brenner 1998; Boyle 2002). Therefore, further economic growth governed by capitalist social relations required a territorial configuration that could integrate the technology, labor, infrastructure and natural resources necessary for continued accumulation (Brenner 1998, 462). In practice, the scalar fix involved the

circumscription and hierarchization of Pennsylvania in relation to other scales (ibid., 464). The actors involved in the governance of shale gas *entrenched* the state scale. To do so, the governor, in consultation with a public-private partnership, quashed local ordinances that might have limited development by preempting local authority over shale gas drilling. However, fixing Pennsylvania as a scale for gas production was only one step, albeit an essential one, toward a larger hegemonic project.

The primary reason development proceeded in spite of environmental risks was because development served the interests of a powerful set of political agents who had "permeated" the internal structure of the state (MacLeod and Goodwin 1999, 516). The interests of these agents were diffused in the form of persuasive legitimations that perpetuated definitions of correct or "natural" forms of economic activity (Boggs 1976, 39; Joll 1977; Simon 1982). The production of these hegemonic logics in support of development took the form of "scale frames" that were neatly-stacked, one on top of the other, offering the semblance of total trans-scalar beneficence (Kurtz 2003). These scale frames were deployed strategically to rationalize the production of shale gas, serve the interests of gas companies, and justify Pennsylvania's environmental sacrifice. These points were gleaned from primary data gathered from government officials and executives.

I reached these points after interviewing a handful of commissioners on the Marcellus Shale Advisory Commission (MSAC). The MSAC was a public-private partnership between the Pennsylvania Department of Environmental Protection (PA DEP), business representatives, and a few non-profits. Pennsylvania's governor, Tom Corbett, asked the MSAC to provide recommendations on how to revise the state's oil and gas laws. Their report served as the foundation for the "Corbett Plan," many facets of which became the laws contained in Act 13 of

2012 (Rabe and Borick 2013). My analysis of these interviews revealed how commissioners on the MSAC were relating Pennsylvania's boom to other places. Their responses seemed to suggest how shale gas from Pennsylvania would benefit localities, the state, the nation, the international energy market, and the globe. Overall, it was important for the commissioners on the MSAC to frame Pennsylvania in relation to other scales when considering shale gas extraction. Having established the main points, the following section will bring this study into conversation with the wider literature in geography.

Literature Review

During my interviews with the MSAC the focus was not on all the idiographic details that have made Pennsylvania different from other places (although some interviews did unfortunately descend into that type of review). Instead, I was interested in how people conceptualize the relationship between Pennsylvania and other places. As theoreticians in geography have concluded, the geographic concept of scale is an appropriate analytic for thinking through relation (Howitt 1998), especially how places are related to each other.

Overall, scale is an abstract notion that is difficult to characterize (Herod and Wright 2002; Sheppard and McMaster 2004; Marston et al. 2005). However, over the past fifteen years, the literature on scale in human geography has coalesced around a few points. Firstly, traditional scales like the local, state, regional and international can obscure other scales produced through networks of dependence and association between places (Cox 1998). Secondly, when capitalism undergoes a crisis of overaccumulation, the state reterritorializes space to ease the introduction of a new regime of accumulation, and through that process, scales have become fixed and fluid through time (Brenner 1998). Finally, scale is not simply a hierarchy of containers, or a "sizing chart" for space, but is instead defined by its inherently *relational* aspect (Howitt 1998). These

literatures are part of a wider push in geography to examine the social origins of scales rather than treating scale as a setting for social processes.

Scale research in human geography over the past few decades begins with the notion that scale is not a set of immanent boundaries for organizing space(s) but rather is socially produced (Smith 1992; Brenner 1998; Howitt 1998; Marston 2000). In the early nineties, Neil Smith began a critique of the scales set by official control and proposed a politics of scale based in everyday action (Smith 1992, 60). Following Smith, studies of the social production of scale have examined moments when scales were unfixed and reconfigured by regional, national, and transnational governance institutions (MacLeod and Goodwin 1999; Boyle 2002; Mansfield 2005). Scale has been the object of analysis in studies of the environment (Zulu 2009; Harris and Alatout 2010; Pesqueira and Glasbergen 2013), environmental justice (Sze et al. 2009), political ecology (Engel-Di Mauro 2009; Neumann 2009; Rangan and Kull 2009) and resource extraction (Huber and Emel 2009). Further, literature on the social production of scale in environmental politics has explored the political strategies that guide the production of scale(s).

Scale literature has focused on how the politics of scale are practiced by actors involved in political disputes over environmental issues. Bolivian campesinos in disaggregated communities of workers across the country organized a national opposition movement against international capital that wanted to ship natural gas from Bolivia to Chile (Perreault 2006). Environmental groups adopted a multi-scalar "war of position" strategy in their struggle against a Canadian firm that sued the US government for future losses of profit (McCarthy 2005). In McCarthy's case, the Canadian firm couched California's environmental regulations in terms of violating an international agreement, a chapter of NAFTA, that prohibited "regulatory taking" of private property on the part of the state (ibid., 740). Environmental groups have framed their

concerns in scalar terms to "push up" (Harrison 2006) the scale of their local conflicts, to broaden the relevance of their particular concern by framing it as constituting environmental injustice and driving global climate change (Kiel and Debbane 2005; Lindseth 2006; Barrett 2012). Further, the materiality of biophysical processes has been shown to set particular conditions and constraints on the socio-political processes of scaling resources and ecosystems (Sayre 2005; Huber and Emel 2009). These studies have contributed to filling a need for scale literature that includes the reproduction of environmental conditions (McCarthy 2005, 732). Like these literatures, this thesis also aspires to McCarthy's call for environmentally-focused scalar research. In the following section, two theoretical dimensions of scale that this thesis draws upon in particular will be explained.

Two theories of scale make it the appropriate concept for understanding the MSAC's role in perpetuating Pennsylvania's shale gas rush. First, over the past twenty years, geographers and other spatial thinkers have shown how scales have been grown, shrunk or rearranged according to the social actors who invoke them (Smith 1995; Brenner 2001). The notion of scale as a set of concrete boundaries for organizing space gradually eroded and was replaced with the idea that scale is a set of malleable containers (Smith 1995). A persistent theme in the literature was how levels within a scale assumed a hierarchical structure (Brenner 2001, 597; McCarthy 2005; MacKinnon 2010). Without taking into account the hierarchical aspect of scale, this spatial idea might be confused with others, like place or space. Indeed, this common mistake was what Neil Brenner referred to as the use of scale in its "singular" sense (Brenner 2001, 599). Brenner observed that scale was different from place or space because certain levels within a scale were made to seem more or less important than others over time. Brenner called this process "hierarchization and rehierarchization" (ibid., 600). Without hierarchy, scale may be

misconstrued as a politically-neutral metaphor for "cascading" spatial abstractions like the body, home, neighborhood, locality, nation or globe (Marston et al., 2009). On balance, the preceding apolitical definition of scale does not share much in common with the results of this thesis. Instead, it was found that powerful actors in corporations and state institutions rearrange how scales are related hierarchically with significant consequences in terms of environmental despoliation and economic plunder (for similar conclusions see Huber and Emel 2009). Having established the basis for an understanding of the essential role of hierarchy in scale theory, the next section will examine the arguments for scale frames in the literature.

Scale literature has shown how social groups can deploy scales strategically to broaden the reach of their concern. During contentious land use decisions, like the siting of a plastic factory or a natural gas pipeline (Kurtz 2003; Lindseth 2006), opposing interests have emphasized the scalar dimension of their object of concern to advance their particular agenda. In particular, geographers have shown how the global is a *hegemonic* scale in the current phase of globalized capitalism (MacLeod and Goodwin 1999). An invocation of the global scale calls forth a pervasive, ubiquitous nexus, regulated by competition and mediated by market relations and is an extremely useful rhetorical device (Smith 1995). Invocations of the global have been used to diffuse responsibility for problems like climate change, draw attention towards economic competition between nation-states, and marginalize cities that pursue local-scale solutions to global problems (Lindseth 2006). In sum, scaling an issue in relation to the global market can be a hegemonic practice, which seeks to legitimize elite class power as common sense. However, scale is a double-edged sword, and can also be used for defending the health and environments of the working poor. The following two studies illustrate how scales have been used as *framing* devices in struggles for environmental justice.

Invoking global capitalism is not always the most effective means of winning a political and environmental conflict. For example, Hilda Kurtz showed how environment justice advocates successfully opposed the siting of a plastic factory in their neighborhood by scaling up their struggle from a local fight to a national conflict. Justice advocates reframed the plant from a potential global competitor in the petrochemical industry, to an example of perennial environmental racism. In their words, the proposed facility was endemic of the disproportionate siting of noxious and polluting industries in communities of color in the US (Kurtz 2003). State authorities that supported the factory retaliated with their own "counter-scale frames" that framed the facility in terms of economic activity that would take place at the state scale. Authorities used these counter-scale frames to undermine the framing of the facility in terms of a national civil rights violation by calling attention to the Caucasian presence in the community (ibid., 907). In the end, the local community prevailed when they embedded their conflict in the national problem of environmental injustice. However, local scales are not always the site of resistance against the hegemony of state and capital. Actors involved in the pursuit of *unjust* social outcomes can also use local scale frames to aid their agendas.

In cases of environmental pollution, the scale of chemical spills can itself become a platform for discursive contestation. In the case of pesticide drift in California, it was found that state government officials attempted to "push down" (Harrison 2006, 519) local scales to downplay the severity of these accidents. In point of fact, pesticide drift was not just a set of isolated incidents as state officials said it was (ibid., 508). Instead, the over-application of harmful pesticides occurred in regular intervals and in close proximity to migrant worker housing. In spite of this, state officials framed the systemic problem of pesticide drift as a local problem. By scaling the problem from a state or regional issue down to a set of local,

disaggregated incidents, the state could justify regulatory devolution. This worked to the officials' benefit, because avoiding a scaling-up of pesticide drift meant that regulatory power could remain in the hands of local inspectors. These inspectors traversed a revolving door of paid employment between their local government offices and the industries they were supposed to be regulating (ibid., 516). Consequently, violations frequently went unreported or under-enforced, which pleased the officials' contacts in agribusiness. The preceding two aspects of scale, its hierarchization and its use in framing political struggles, greatly informed this thesis and allowed it to enter into conversation with the broader literature. Specifically, this thesis contributes to a recent debate about scale in geography.

Deep ambiguity has emerged about the appropriate use of scale and a debate in the literature has ensued. Some say scale should be used to chronicle the changing politics of the body and the home (Marston 2000). Others counter that studies about scale should really explain the relations between different scalar "levels" (Brenner 1998; Sayre 2005, 285). This debate has not been neatly resolved and has been (correctly) labeled a "disconnected nondebate" (Marston and Smith 2001; Purcell 2003, 320). However, some have issued a call to abandon scale as a geographic analytic entirely (Marston et al. 2005).

The results of my study counter Marston et al.'s (2005) argument for the need to abandon scale completely because of its hierarchical aspect. Marston et al. propose a so-called flat ontology, the horizontalization of scale. However, this study found that the state scale was fixed in hierarchical relations with the local scale, and scale frames that positioned scales in hierarchical relation to each other legitimated that development. Therefore, this study confirms that hierarchy is what differentiates scale from other geographical notions like place and space

(Brenner 2001, 597). This thesis also broadens our understanding of the scales produced through neoliberal governance.

The MSAC was a prototypical neoliberal governance project. As previously mentioned, the MSAC was a public-private partnership between the Pennsylvania state government's environmental branch (PA DEP), corporations, gas companies and a few nonprofits. As David Harvey has observed, public-private partnerships allow consultants from the private sector to become intimately involved in the crafting of state regulatory frameworks (Harvey 2005, 85). The MSAC provided a setting for state employees involved in environmental regulation to collaborate with corporate interests. However, the foundation of the partnership in the state's environmental branch (the PA DEP), differentiated the MSAC from other types of neoliberal governance practices.

The MSAC was also, and more specifically, a prototypical neoliberal *environmental* governance project. Although the MSAC included a few members of environmental NGOs, most of the thirty commissioners represented companies that would benefit from developing shale gas. Therefore, actors internal to the governance project were obligated to manage nature and natural resources "in such a way as to favor market-based actors and practices" (Bridge and Perreault 2009, 487). One of the central tasks of environmental governance, as a practice that is "all about scale" (ibid., 479), is to create the scales through which environmental governance is practiced. Literature on scale in environmental governance theorizes scale as a processual outcome of the governance process (Bulkeley 2005). The processual understanding of scale in literature on environmental governance begins with the idea that scale is "a produced outcome of political-economic activity" (Bridge and Perreault 2009, 479). Further, this study challenges literature in

environmental governance to confront the differences between energy and other natural resources.

In the discipline of geography, concepts like neoliberal environmental governance are on the cutting edge of research. Unfortunately, scholars have yet to turn these sharp analytical tools towards the topic of energy directly. Environmental issues and energy issues are inextricably linked, but the literature on "energy governance" does not yet fully engage with concepts from the critique of political economy (Goldthau and Witte 2009; Florini and Sovacool 2009; Fritzsche, Zejli, and Tänzler 2011). This thesis hopes to integrate understandings of broad-scale political economic change like "neoliberalization" with an emerging literature on *energy governance* (Brenner and Theodore 2002). An explanation for how that integration might take place is put forward in what follows.

The MSAC was a neoliberal environmental governance institution because it brought together people from the state and the private sector that managed natural resources in a way that benefited market actors. However, the MSAC was also an *energy governance* institution. Energy and the environment are closely linked, but energy holds a special role as foundational to the reproduction of the capitalism. Providing the Pennsylvanian economy with energy not only affected the natural environment, but it provided the fuel for essential social relations of production within the capitalist system (Huber 2009a). In this work, Huber has argued that fossil fuels, like natural gas, should be reconsidered as constitutive of the social relations of production, and calls for recognition of the fossil fuel dependency of capitalist modes of production. This thesis borrows from Huber's conclusion and extends it, to say that the foundational role of fossil energy to capitalist social relations is a key aspect of the neoliberal governance practices of environmental institutions. Together, these notions create a space for

studies that grasp the necessity of fossil fuels to the capitalist mode of production and their increasing governance by public-private institutions that seek market-oriented outcomes under neoliberalization. Finally, this thesis also contributes to a broader sub -discipline of geography.

This thesis contributes to new geographies of energy, an emerging and exciting new direction within the discipline. Geographies of energy draw from natural resource studies and histories of technology, and explain trends using theories of political economic change. Geographies of energy are grounded in accounts of energy booms and periods of scarcity that complicate peak-resource alarmism (Bridge and Wood 2010; Bridge 2010; Bridge 2011; Huber 2011). Geographers venture into the flashpoints of energy geopolitics, providing critical insight on the resource curse hypothesis, globalizing energy markets and regional energy networks (Watts 2004a; Bridge 2004; Bouzarovski 2009). Geographers have worked alongside colleagues in energy studies to explore how space, place, territory and scale can inform the transition toward lower-carbon emitting fuel sources (Bridge et al. 2013). Crucially, this area of research has revealed how plentiful, highly concentrated energy fuelled the political economy of modern automobile-centric, single family home geographies (Huber 2008; Huber 2009a; Huber 2009b; Huber 2012; Huber 2013). In sum, this thesis hopes to contribute an empirical case study of the scalar dimensions of Pennsylvanian shale gas governance to these new geographies of energy. Having established some literatures to which this thesis could contribute, its structure is explained in the following section.

Methods

I arrived in Pennsylvania's state capital, Harrisburg, in June 2012 with a copy of Tom Wilber's book, *Under the Surface* (2012), some newspaper clippings, and no approval from my University's internal review board (IRB). It took a few weeks for the IRB to clear my study so I

spent the interim time reading Wilber's book carefully and familiarizing myself with local politics. As soon as the IRB approved my study I started emailing and calling people I had read about. The first response was from Patrick Henderson, the energy executive of the Governor's cabinet. It was Henderson who drew my attention to the MSAC. He argued that the MSAC had accomplished significant regulatory achievements for the environment and the state's economy. Just from my passing familiarity with the acrimonious public response to aspects of Act 13, I knew that could not be the complete story.

The MSAC seemed to be less beneficent than how Henderson had described it. Henderson had credited them with producing "a comprehensive, strategic, plan for the safe, responsible development of natural gas in Pennsylvania" (Interview with Patrick Henderson, 6/26/12). However, during one of the public meetings of the MSAC, the president of an environmental group was reported to have tweeted "Enviros (an abbreviation for environmentalists) just being rolled" (Gilliland 2011b). Henderson's description of the MSAC as a seamlessly inclusive and comprehensive project was inconsistent with the environmentalist's tweet. This inconsistency drew me towards the MSAC and sparked my interest in their role in the shale gas boom.

I interviewed six commissioners from the MSAC, including Henderson, during the summer of 2012, one year after the MSAC submitted their final report to the governor. I reached out to former commissioners of the MSAC and interviewed as many as would respond. I tried to access how they related Pennsylvania's recent boom in shale gas development to other scalar levels like the region, the US and the globe (see the appendix for my interview questions). Because many of the MSAC's former commissioners did not reply to requests for interviews

(and the Syracuse University Department of Geography had provided funds for three months of field work) I collected as many interviews as possible with other experts.

I contacted one hundred and eight individuals and conducted twenty-two interviews in total. I gathered these additional contacts from reviewing secondary sources and looking up their contact information on the internet. I had the chance to speak with experts who had written dissertations and reports for NGOs about shale gas. Transcribing the interviews with these experts provided me with a synoptic perspective. I used their responses as a learning opportunity about the topic and I parsed common threads from their arguments for and against shale gas development. Although this thesis is focused on the MSAC, the comments of these experts deserve mentioning.

A series of perspectives emerged from my interviews with experts outside of the MSAC. Energy has to come from somewhere, and natural gas is one potential source. Shale gas has tremendous economic potential for the state and is a tremendous opportunity to collect tax revenues. Water pollution from hydraulic fracturing is not as bad as the water pollution from mountain-top removal or acid-mine drainage. The impacts of shale gas development on local communities can be a strain on schools, emergency services and other bureaucratic infrastructure. All told, these points raise many questions for future research. Indeed, topics such as the potential for job creation and water pollution from shale gas development have been examined in great detail by NGOs and research firms (Food & Water Watch 2012a; Food & Water Watch 2012b; AEA Technology 2012), and are not the direct focus of this thesis. As my research progressed I became increasingly directed towards the neoliberal environmental governance practiced by the MSAC.

What emerged from my interviews with former MSAC commissioners was a complex set of relationships between Pennsylvania and other places. Out of these data I coded two points, one about hierarchization and the scalar fix (Smith 1995; Brenner 1998; Brenner 2001) and the other concerning scale frames (Kurtz 2003). It was during the coding and analysis phase, I saw how the state scale had been repositioned relative to other scales. I could also recognize how Pennsylvania was being situated towards the center of an evolving US energy landscape, which was being legitimized through a series of scale frames of extraction from US soil.

Plan of This Work

This thesis is organized into three main body chapters plus a concluding chapter. The second chapter is a historical narrative containing some background on how shale gas came about, both geologically and socially. Because shale gas is so new, the first chapter tells the story of how shale gas became a resource and traces the network of social relationships that allowed that "becoming" to take place. The third chapter provides an analysis of the scalar fix of the state scale, and also the local and regional scale frames produced by the MSAC to legitimize shale gas development. The fourth chapter explains the national and global scale frames that the MSAC used to legitimize shale gas development in Pennsylvania as universally beneficent. In the concluding chapter, I recap my main points and offer some wider implications of this work.

Chapter Two: How Shale Gas Became a Resource

This chapter will provide a background to Pennsylvania's recent boom in natural gas production using the functional and dynamic definitions of natural resources from resource geography (Zimmermann 1957, 7–8). Too frequently natural resources like shale gas are taken for granted as either free gifts of nature or the result of some indefatigable human spirit for discovery. Library shelves are littered with triumphant narratives of enigmatic and dauntless entrepreneurs that wrench forth the hidden treasures of the Earth for the benefit of the less adventurous. Edwin L. Drake's discovery of oil in Titusville is just one notable example. These teleological histories center on titans of industry and genius inventors. From Carnegie and Rockefeller to Edison and Bell, frequently these narratives bracket off technical achievements of entire industries as the work of one (usually) man, above all others. Shale gas is no exception to these types of narratives. George P. Henderson is the unrelenting risk taker most often cited as kick-starting the shale gas "revolution" (Yergin 2011a, 325–327). By displacing the lone, saint-like progenitor from histories of resources and industries, resource geographies on materials like shale gas can chart the gargantuan blunders and destructive forces of greed and wrath that brought these deposits into humanity's grasp. In sum, natural resource histories can be stories about real humans acting socially with one another, instead of hero worshipping.

Resource geographers write against these teleological histories by focusing their scholarship on the economics, states, and politics that produce resources. From the 1950s, resource geographers like Erich Zimmermann were proposing theories of natural resources that placed society in more intimate relation with the raw materials of nature. To Zimmermann, "The answer is simple, … as is maintained through this volume, 'resources *are* not but *become*, resources evolved out of the dynamic triune interactions of natural, cultural and human forces'"

(Zimmermann 1951, 174). To study this "triune," Zimmermann picked moments when natural resources stopped being the "neutral stuff" of the biophysical world and entered into social relations of production (Zimmermann 1957, 7). From this early stage, resource geographers have made the point that resources expand, contract and become available according to human need and, more importantly, in response to human culture (ibid.). Zimmermann's foundational conceptualization of natural resources as "becoming" through human agency and culture has been refined and expanded by the following studies.

Scholarship on the social dimension of so-called "natural" resources has been deepened by studies in resource geography undertaken since Zimmermann's time. These studies indicate an increasing correlation between human needs and efforts and the growth of resource supply, production and consumption. Consequently, concerns have arisen about the sustainability and justice of reducing ever more of the earth into raw materials and commodities. A unifying characteristic of these new resource geographies is an adherence to the social aspects of biophysical resources. Resource geographies examine the global resource supply crisis in terms of the intractability of resource production for profitable use, standards of high-level consumption, and state rhetoric that avoids limits to growth (Emel and Bridge 1995, 321–323). The use and sharing of access to natural resources is examined through the lens of ideological difference; specifically in philosophical and political economic theories of property, rights and liberty (Emel, Roberts, and Sauri 1992). Resource geographers acknowledge the biophysical materiality of resources and also demand a recognition of their social dimension, specifically the technical and scientific practices that bring aspects of nature into the social realm (Bakker and Bridge 2006). Resource geographies confront the social changes that transform components of the non-human world into value-bearing elements (Bridge 2009, 1220–1221). As this brief

review has shown, resource geographies highlight the economics, politics, and ideology that produce the "neutral stuff" of nature into existence. In sum, resource geographies differ from teleological histories when they account for the human labor that transforms material from Nature into exchange-value bearing commodities (Marx 1975, 71). In what follows, I am going to tell the story of how shale gas became a resource.

Shale gas was not the result of mankind's technological triumphs over nature, as eminent oil historian Daniel Yergin would have us believe (Yergin 2011a). In his view shale gas was the stupendous achievement of indefatigable entrepreneurs, who wrested resources from the unforgiving soil for the benefit of all (Yergin 2011a, 325–327). In point of fact, shale gas is a natural phenomenon that only recently became a resource through a combination of massive government spending and environmental deregulation. This chapter will chronicle the becoming of shale gas as a resource - the circumstances through which shale gas was transformed from a geologic phenomenon into an extractable asset.

I have organized this chapter to cover the biophysical aspects of shale gas and society's role in the becoming of this resource, specifically the political economy of shale gas. I begin with the biophysical basis of shale gas development, its presence as a geologic circumstance located in the Earth's crust. Next, I chart a brief history of the becoming of natural gas to contextualize the significance of shale gas in that broader resource market. Next I delve into the origins of the technology developed for shale gas production to find that the social relations between corporations and the state were essential to the becoming of shale gas as a resource. Following that, I contextualize the rapid growth of shale gas development as a consequence of the 2008 financial crisis and capital's search for safe harbors for profitable investment. In the penultimate two sections I show the regulatory hurdles that shale gas surmounted in becoming a resource.

These sections are an examination of the evolution of shale gas regulation from its roots in federal natural gas policy to its enactment in Pennsylvanian state policies. Before closing, I offer two examples of the public's response to shale gas regulation in Pennsylvania to exemplify the contested social politics of this resource's becoming.

Devonian On

What follows will outline the biophysical basis of shale gas development, the geologic production of shale gas within the geosphere. About four hundred million years ago, little plants covered the Earth. Life on the surface was mostly non-sentient, so the real action was happening in the massive oceans. Indeed, marine life was plentiful in the Devonian sea. For instance, a species called a placoderm prowled the depths with massive jaws and armor-plate bones (Goldring 1978). When organisms like the placoderm would die, perhaps from biting off too much fish and choking, they would sink into the abyss where their bodies would fossilize into the clay or simply decompose. The decaying organic matter mixed into the ocean floor, piled up, and turned into rock very slowly through forces of geologic heating and compression. As heat and pressure from the Earth hardened the ocean floors into shale, the particles of organic matter from the terrestrial vegetation (or little bits of our charming friend the placoderm) were cooked into methane gas. Clay particles are very tiny, so they can be packed in very tightly with the bubbles of gas. Consequently, these small pockets of methane can only be seen when magnified by powerful microscopes. Because methane is lighter than air, it would rise and shift into tiny cracks formed by tectonic compression and expansion through the millennia (Curtis 2011). No one besides a few scientists cared much about the shale or its gas until about four hundred million years later. Finally, by the mid-nineteenth century, shale gas became of interest to humanity as a source of light and heat.

Methane is a hydrocarbon, and the principle component of natural gas, a flammable fossil fuel that industrial societies have prized for its energy upon combustion (Natural Gas Supply Association 2011b). Beginning in the mid-nineteenth century, humans began widening the cracks in shale formations, capturing the methane inside them, and burning it for light and heat. Although the use of pressurized water to artificially induce cracking dates to 1947 (a process that was called "hydrafracing" [Montgomery and Smith 2010, 27]), people have pulverized hydrocarbon-bearing rock layers for much longer. The first intentional fracturing of shale for natural gas production occurred in 1857 when Preston Barmore ignited eight pounds of black powder at the bottom of a shale gas well in Fredonia, NY. Following the explosion, a great quantity of gas rushed from the borehole (Lash and Lash 2011). Since Barmore's powder keg experiment, increasingly dangerous methods have been used to fracture subterranean rock formations and release gas. Even more foolhardy attempts have been made to force gas from the geologic grip of nature and into circuits of value-bearing exchange.

Increasingly hazardous substances have been used to make the "neutral stuff" of nature into raw materials. Intentional fracturing to increase hydrocarbon production has employed nitroglycerine, acid, napalm, gelled gasoline, diesel fuel (Montgomery and Smith 2010), and even surplus nuclear warheads. In 1969 the US government detonated a nuclear device inside a sandstone formation a mile and a half underneath Rulison, Colorado, three hours west of Denver. The device was twice the size of the bomb that flattened Hiroshima, and the gas that emerged was too irradiated to be used. Any further drilling and extraction in the area was forbidden (Tsai 2010). Although the Rulison experiment was an attempt to find peaceful uses for nuclear weapons following the Second World War, it exhibits the extraordinary recklessness humanity

can display in its attempts to acquire fossil fuel energy. To understand why society has gone to such great lengths to produce these raw materials requires some broad contextualization.

Industrial civilization is completely dependent on "fossilized sunshine" (Crosby 2006, 59–62). Coal, oil and gas were subjected to geologic conditions that transformed old dead plant matter into hydrocarbons that powered the machines of industry (ibid.). In the early nineteenth century, around 1820 according to the environmental historian John McNeill, humanity switched from muscle power to fossil fuel power. The "somatic" energy regime, based on the work of human and animal muscles, came to an end and any society that did not exploit huge amounts of fossil energy would be "doomed to poverty" (McNeill 2000, 298). During these early days, natural gas was treated as a waste product because despite the success of limited regional distribution in the nineteenth-century, gas could not be transported long distances. Consequently, gas was either flared or dissipated into the atmosphere during oil exploration. It was not until the invention of adequate technology for compressing and transporting gas in large-diameter steel pipes that natural gas became anything more than a byproduct of the production of oil (Smil 1994, 168). The construction of pipeline networks and compressor stations for the increased exploitation of natural gas as an energy source exploded in the United States following the Second World War (ibid., 172). However, the gas that coursed through the veins of the American post-war industrial complex was not the same type piped into homes and factories in 2013. Natural gas is divided into two different resource types based on the labor required to produce the stuff.

In recent years natural gas has been classified as either conventional or unconventional, depending on how it was produced. Conventional natural gas was typically produced as a side effect of oil production, because oil and gas are frequently commingled in the Earth's crust

(Zimmermann 1957, 236). Unconventional types of gas are gases that are difficult or expensive to extract and include: shale gas, coal-bed methane, tight gas, gas hydrates (also known as methane hydrates), deep natural gas, and gas from geopressurized zones (Natural Gas Supply Association 2011c; Canadian Association of Petroleum Producers 2012). Unconventional types of gas are hard to extract because of a combination of factors. They can be located in harsh environments like the Arctic, and below the ocean floor or they can be technically difficult to produce, like the gas distributed through shale formations a mile below the Earth's surface. For example, methane hydrates may contain 40,000 trillion cubic feet of natural gas, or enough to provide the US with enough gas for millennia, but the industry has not yet figured out how to remove the methane molecules from their ice lattices economically (Natural Gas Supply Association 2011c). Additionally, coal-bed methane, tight gas and shale gas can only be produced by combining expensive technologies like horizontal drilling and hydraulic fracturing. The becoming of shale gas, from tiny bubbles of methane distributed through hundreds of square miles of shale strata to economic commodity, was utterly dependent on another resource: water.

Shale gas requires much more water to produce than conventional natural gas. Natural gas from shale is trapped in tiny bubbles, sometimes microns wide, distributed throughout formations of rock that can extend laterally for hundreds of miles. In the past, shale formations have served as "source" rocks for conventional natural gas reservoirs. Source rocks are where the decomposition of organic material occurs and where natural geologic forces, like heat and pressure, produce oil and gas over millions of years. Reservoir rocks, like limestone for example, are more porous and act as a sort of pool for the oil and gas from nearby source rocks. In the past, drillers would drill a hole straight down into a reservoir rock and, through natural pressure or using pumps, produce the oil that was being held within it (Silver 2011). To extract the gas

located in a source rock, for example shale, a massive amount of force is required to shatter the shale and release the gas. Initially, drillers had experimented with blasting different types of materials, like chemical foams or compressed air, at the gas-infused shale using tractor-trailer sized pumps that created gigantic high pressure. However, it was not until a French engineer threw the wrong switch and mistakenly shot *water* at the gas-bearing shale that natural gas development from shale was proven to be economically viable (McGraw 2011, 49). The drill site where the French engineer was working was experimenting with hydraulic fracturing and horizontal drilling, the two technologies that have allowed the production of natural gas from shale to occur. Hydraulic fracturing, of "fracking," requires millions of gallons of freshwater (McKibben 2012). Once the water has been used in the fracking process normal water treatment facilities cannot clean it before returning it to the water supply (Caruso 2012). To aid in the extraction of gas from shale, a cocktail of synthetic chemicals is added to the water, along with several tons of sand (Associated Press and Karnowski 2012). Of the known chemicals used in fracking, almost half pose risks to bodily functions (Colborn et al. 2011). Untreatable wastewater from fracking is an unavoidable consequence of the becoming of shale gas as a resource. After drilling, a fifth of the water used to frack a well returns to the surface laden with production chemicals and salt, barium, heavy metals and radioactive materials picked up below (Howarth, Ingraffea, and Engelder 2011, 272). Although some gas drillers have begun injecting flowback into deep disposal wells, wastewater disposal methods in the early years of the shale gas boom included river dumping and semi-permanent open pits lined with plastic tarps (Griswold 2011; Caruso 2012). That did not escape the attention of some, and those missteps prompted the EPA to undertake a multi-year, multi-site study of the environmental effects of hydraulic fracturing (Lustgarten 2010). Fracking is a cumbersome, dirty, and expensive industrial practice, and

society might never have bothered producing it as a resource if economics had not provided some reward.

For the gas industry to produce a cumbersome resource like unconventional natural gas, the price of natural gas would have to provide an incentive. In 1978 the US federal government began slowly deregulating the natural gas market that led to market-based pricing for gas. Legislation that had been put in place to curb monopoly power forty years prior had authorized the federal government to set natural gas prices (US Energy Information Administration 2009a). In 1971 the production of natural gas peaked, along with oil, at 24,088,031 million cubic feet (US Energy Information Administration 2013a). The federal government responded to a decade of stagflation, and the first prolonged occurrence of energy scarcity in the US since WWII, by phasing in relaxed price controls. The Natural Gas Policy Act (the NGPA) of 1978 implemented a phased deregulation of the price of natural gas, stripping the government of its power to set gas prices. At the whim of the market, the price of gas rose to the level determined by commodity traders instead of the "just and reasonable" rate set by the state for the previous forty years (Tussing and Barlow 1984, 18; US Energy Information Administration 2009b). The NGPA succeeded in incentivizing new production that allowed the price of natural gas to drop and level off, although never again reaching the low prices provided by government price controls (US Energy Information Administration 2013d). Beginning in the early 2000s gas prices began fluctuating wildly, far beyond historical levels, reflecting the turbulence of speculative markets in commodity futures (US Energy Information Administration 2013e). Prices reached new highs and methods of extraction that had been too expensive became profitable (Rogers 2011). The NGPA set the stage for huge price fluctuations that would incentivize the production of unconventional natural gas instead of relegating it to the annals of geological curiosities. The

federal government also held a direct influence over *where* unconventional natural gas development would take place, through a research initiative that also began in the 1970s.

Help from the State

The state directly contributed to the becoming of shale gas through a series of research and development interventions. The government's response to declining natural gas production in the 1970s was not only regulatory but also exploratory. The Ford administration oversaw the establishment of the Eastern Gas Shales Project in 1976, a public-private partnership between universities and government researchers. The project offered universities and companies the research products of a government lab that specialized in energy, which would be folded into the newly-created Department of Energy (the DOE) by the Carter administration (Trembath 2012). The project had two objectives: to map physical characteristics of shale formations underneath the Appalachians, Michigan and a few Midwestern states, and to develop production techniques for the gas deposited therein (PA Department of Conservation and Natural Resources 2013). The maps and other technologies that the project created were essential to informing the earliest innovators in shale gas development (Institute Staff 2011). Two of the engineers working in the government lab would patent a new drilling technology that would be instrumental in making shale gas production possible (Trembath et al., 2012). For these reasons, it would be hard to imagine the becoming of shale gas in the early twenty-first century without government interventions in the energy business.

Another way to conceive of the becoming of shale gas as a resource could be the instrumental role of decades of investment by US taxpayers. Development of shale plays like the Barnett in Texas, Haynesville in Louisiana and Marcellus in Pennsylvania only became technically feasible after many years of expensive research. In the 1970s, the United States

Geological Survey became aware that deep shale strata, in places like Pennsylvania, were a source of natural gas (US Energy Information Administration 2011b). Following the seventies energy crises, Congress encouraged energy production by gifting the oil and gas industry thirty years of tax credits that eventually totaled ten billion dollars (Begos 2012a). The oil and gas industry also took advantage of thirty years of research and development on fossil energy by the DOE that cost US taxpayers $24 billion (Shellenberger and Nordhaus 2011). Government research included funding the first combination of directional drilling with hydraulic fracturing (Trembath et al. 2012). The coordination of these two technologies were what made shale gas development possible (ibid.). Before moving forward, it bears mentioning that the relatively recent becoming of shale gas is a disputed fact. The date when shale gas became a major resource hinges on how one defines the scale of the process of hydraulic fracturing. To engage with this dispute, it is necessary to examine changes in the sociotechnical dimension of shale gas extraction.

The same techniques that drive shale gas production have been employed for seventy years, but not at the same scale. Hydraulic fracturing is a well-completion method that has been used since the 1940s to increase the production of oil and gas wells (Montgomery and Smith 2010). Fracking works by injecting highly-pressured water into wellbores using powerful pumps. However, since the forties, the technologies used to frack have been advanced to such an incredible degree that fracking in the forties was practically unrelated to the fracking done now. Comparing hydraulic fracturing from the 1940s to the hydraulic fracturing used today would be equivalent to comparing the horsepower of an economy car to a semi-tractor trailer. The amount of water used to stimulate conventional oil and gas reservoirs in the 1940s was one-thirtieth to one-fiftieth the amount used to fracture gas-bearing shales today (Wilber 2012, 118). The

pressures used to fracture the strata increased from pumper trucks with seventy-five horsepower engines to modern trucks hauling 1500 horsepower engines (Montgomery and Smith 2010, 30). Refining hydraulic fracturing from a small-scale well-completion method into an economically-viable strategy for producing massive amounts of natural gas from shale took more than two decades of support from the federal government. In other words, because shale gas is dependent on hydraulic fracturing, and hydraulic fracturing was dependent on government funding and research, state assistance was instrumental to the becoming of shale gas. The intertwined relations between the private sector and the state through which shale gas became a resource run straight to the roots of this resource.

Massive, multi-stage, horizontal, slick-water hydraulic fracturing of shale was first proven possible in 1997. George P. Mitchell, owner of the oil and gas company Mitchell Energy and Development Corporation of Dallas-Fort Worth, Texas, is often credited with making shale gas development possible (Yergin 2011a; Yergin 2011b; Yergin 2012; Wright 2012a). However, the first application of horizontal drilling that Mitchell Energy conducted was made possible through direct funding from the federal government and indirectly through technical support in survey methods like seismic mapping (Trembath 2011). Although hydraulic fracturing receives more media attention (Blackmon 2013), directional drilling was also key. Directional drilling allowed the production of shale formations, which run parallel to the Earth's surface. The ability to turn the drill bit horizontally greatly increased the surface area of the shale layer that gas companies could frack (Manning 2013). Horizontal wells could extend up to two miles from the wellbore in all directions. With technical and financial assistance from US taxpayers, shale gas has roared into the 21st century and become subject to the whims of the social relation of

production: capitalism. As a result of unleashing these new technologies into the market, a gas rush has ensued in places overlying shale formations.

The onset of shale gas extraction on a large scale began shortly after the state and Mitchell Energy collaborated to test hydraulic fracturing. Since the late nineties, shale gas development in shale basins from Texas to Pennsylvania has proceeded rapidly. From 2007 to 2011 shale gas production increased more than fourfold, from approximately two million cubic feet to eight-and-a-half million cubic feet (US Energy Information Administration 2013a). As mentioned in the introduction, although these technologies were as crucial as US taxes to the development of shale gas, its rapid growth cannot be explained without understanding the concurrent finance and credit landscapes. The industry could finance this boom directly because of the financial and economic downturn of the global political economy in the late 2000s.

Rush, Boom and Bust

Shale gas was propelled into becoming a resource through the cycles of capital accumulation more than any other single force. The 2007 housing market bust attracted capital towards safe investments that guaranteed a return. Because natural gas prices were high, natural gas companies were able to raise huge amounts of credit, which they used to start the shale gas boom. However, the bubble eventually burst when natural gas companies overproduced the resource and effectively drowned the market and collapsed the price. The specific circumstances of the shale gas boom and bust will be outlined below.

The reason for the rapid ascent was the familiar profit motive. Specifically, shale gas development has made some rich people more so in a very short time. For example, XTO energy was an independent oil and gas company with shale gas drilling rights in a section of the Marcellus shale underneath the Southern Tier of New York. ExxonMobil acquired them for $35

billion in the largest acquisition, for history's most profitable company, since Exxon's merger with Mobil in 1999 (O'Keefe 2012). Geologist Jeffrey Hildebrand acquired rights in the Eagle Ford Shale in Texas and in 2010 the private equity firm handling Hildebrand's estate made a deal with Marathon Oil for $3.5 billion. Stacy Schusterman, the daughter of an oil and gas tycoon, had her private-equity firm broker a deal to sell the family business to an undisclosed set of corporations for $7.2 billion in 2011. Terrence ("Terry") Pegula, a self-made gas billionaire, began his business with $7,500 borrowed from friends and family. He spun that lowly sum into $4.5 billion when he sold the mineral rights from a large swath of the Marcellus formation to Shell (Lattman 2011). (In an interesting twist, Pegula then bought the Buffalo Sabres hockey team and donated $102 million to Penn State University for a new hockey rink [Marsh 2012]). In sum, shale gas became a resource during a time when many oil and gas companies were betting on the price of natural gas to rise.

The case of Aubrey McClendon provides a snapshot of the shale gas boom as it transitioned into a shale gas bust. Until April 2013, McClendon was the CEO of Chesapeake Energy, the second-largest producer of natural gas and "most active" driller of new wells in the US (Chesapeake Energy Corporation 2012). In 2012, one of Chesapeake's single largest investors demanded a series of personnel changes on the company's board of directors. The change in management followed a spectacularly bad year for the company: a $16 billion shortfall, a greater-than-fifty-percent drop in stock value, and a report that McClendon used his stock in Chesapeake as collateral for one billion in loans (Reuters 2012b). Quotes from McClendon painted him as a bullish and confident advocate for shale gas development, while the recent history of his former company seems to tell a different tale (Urbina 2011a).

By April 2012 the CEO of ExxonMobil was apoplectic over the acquisition of XTO, a decision he had trumpeted when the deal went through. Shale gas had grown too fast and drillers had created a glut of gas supply, overwhelming demand and collapsing the price (O'Keefe 2012). Gas companies like Chesapeake had been taking advantage of an easy credit market for safe, reliable industries that provided a dependable return. After the collapse of the US housing market, the industry took on $126 billion in loans between 2006 to 2012 (Krauss and Lipton 2012). Between 2006 and 2012 the price of one thousand cubic feet of natural gas dropped from a high of almost $8 per thousand cubic feet to less than $3 (US Energy Information Administration 2013e). Consequent to the changing economics of gas, drilling rigs have moved on from Pennsylvania (to North Dakota to develop the Bakken oil shale), and contractually-obligated shale gas production continues, sometimes with no outlet to the market (Associated Press 2012; Krauss 2012; Malik 2012; Reuters 2012a). Shale gas, which at first seemed like an endless boom, now seems like a slowly-leaking balloon.

Estimates of recoverable reserves, revised after several years of actual production, showed much less gas than experts had originally calculated (Urbina 2012; Wilber 2012, 2). Predictions that shale gas production will spread around the world, which had become ubiquitous in recent years, were belied by ExxonMobil's decision to divest its interest in Polish shale gas exploration (Urbina 2011b; Yaros 2012; Wright 2012b; US Department of State 2010; Lee 2012; Kahn and Onoszko 2012). The bust came as no surprise to one Pennsylvanian quoted in the press. The perfectly-named Mr. Price seemed inured to the boom and bust cycle of resource-led development:

> "Mr. Price said he was skeptical that Pennsylvania could buffer the cycle of boom and bust, one the state had seen before with timber and coal. The area has already had a taste of what a bust might be like; natural gas prices have dropped in the

> past year, and drilling has slowed. 'You would think that there would be a sensitivity to this issue,' Mr. Price said. 'But memories are short'"(Schwartz 2012).

The amnesia Mr. Price described may not stem from an alleged lack of sensitivity to history, as much as it may reflect a desperation festering in areas blighted by economic downturn and global economic restructuring. The creation of shale gas as a natural resource was as much propelled by the surge in credit following the recession as it was by the pre-existing economic landscape in prospective drilling areas.

Shale gas was able to exit nature and become a valued commodity within circuits of capital because it was developed in areas that were already poor, and had a history of resource extraction. Between 2009 and 2011, shale gas drilling in Pennsylvania quadrupled, and now leads the rest of the Northeast in production (US Energy Information Administration 2012a; US Energy Information Administration 2011a). Economic booms and busts led by resource extraction have left deep environmental scars in the Pennsylvania landscape, which have been long in healing (Black 2003). Pennsylvania's agricultural industry, a pillar of employment in the commonwealth, had been in steep and steady decline that was exacerbated by the collapse of the housing bubble in 2008 (Vaidyanathan 2012). In addition to losses in agriculture, many rural communities surrounding Pittsburgh were still feeling the sting of the shuttered steel and ironworks that earned Pennsylvania its place along the Rustbelt (Casselman and Gold 2012). In this debilitated economic landscape, impoverished families that cared deeply for the land were being offered unprecedented sums to allow shale gas drilling on their land (McGraw 2011). In small, rural towns nearby drilling sites, rents skyrocketed as roustabouts and roughnecks from Oklahoma, Texas and Louisiana with huge paychecks rented up properties and squeezed local tenants out of the market (Seelye 2011). In that desperate economic landscape, the gas industry

was offered a chance to turn Pennsylvania into the cheapest place to do its business (Begos 2012b). Having established a rather chaotic image of the becoming of shale gas through purely economic forces, we now turn to the urge to control the effects of development. The oil and gas industry could not have transformed Pennsylvanian shale gas into a significant natural resource without cooperation on the part of the state.

Regulating Gas

Through most of the US government's involvement with the natural gas industry, regulation has been under state control. For the first century of the industry's history, beginning in Fredonia in the nineteenth century, government intervention in the business of gas was limited to city and local scales by the fact that gas was difficult to transport over long distances (Lash and Lash 2011). Specifically, regulatory jurisdiction of natural gas could end at the borders of states because interstate commerce was limited by the nascent technological ability to deliver gas in pressurized pipelines (Tussing and Barlow 1984, 23–24). The types of relationships that the US government initiated with the natural gas industry in the nineteenth century were municipal contracts for street lighting and the granting of rights to eminent domain and natural monopoly (ibid., 17). Beginning in the twentieth century the federal government started to play a more active role in the commercial buying and selling of natural gas. However, it would be difficult to continue a story about natural gas regulation without mentioning oil. Just as oil and gas have naturally cohabited within the Earth's crust, the resource politics of oil and natural gas have been inextricable as well.

Beginning in the 1930s, the government saw it necessary to increase its control over the business of producing and selling oil and natural gas (Cornell University Law School 2013). The government was responding to extreme volatility in oil prices and production that was leading to

rampant waste (Zimmermann 1957). When the price of oil was high, drillers would sink wells feverishly and with wild abandon, plundering the reservoir of the facile deposits and leaving the harder-to-reach oil in the ground (Soraghan 2011). This was a problem because the more difficult oil was at risk of incursion by groundwater, after which it would be impossible to extract (ibid.). Because oil could fetch a higher price, and gas pipelines are expensive to assemble, much of the associated natural gas was "popped" after drilling. Popping gas meant venting it directly from the wellhead and allowing it to dissipate into the atmosphere (Zimmermann 1957). In states where significant amounts of oil were being produced, like Oklahoma and Texas for example, government institutions at the state level began regulating the conservation of oil and gas (Soraghan 2011). State regulatory practices during the thirties included limiting output to maintain high prices, a practice also known as "prorationing" (Huber 2011; Huber 2013). Government regulation culminated in 1954 with the Supreme Court's decision to allow the government to set the price of natural gas as part of the national interest (Castaneda 1993, 3). The next major shift in the state's intervention into the becoming of shale gas occurred during the energy upheavals of the 1970s.

Federal regulation of natural gas in the 1970s was influenced by a transdecadal collision of competing energy and economic crises. In the year 1970, US oil production peaked, meaning that for the first time in its history, average oil production stopped increasing and went into decline (US Energy Information Administration 2013f). The decade-old Organization of Petroleum Exporting Countries placed an oil embargo on the US in response to its support of the State of Israel (Yergin 1991, 570, 590). Several winters broke cold temperature records and the demand for gas increased, especially in the northeast and Great Lakes regions (Tussing and Barlow 1984, 106). Spurred on by the increase in demand, and set against a background of

unprecedented national energy crisis, the federal government passed the NGPA. It was also during the seventies that the federal government ushered in a raft of powerful, new legislations designed to protect the environment. These regulations would pose obstacles to making shale gas a resource, that oil and gas companies like Halliburton lobbied hard to have rolled back (Hamburger and Miller 2004).

It is unusual that environmental legislations posed an obstacle to firms with interests in shale gas in the broader context of environmental regulations on the oil and gas industry. Before the seventies, federal government regulation of the natural gas industry had very little to do with protecting the environment from the industry's pollution. The institutions entrusted with enforcing environmental legislation were holdovers from the 1930s, designed to conserve production, not the environment. Specifically, state oil and gas conservation institutions were designed with the intent of protecting oil reservoirs from incursions from water, not the other way around. In addition, environmental institutions were not well equipped to deal with the sudden surge of natural gas production from shale (Soraghan 2011). The institutions tasked with enforcing environmental regulations were underfunded, understaffed and could not adequately enforce the laws (Sumi 2012). In the 1970s, the environmental movement pushed the government to pass landmark legislation for the protection of air, water and soil and established a federal agency tasked with enforcing those laws: the EPA (Dunlap and Mertig 1992, 96). Although the impact of the oil and gas industry on the environment did not directly inspire the passage of the Clean Air Act, Clean Water Act and other major environmental regulations, they did apply to that sector once passed. However, shale gas could still not come into existence while certain environmental regulations still applied to its production according to Halliburton

(Hamburger and Miller 2004). That was until Dick Cheney, ex-CEO of Halliburton, entered the White House as vice president.

The Safe Water Drinking Act obstructed the becoming of shale gas as a natural resource according to Halliburton. The nonprofit group Common Cause compiled a report in 2011 that showed trends in campaign contributions around key dates in the legislation of shale gas, including the 2005 Energy Policy Act. Common Cause found that industry contributions heavily favored current members of Congress who voted for the 2005 Energy Policy Act. This act exempted fracking from key sections of the US Safe Drinking Water Act (109th US Congress 2005). Current members who voted for the bill received an average campaign contribution from the oil and gas industry of $73,433, while those who voted against the bill received an average of $10,894 (Kaplan and Browning 2011). The act earned its name as the so-called "Halliburton loophole" because, as previously mentioned, the oilfield services corporation Halliburton offered hydraulic fracturing as one of its products (Hamburger and Miller 2004). Halliburton's former CEO and then-vice president Dick Cheney vigorously pursued the passage of the 2005 Act. Without exemptions, the fracking process would have been subject to environmental legislation, with oversight, regulation, enforcement and monitoring driving up the cost of production. Once the regulatory conditions were set at the federal level, oil and gas companies eager to being shale gas development targeted state governments.

In Pennsylvania, contributions from the oil and gas industry reached unprecedented heights in 2010 as the industry "came to recognize the potential profitability of Pennsylvania's unique geographical and *regulatory* positioning" (emphasis added) (ibid., p. 21). In 2011 a conservative gubernatorial administration with close ties to the gas industry was voted into power. The new governor, Tom Corbett, was an outspoken supporter of shale gas development,

and staunchly opposed levying any tax whatsoever on its extraction. Corbett received a fifth of his 2010 campaign fund from the Republican Governors Association (RGA), a "backdoor" for large political donations from corporations, of which oil and gas industries are always top contributors (Dunbar and Duszak 2012). In his first state annual budget proposal, Corbett cut funding to public schools, higher education and public libraries by fifteen percent and let shale gas production proceed untaxed (Krawczeniuk 2011). Corbett ignored polls that sixty percent of Pennsylvanians supported a tax on shale gas and argued that a tax would frighten the industry and push their capital toward other states (ibid.). In 2011, Pennsylvania was the largest producer of natural gas in the nation where the industry enjoyed tax-exempt status from the state government (Cattabiani and Worden 2011). Pennsylvania was also one of only three states without a severance tax, the other two being Maryland and New York (Kent et al. 2011). A severance tax can range anywhere from twenty-five percent of natural gas net value (the rate paid in Alaska) to seven or eight percent, which the industry pays in Alabama and Oklahoma (ibid., 3). Names like Terrence Pegula, and his wife Kim, also appeared on Corbett's gubernatorial campaign-contribution receipts. The difference between Pegula and other campaign donors is that Pegula was later invited to craft the state's policies governing shale gas development on the MSAC. Through the MSAC, the oil and gas industry was given an opportunity to ensure that shale gas became a resource they could profit from.

On March 8th, 2011 Corbett signed his first executive order and created the Marcellus Shale Advisory Commission (MSAC). The commission was asked to compile a set of recommendations for drafting state regulation of shale gas development (Corbett 2011). The commonwealth had not updated its environmental regulations on oil and gas since 1984 (K&L Gates LLP 2012). The outdated laws were written before cutting-edge methods of extraction,

like horizontal drilling with hydraulic fracturing, had been combined. However, even before the commission released its report there were hints that it might not address social and environmental dimensions in a comprehensive way.

Many of the MSAC commissioners had contributed money to Corbett's election campaign, many owned or represented businesses, and there were signs environmental concerns were not a high priority on the commission. Nearly half of the MSAC's commissioners contributed to Corbett's campaign funds and altogether they donated $1.4 million (Mauriello and Olson 2012). They included executives from ExxonMobil, Chevron, Consol Energy, Range Resources, Chief Oil & Gas, EQT Corporation (a natural gas firm), U.S. Steel, and a pipeline company called NiSource (Park 2012). Of the thirty total commissioners, only four represented environmental interests (ibid.), unless a geologist instrumental in stoking the boom could be counted as a representative for the environment (Silver 2011). One commissioner had been litigated against by the PA DEP for environmental violations; mines he had once owned drained toxic waste into the surrounding watershed and he tried to abandon them without remediation (Mauriello and Olson 2012). Because Corbett allowed the MSAC to guide shale gas regulation in Pennsylvania, the becoming of shale gas as a resource was to be managed by the regulated industries themselves.

The MSAC made it clear that the becoming of shale gas was their number one priority, above property rights, environmental quality or a fair severance tax. The commission released their report, advising the governor on how to regulate shale gas development, on July 22nd, 2011. Of the 43 recommendations made on health, safety and environmental protection, none focused on air quality protections (Puko 2011). (The insidious effects of air pollution from shale gas development are an oft-neglected detriment of the industry [Wolfgang 2012]). Among the

commission's recommendations was forced pooling, a legal procedure whereby landowners who did not want development would have their land pooled with neighbors who did, for the sake of efficiency (Litvak 2010; Gilliland 2011a; Boehm 2011; Baca 2011; Gilliland 2011b). Among the MSAC's recommendations, was an indirect tax called an impact fee (MSAC 2011, 121)

Governor Corbett released his plan for shale gas development based in consultation with the MSAC's report. In his plan, Corbett laid the schedule for an indirect tax called an impact fee. According to Corbett's plan the fee was $160K paid by gas drillers and spread out in payments over a period of seven years. Of that amount, less than a third would go towards funding environmental protection, and most would be used for municipal maintenance issues like road repair. Jan Jarrett of the environmental NGO PennFuture lamented, "It appears that the governor's thinking in devising his plan was, 'What's the least I can ask of the drilling industry?' " (Levy and Begos 2011). Once Corbett's plan was rushed through the legislature, it appeared that the efforts of the industry's representatives on the commission had been successful. When the MSAC's recommendations were turned into law, there were no barriers to shale gas becoming a major extractable asset for the oil and gas companies.

The MSAC used its position to recommend regulations that benefited industry and oil and gas firms. On February 13th, 2012, the governor signed Act 13, and the recommendations of the MSAC were made into state law. The impact fee amounted to an annual cost to drillers of $50K per well, functionally a one percent severance tax (Swift 2012). Counties would only receive fee revenues if they enacted the laws that came bundled with them, and many did (Corcino 2012). However, some counties decided to challenge the state's authority to withhold impact fee revenues based on concerns they had with an entrenchment of the state's regulatory power under Act 13.

By accepting impact fee revenues, municipalities across the state would be forced to restrict their own ability to set local ordinances on shale gas development. In some cases local governments that tried to block shale gas development using local regulations, and had been sued by gas companies eager to develop mineral leases (Tavernise 2011). Local ordinances could take the form of limiting development by proxy, through ordinances such as restricting fracking, noise, pollution and toxic waste dumping (Community Environmental Legal Defense Fund 2010). The Corbett administration proclaimed that preempting local regulations was a crucial step to facilitating development. The governor was quoted as saying, "The one thing that we definitely need is consistent uniform application of the rules across the state" (Detrow 2011). In creating this uniformity, the state disciplined townships that had filed complaints against the industry by holding their portions of the impact fee in abeyance until their complaints were dropped (Hurdle 2012). Seven municipalities organized to challenge the constitutional authority of Act 13 under a similar legal precedence (Levy 2012; Su 2012; Supreme Court of Pennsylvania 2009). The state defended its legislative decision by arguing that since the municipalities were "formed under the auspices of the state," the state had the right to overrule local laws (PennEnergy Editorial Staff 2012). The commonwealth court disagreed and ruled that the state did not have the authority to override local laws (Olson and Schwartzel 2012). The case has subsequently been appealed by Corbett's administration. Meanwhile, groups working to oppose shale gas development have used the preemption clauses of Act 13 as evidence that the industry and the state are violating civil rights by forcing shale gas development onto communities (Olson 2012).

Opposition to Act 13

The becoming of shale gas has not been without its contestation. Discontent with shale gas development in Pennsylvania has been practiced through scattered local bans and opposition across the state. Environmental NGOs like the Community Environmental Legal Defense Fund encourage communities to organize for more democratic development outcomes (interview with CELDF member, 7/10/12). The CELDF has been working with communities that have found common cause between the effects of shale gas industrialization in Pennsylvania and other resource extraction zones around the world:

> "CELDF's (Ben) Price predicted there would be a growing backlash once more Pennsylvanians learned how their civil rights have been subordinated to industry. 'The tables are turned,' Price said. 'Americans aren't used to being treated like they are the indigenous people being colonized. But that's what's happening' " (Rosenfeld 2012).

Remarkably, the CELDF's conceptualization of Pennsylvania as a colonized territory used for resource dispossession was not a completely unique case: " 'Now I know what it feels like to live in Nigeria,' said recently retired Pittsburgh City Council President Doug Shields. 'You're basically a resource colony for multi-national corporations to take your natural resources, … add value to them, and then sell them back to you' " (ibid.). These perspectives suggest that the becoming of shale gas in Pennsylvania has transcended a local extraction issue. The interviewees found a shared cause for opposition to gas extraction with Nigerian rebels working against the oil industry (Watts 2004b). The network of opposition to resource development could be further extended to include Bolivians protesting *for* the development of national gas resources to serve national welfare instead of transnational corporate profit (Perreault 2006, 168). These trans-global linkages between contested zones of the forced becoming of resources have inspired some to speculate about a possible resource curse in Pennsylvania (Kay 2011).

The resource curse is a theory that natural resources have a negative impact on the economic growth of a country because sectors like manufacturing and industry are not incentivized to grow (Ross 1999; Sachs and Warner 2001). As shale gas becomes a major economic export of the Pennsylvanian economy, concerns have arisen about an imbalance in trade. One stakeholder expressed concern over the amount of value shale gas removes from the state and the amount that would be spread among its citizenry. An imbalance could bring an economic legacy that would blight the state for years to come. "The current wholesale price of natural gas is about $3 here, but $12 or more in Europe and Japan. 'It's clear people will want to export' the Marcellus gas, Apt said, adding that such an outcome could lead to what economists call 'the resource curse,' which is when the general population hardly benefits, while a few get very rich" (Begos 2012c). Recent studies of the subnational effects of Marcellus shale economies show some aspects of the resource curse appearing, specifically poor governance and the crowding out of other types of economic activity (Kay 2011, 28). If the resource curse does establish itself, as the interviewee postulated it might, Pennsylvania may enter a network of countries in the developing world where wealth is extracted through the becoming of resources, usually amidst a backdrop of violence and deprivation (Bradshaw 2010, 285). If shale gas becomes an even greater part of the Pennsylvanian economy, or US energy policy, then perhaps it will join the ranks of states beset by the violence and deprivation of the so-called resource curse.

Conclusion

In closing, the purpose of tracing the becoming of shale gas has been to explore the social origins of a biophysical phenomenon. Boosters of shale gas have argued for its potential to address a number of US economic, environmental and foreign policy conundrums in the 21st

century. They presume the presence and feasibility of shale gas as a fortuitous circumstance, produced by entrepreneurs and the incentives of a free market economy. As I have tried to show here, the becoming of shale gas was a highly contingent process that was guided and manipulated by government intervention at critical turns.

Chapter Three: Employing the Locals and Supplying the Region

As the shale gas boom entered its fifth year, the effect of Pennsylvania's governance compared with other states with the same resource potential was obvious. On December 10th, 2012 *The New York Times* ran a full-page ad proclaiming "GOVERNOR CUOMO: IMAGINE THERE'S NO FRACKING…" Although the newspaper does not limit the scope of its reportage solely to New York State, the ad was referring to a particular state policy and was directed toward New York's sitting governor, Andrew Cuomo. Artists Against Fracking, a group established by Sean Lennon and Yoko Ono, paid for the ad. The celebrities were entreating the governor to uphold a state-wide moratorium on fracking for shale gas. Two months later, Bloomberg reported that Sean and Yoko had travelled to Dimock, Pennsylvania, where shale gas development by the Cabot Oil & Gas Corporation had contaminated a drinking water aquifer (Wilber 2012, 202; Roston 2013). The next week, a group of Pennsylvanians who had leased their land for shale gas development appeared in Albany to share their negative experiences with fracking. Some carried jugs of contaminated water drawn from their wells. The group that sponsored them, New Yorkers Against Fracking, unveiled a new television commercial that ended with the message "Tell Gov. Cuomo: learn from Pennsylvania, ban fracking…" (Seiler 2013). Although New York and Pennsylvania both shared the geology for shale gas development, only Pennsylvania was a model for what could go wrong with fracking.

By 2012, five years after shale gas development began in earnest, Pennsylvania was a showcase for the mishaps of fracking. New Yorkers could visit a sacrificial zone for natural gas in the afternoon, take in the depressing sites, and head home to enjoy a glass of uncontaminated water that night. Both states could have developed shale gas but their diverging policies kept New Yorkers from experiencing the type of water pollution that the residents of Dimock had

been living with for years (Associated Press 2011). These disparate outcomes in proximate places were an effect of diverging governance strategies. Former Governor David Paterson and Governor Andrew Cuomo had put the brakes on drilling in New York, while Former Governor Ed Rendell and Governor Tom Corbett had opened Pennsylvania for business. As note earlier, Corbett had put a group of business executives in charge of recommending the state's regulation of shale gas. This group, the MSAC, used this opportunity to push forward shale gas development in two ways.

The MSAC supported creating Pennsylvania as a scalar fix for state and local economic woes. This involved supported sections of Act 13 that preempted local governance of shale gas. Secondly, and more importantly, the MSAC argued that shale gas would benefit local scales, state scales and the Northeastern region. This neat stack of scale frames gave shale gas the appearance of universal beneficence, in spite of the glaring lived experiences of Dimock's residents. These stacked scale frames were ideological and rhetorical in form, but their content softly coerced public consent for the perpetuation of elite class power. The profits made by the MSAC's sponsors were framed as benefiting the layperson while shale gas development could very well harm laypersons, as it already had in Dimock. Having reviewed the two main points of this section, what follows are some interview data from commissioners on the MSAC exhibiting the scalar dimensions of their project.

The Scalar Fix

The MSAC's recommendations to the governor on how to manage shale gas development framed shale gas as a panacea for a set of challenges that spanned scales far beyond the commonwealth's boundaries. The establishment of the MSAC was a strategic move on the part of the Corbett administration. At the time of their meetings, the US was in the throes of an

economic recession, to which shale gas was presented as the cure. For instance, upon entering office, Governor Corbett made that point clear in saying that shale gas was the "foundation for a new economy, not just something new to tax" (Glass and Koenig 2011). Shale gas from Pennsylvania would supposedly allow the US to exit from an embroiled international oil market by providing cheap, American energy. Additionally, according to the secretary of the PA DEP, Mike Krancer, and the governor's energy executive, Patrick Henderson, the commonwealth was going to become "the energy center of the world" (Krancer and Henderson 2012). When the MSAC met to recommend governance for shale gas they reflected these perspectives in their legitimation for shale gas development. The product of their collaboration was an argument for shale gas as a trans-scalar inoculator against different types of hardship. Their recommendations to the state government were to step aside and only intervene when and where they could ease the efficient accumulation of capital.

The MSAC held five meetings in the spring of 2011, and completed their set of recommendations in July. Governor Corbett devised the "Corbett Plan" in consultation with the MSAC's final report that fall, and in February of 2012 the Republican-controlled state congress passed many aspects of his plan into law (Rabe and Borick 2013). As previously mentioned, one of the most controversial aspects of Act 13 was the preemption of local government regulation by the state (Olson 2012). The governor's intention was to create a uniform regulatory structure across the state by "pushing down" the scale of local regulation (Harrison 2006), to scale up the economic competitiveness of the state. This was nothing new, and in fact state and corporate interests had used the national and global scales in order to "push down" local governments before, when they clamored for inclusion into environmental governance (Lindseth 2006). To aid the efficient operation of the gas drilling industry, the state legislature included §3303 and §3304

of Act 13. These two sections preempted local zoning restrictions, outright bans, and bans-by-proxy on drilling activities (Detrow 2012a). Whereas in the past, gas companies had sued local governments that banned fracking (Tavernise 2011), Act 13 armed the industry with the full authority of the law in demanding that drilling take place. In sum, the state government had established a scalar fix for shale gas extraction in Act 13 at the scale of the state.

The particular legitimizations given for the contentious scalar fix explicitly framed it in terms of easing the introduction of a new accumulation strategy. In the words of a former MSAC representative and industry spokesperson speaking under condition of confidentiality, the relinquishing of local control was absolutely crucial to the industry's interests.

> The state, under Act 13, [by] *preempting the ability of the locals* to control many aspects of gas development [consequently] we're going to see a much better environment under which we can determine how we're going to do things .... rather than try to cherry pick the local areas based on what the local standards are or are not.
> You may or may not know … in Pennsylvania there's (sic) 2,500 different municipal governments and that creates *a real nightmare*. Not all of those are in the Marcellus shale play but nevertheless … it's very hard to pin down what you can do and when you can do it ….
> That issue of preemption of municipal requirements is currently being debated in court. That part of Act 13 has been challenged. Hopefully that'll be reaffirmed by the state court and *if it is then the industry is going to have a clear pathway* for knowing what their obligations are looking forward (interview with MSAC commissioner, with emphasis added by the author, 7/24/12).

In his/her statement, the spokesperson legitimized the suppression of local government in favor of maintaining the easy operation of the industry. This was unsurprising, as he/she was merely defending an established scale for "strategic" purposes (McCarthy 2005). That is, he/she was primarily concerned with defending continued capital accumulation on the part of his/her clients in the industry. The spokesperson supported the scalar fix of the state scale because it disencumbered the industry from local politics.

The state scale provided the homogeneous regulatory landscape that the industry preferred in order to conduct itself without having to comply with local concerns. According to the industry spokesperson quoted above, local scales of governance would constitute a real "nightmare" for the industry. Merely by citing the number of local government bodies within the entire state (2,500), he/she implied that local controls on development would bog down the industry with contradictory and burdensome ordinances. To the spokesperson, local laws like municipal ordinances or borough restrictions would slow down the drilling process and make shale gas development a painstaking ordeal. In light of the difficulty that satisfying local concerns would bring to the industry, the spokesperson defended the scalar fix of the state scale.

According to the industry spokesperson, the state provided the adequate oversight for an activity with the scope and incidence of shale gas drilling. It seemed from his/her comments, that the industry desired a uniform, homogeneous set of regulations, over and above the local zoning rules, which could mire drilling in the concerns of nearby residents. In sum, the spokesperson preferred a scalar fix of the state to ease the ensuing accumulation strategy. In contrast, Pennsylvanians who opposed the preemption sections of Act 13 held a different view of the entrenchment of the state scale.

The rush to drill had overwhelmed some municipal governments with its rapid industrialization. Suddenly, rural and agricultural areas were receiving huge demands for water supplies, housing, and roads from the shale gas drillers (Tavernise 2011; Su 2012). In other communities concerns over the disposal of fracking wastewater had motivated bans on waste dumping (CELDF 2010). As referred to in the previous chapter, the CELDF had been working with local communities in Pennsylvania who opposed Act 13 and specifically its scalar fix.

The CELDF worked alongside communities that were opposed to the preemption of local governance by the state. As part of their larger strategy, the CELDF encouraged democratic participation and the crafting of local ordinances that had gained the local community's consensus (interview with CELDF organizer, 7/10/12). For example, the CELDF had worked closely with communities that wanted to manage the shale gas boom through local ordinances or put an outright ban on development. When Act 13 preempted local control, communities felt as though their rights had been impinged upon:

> … the general feeling from local officials and from local governments is that they're frustrated as all hell and they're very, very, very unhappy with the way that things are going. Even the ones that support the gas industry are very ticked off about the way they're … *(l)ocal governments, are essentially being treated as undemocratic extensions of state power*. Citizens, *people who thought they were local citizens of the municipalities*, are realizing that they're basically *mere tenants*, they're not citizens at all (Interview with CELDF organizer, emphasis added by author, 7/10/12).

While the comments of the CELDF organizer were helpful in understanding the contested nature of the scalar fix, they displayed only a partial understanding of neoliberal governance strategies. The CELDF representative invoked a sense of democratic environmental governance that the state had foreclosed on months prior to the passage of Act 13. Although the environmental effects of fracking were represented (albeit marginally), key data on the possible effects of natural gas drilling on the environment were disregarded. The MSAC ignored a critical study (Howarth et al. 2011) because the commissioners distrusted its author for not adequately supporting the use of natural gas (Puko 2011). Moreover, the MSAC was primarily composed of corporate and industrial representatives whose concerns over pollution, if present at the time of the meetings, were not reflected in their governance recommendations. The MSAC was a neoliberal environmental governance practice and was mostly concerned with managing natural resources to benefit private capital.

In sum, the MSAC supported fixing the scale through which shale gas could provide a new strategy of capital accumulation. The legislature had fixed shale gas regulation at the state scale to provide a uniform, frictionless surface for the maximum efficiency of drilling activity. According to the industry spokesperson on the MSAC, the commission had supported a scalar fix that should be defended against litigation by those who contested it. The representatives from the gas industry and heavy manufacturing on the MSAC had a particular scalar hierarchy in mind. They supported a set of transferable, state-wide rules governing shale gas development that would allow them to bypass local control. The less time spent negotiating local bans on fracking near schools and homes meant a stable, homogeneous scalar framework for continued accumulation. Having discussed the MSAC's support of the state scalar fix for shale gas development, the next section discusses some of the local and regional scalar frames used to legitimize shale gas development.

Cheap Gas and Plentiful Jobs

Shale gas was also framed as a cure-all for some of the long-term economic hardships that have befallen Pennsylvania. According to the MSAC, shale gas would provide cheap, abundant energy for Pennsylvanians and the jobs they needed to overcome the economic recession. With these statements, the MSAC built the base of a neatly-stacked set of scale frames that legitimated Pennsylvania's scalar fix on the promise of local job creation. Pennsylvania had been dealing with long-run economic woes stemming from losses in manufacturing, extraction and other sources of reliable manual labor. To these long-term economic concerns, MSAC commissioners answered: shale gas.

According to one commissioner, shale gas was an answer to energy poverty, by providing cheap energy for rural Pennsylvanians. As he/she put it, abundant shale gas would serve industries cheaply and conveniently.

> *It lowers their costs of operations as a fuel source*. We're in that early stage of having to marry up equipment that uses natural gas with having the fueling stations. We know where the gas is [and] we know how to use it but we have to build that middle link. It's probably akin to what the 1900s was like after Ford starting making cars. There weren't fueling stations sitting all around the country (interview with MSAC commissioner, emphasis added by author, 7/23/12).

To struggling local families, the promise of alleviated utility bills was a welcome respite from the economic downturn. As previously discussed, the price of natural gas collapsed following the shale gas boom. Additionally, previously-high energy prices had caused some dairies to fall on hard times or shut down in the recent past (Vaidyanathan 2012). The strategy of framing shale gas development as a solution to high energy prices was effective because of it immediacy. Prior to the shale gas boom, natural gas prices had been at record highs (Rogers 2011), so alleviating utility costs was a compelling argument given the circumstances. However, while energy costs were a local frame for the scalar fix, more MSAC commissioners framed the local benefits of shale gas in terms of jobs.

One commissioner suggested that industries would benefit from cheaper gas and would locate their facilities in Pennsylvania as a result. These facilities would bring much-needed employment to a state with proud manufacturing traditions. "We work with a lot of local economic development agencies who are trying to attract [capital] to their vacant industrial parks for example… if they can say 'Hey, we can run a line from a Marcellus well and give you cheap energy,' that can be an added benefit, a strong attraction..." (interview with MSAC commissioner, 6/26/12). Framing shale gas as a condition for reindustrialization was a strategic

move in the Pennsylvania context. Pennsylvania has a relatively long history of industrial labor and presenting shale gas as a "renaissance" for manufacturing resonated with that legacy (Casselman and Gold 2012). Since the passage of Act 13, the Corbett administration has vigorously pursued this strategy, offering Shell $1.65 billion in tax credits to build a petrochemical factory outside Pittsburgh (Detrow 2012b). The scalar fix was also framed as a local job provider through the drilling itself.

To commissioners on the MSAC, fixing Pennsylvania for shale gas development meant providing the state with a solution to long-term unemployment. In their own words, shale gas was alleviating structural, long-term unemployment by providing jobs:

> People in the local communities are seeing opportunities. …rural areas that have been underemployed and [have had] higher unemployment rates historically. *We've seen a collapse of [the] steel industry back in the seventies and eighties being revived*. We're seeing folks going to college, who would send their children to college who would then have to go elsewhere to find a job, now are *seeing job opportunities right close to home* (interview with MSAC commissioner, emphasis added by author, 6/26/12).

> *The impact on those locals has been significant*. You only need to talk to the mayor of Williamsport, Pennsylvania to find out what they think of [what] the shale gas industry has been to that whole area… Bradford counties, [and] *areas that had acute, chronic, unemployment, are now at the full employment level*. They have some of the lowest unemployment rates in the country now. [These were] some of those economies that had chronic ten or twelve percent unemployed (interview with MSAC commissioner, emphasis added by author, 7/24/12).

These commissioners framed development as a solution to declines in rural employment, especially in manufacturing since the seventies and eighties. As they both mentioned, Pennsylvania had been suffering through a historic period of underemployment. This was an effective legitimation for the scalar fix because Pennsylvania is desperate for jobs. In April 2013, two-thirds of the other states in the nation had better unemployment rates than Pennsylvania (US

Department of Labor 2013a). What the commissioners failed to mention was exactly how *many* jobs they expected the shale gas boom to provide, and what type.

Many of the highest paying jobs in shale gas, working as roughnecks and roustabouts on drilling rigs, pay fifteen to twenty dollars an hour, more than double the state minimum wage of 7.25$ (US Department of Labor 2013b). However, estimates show that seventy to eighty percent of these jobs went to workers from out of state (Wilber 2012, 102). Pennsylvanians were not trained to take advantage of the shale gas boom, and drillers simply imported more experienced labor from out of state. Of the remaining jobs associated with extraction, the employment estimates have ranged from one to four percent of the state's total employment (Maykuth 2013). The weak performance of oil and gas for job creation in Pennsylvania should have been no surprise because drilling does not create many jobs. In point of fact, a fifty percent increase in oil and gas drilling employment in the mid-00s had added a paltry less-than-one-twentieth of one percent to total US employment (Krugman 2012). Additionally, the jobs provided during the drilling boom were short-term service jobs that would dry up as soon as drilling ceased (Christopherson 2011, 4). Regardless of the quality of jobs, framing local jobs was politically strategic, given the desperate employment need in Pennsylvania.

As the MSAC commissioners mentioned, the drilling boom was happening in areas with high levels of unemployment. Drilling hotspots like Washington County, outside Pittsburgh, had been sites of capital accumulation strategies that had since come and gone. Coal mining conglomerates and steel mills had decided that labor power in Washington County was redundant and moved on to cheaper shores. Pennsylvanians had been turned into surplus labor through structural political economic shifts and they were desperate. Shale gas provided a quick, short infusion of cash, often in service jobs such as truck driving, waitressing or through leasing

of land for drilling. The local scale frames for shale gas development did not provide frameworks for long-term economic stability, but they were powerful rhetorical aids in support of drilling. With local scale frames established, and profits set to flow towards their corporate sponsors, the MSAC stacked a regional frame neatly on top.

Regional Benefactor

The MSAC framed shale gas in Pennsylvania as a regional supplier to the energy-hungry Northeastern markets. Natural gas from the keystone state was heating homes in New York City, cooking dinners in Maryland and powering generators in Ohio. Savings from pipeline expenses, mentioned previously in the introduction, made gas from conventional natural gas fields in the Southeast and Southwest too expensive. To the MSAC, the major Northeastern markets appeared to have been blessed by the discovery of a large source of natural gas right next door. In other words, according to the MSAC, the scalar fix for shale gas development in Pennsylvania was worth the benefits that would accrue to the region:

> When we first started drilling, gas could go straight from the wellhead to the user. *They'd pump it right into the transmission lines and it could go into New York City*. … When the price of gas was up and they were sending it directly to them it was a win-win situation. The industry was getting rid of their gas and *the northeast was getting a cheap gas* (interview with MSAC commissioner, emphasis added by author, 7/23/12).

> Shale gas, largely, is being produced enough closer (sic) to the end user that transportation costs are eliminated and in the case of bringing gas from the Gulf of Mexico, *as much as one third of the cost of the gas is in transportation*. So if that can be eliminated this is a real savings to the end user (interview with MSAC commissioner, emphasis added by author, 7/5/12).

> The majority [of gas] that serves the Northeast comes in through the Gulf of Mexico. The pipeline infrastructure has been in place for years and years to bring natural gas through mid-continent, through Appalachia, Pennsylvania and run gas into *New York and also New Jersey and New England*. … With shale gas being located and produced in Pennsylvania, [and] soon to be Ohio [and] hopefully New York – *this is the market*. … When you have the market close to the production,

> economics is telling me that this makes a lot of sense (interview with MSAC commissioner, emphasis added by author, 8/2/12).
>
> *New York, New Jersey, Maryland, West Virginia, Ohio are all benefiting from lower electricity and lower natural gas costs because of Marcellus shale*. …. Some states have been reluctant to realize that or embrace that, especially to our south. But they're seeing those benefits as well (interview with MSAC commissioner, emphasis added by author, 6/26/12).
>
> The real benefit is the fact that you've got [a] huge supply of natural gas that is not coming from the Gulf Coast or the West. *It's here, local*. The transportation charges from bringing [natural gas] out of Bradford County versus bringing it from Louisiana are significant. There's a cost differential there that [has] actually been significant in driving the price of the commodity down. … *The benefits are there for the Northeast* … (interview with MSAC commissioner, emphasis added by author, 7/24/12).

The regional scale frame reflected in these commissioners' statements placed Pennsylvanian shale gas development at the center of a regional hub of states that were benefiting from the boom. According to the commissioners, New York, New Jersey, Maryland and others were saving money on energy bills because Pennsylvania had decided to produce this resource and natural gas prices had fallen as a result. The MSAC's regional framing of shale gas development related Pennsylvania to neighboring states in a dependent relationship that the region was "reluctant" to "embrace." However, this dependent relationship was not an immanent consequence of predetermined economic geography. Pennsylvania was a supplier and other states were consumers because of decisions made by governance structures like the MSAC.

The dependent relationship between Northeastern natural gas markets and Pennsylvanian shale gas production was not a foregone conclusion. As previously mentioned in the introduction, many of the states surrounding Pennsylvania had the geological potential for Marcellus shale gas production, but chose not to engage in it. (Since the time of these interviews, Ohio and West Virginia have begun drilling, but at a slower speed and across a smaller extent than Pennsylvania.) Indeed, the decision not to drill for shale gas in New York was heavily

influenced by concerns over mistakes made in Pennsylvania. However, by framing Pennsylvania as a regional supplier with dependent consumers, the MSAC relinquished themselves of any responsibility for actively participating in the production of that dependent economic relationship. The MSAC could justify Pennsylvania's environmental sacrifice for Northeastern markets as a convenient regional transaction by presenting this scalar relationship as somehow prior to the governance process in which they were already participating. The regional scale frame made Pennsylvanian shale gas development seem like a wise choice for the Northeast and Pennsylvania, although legions of data spoke otherwise (see this long list of the harmed [Pennsylvania Alliance for Clean Water and Air 2011]). However, the MSAC had no interest in confronting uncomfortable side effects of development like water contamination. Truly confronting the challenges of governance was not their concern as much as defending this scalar fix for capital accumulation.

Conclusion

In closing this chapter, we review its main points. The MSAC supported the fixing of the state scale of shale gas regulation as a scalar fix for capital accumulation. In so doing, the MSAC helped legitimize the state preemption of local scale regulation of development, a point that was bitterly contested. Secondly, by focusing on employment and regional supply chains, the MSAC produced a set of *neatly stacked* local and regional scale frames through which to judge this economic regime. These frames made shale gas drilling appear as if it would solve structural economic problems like unemployment and deindustrialization. They also presented the regional dependency on Pennsylvanian gas as a foregone conclusion, thereby relinquishing themselves of the act of governance. The MSAC used these frames to legitimize a new regime of accumulation

for the benefit of its own corporate sponsors, and at the expense of the environment and risks to public health.

Chapter Four: Securing the Nation, Shipping Gas, Cooling the Climate

During their meetings, the MSAC hosted presentations from industry representatives. These trade groups scaled shale gas development as predominantly global and national in its scope and significance. One gas industry trade group, the Marcellus Shale Coalition (the MSC), began their presentation with a section entitled "The Shale Gas Revolution" (PA Department of Environmental Protection 2013b). Their message to the MSAC was that shale gas was an emerging resource with great potential for job creation (Klaber 2011). To reinforce their point they showed two maps made by the US Energy Information Administration that scaled shale gas as a global resource (see figure 3) with ample opportunities for growth on the national scale (see figure 4).

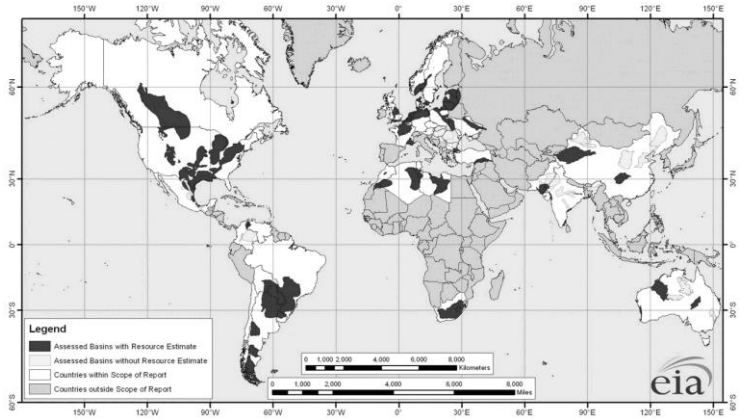

Figure 3: Global shale gas resources (US Energy Information Administration 2011a)

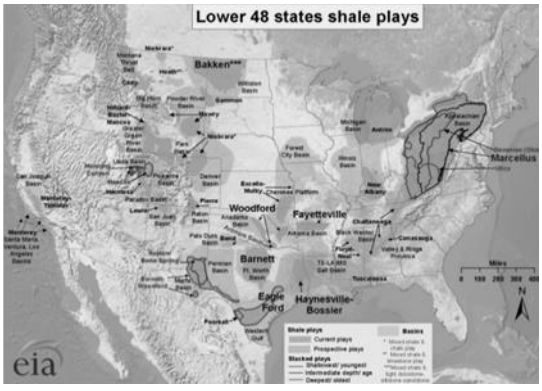

Figure 4: US shale gas and shale oil resources (US Energy Information Administration 2011c)

In presenting shale gas development in Pennsylvania as one small part of a global and national shift in energy production, the MSC produced two more neatly stacked scale frames for considering shale gas development. These two frames broadened the extent of the geographic legitimation for shale gas development, especially when taken together with the MSAC's support of the state as the scalar fix, and their local and regional scale frames. The MSC's frames evidently struck a chord with the MSAC during their presentation, because national and global scale frames for Pennsylvanian shale gas showed up in many of the statements made by commissioners.

Energy Security

The MSAC's final report began with this quote from their chair, the Lieutenant Governor Jim Cawley: "For decades, our national leaders have called for investing in clean, alternative-energy sources, like natural gas, to reduce our dependence on foreign oil" (Marcellus Shale Advisory Commission 2011). Framing Pennsylvanian shale gas as national in its scope and significance invoked a decades-old concern in US politics: energy security. Every US president since Jimmy Carter, regardless of his party affiliation, has made securing domestic sources of power for the US economy a priority. Frequently, this has led to misguided calls for energy independence, or the notion of extricating the US from foreign trade in energy through self-sufficiency (Phillips 2012). This recurring political dream for energy independence showed up in the statements of some of the commissioners on the MSAC as justification for shale gas development. The commissioners use this national frame as evidence of how Pennsylvanian shale gas development was benefiting the whole nation.

> The northeastern United States is [a] big part of the population center. It's a heavy user and *if they can be at the forefront of reducing the demand for foreign oil that's good for national energy policy…* If you can reduce that national

> dependence on foreign oil you really begin to change the economy beyond just the economics of energy (Interview with MSAC commissioner, emphasis added by author, 7/23/12).
>
> "Shale gas plays a very important role … in adding to North America's energy portfolio because *every b.t.u. of domestic gas is one b.t.u. less of petroleum that needs to be imported* (interview with MSAC commissioner, emphasis added by author, 7/5/12).
>
> "We can't be dependent on foreign energy suppliers. We see where it's heading and *[we] can't be dependent on anybody* (interview with MSAC commissioner, emphasis added by author, 7/25/12)."
>
> It's going to affect the oil industry in the Middle East. We consume a lot so we're going to see big benefits here… *We are currently importing energy from nations across this globe who are not our friends* (interview with MSAC commissioner, emphasis added by author, 8/2/12).
>
> The energy independence and energy security standpoint is: *we have a tremendous opportunity to ...displace large amounts of foreign oil.* … a lot comes from places that are not so friendly or that are susceptible to international pressures. The Middle East and all that that entails. … *this is an opportunity to really divorce ourselves from that* (interview with Patrick Henderson, Energy Executive in Governor Corbett's cabinet and MSAC commissioner, emphasis added by author, 6/26/12).

These commissioners legitimated shale gas development as a replacement for imported foreign energy. There are some substantial problems with that logic, but at the time of the shale gas boom, this would have a strategically sound justification for the scalar fix. Justifying shale gas extraction in Pennsylvania was strategic because of concerns over the rising price of domestic natural gas and resource conflicts.

Before the natural gas boom, economists had predicted that future natural gas supplies would have to be imported, at tremendous expense, from Qatar and Australia (Rogers 2011). Simultaneously, the US was still involved in Iraq and Afghanistan. Although these conflicts had not increased oil production, perhaps intentionally (Huber 2011, 824), they were still thought to be fought over oil (Beaumont and Walters 2007). In light of these circumstances, justifying the

scalar fix through the national frame of energy independence was a brilliant tactic. If only shale gas had the potential to provide energy independence, which it does not, as the following section points out.

Shale gas cannot provide energy independence to the United States, although this did not stop the MSAC from framing Pennsylvania's supply at that scale. First, oil and natural gas are not within the same class of global commodities. Unlike oil, natural gas cannot yet be shipped transnationally via tanker to the same degree that oil has been for the past century (Smil 1994, 173). The lack of re-gasification terminals radically shrinks the global reach of natural gas compared to oil (Wright 2012c; Maykuth 2012). Indeed, transnationally-traded gas, sold in liquefied form, only constituted nine percent of total global gas demand in 2010 (International Energy Agency 2013). Second, natural gas and oil are not substitutable sources of energy. As of 2013 only one tenth of one percent of the entire US transportation sector runs on natural gas (US Energy Information Administration 2013g). For the moment, US transportation remains overwhelmingly dependent on oil. Third, oil and natural gas constitute two enormous portions of the total energy supply mix of the US. Oil supplies more than a third of the nation's energy, and natural gas supplies an additional twenty-five percent, for a total of more than half of the nation's total energy (US Energy Information Administration 2012b, 37). For natural gas to replace the demand for oil, production would need to more than double. Geologist David Hughes has called a such a proposition a "logistical, geological, environmental and financial pipe dream" (Hughes 2011, 1). Energy security is also directly contradicted by another scale frame for the scalar fix: exporting gas to foreign markets.

LNG Exports

MSAC commissioners claimed that benefits from Pennsylvanian shale gas drilling would accrue to the global scale through exporting natural gas. Liquefied natural gas (LNG) is natural gas that has been cooled to a liquid state for shipment via special ships (Bridge 2004). Prices for natural gas have collapsed in the US since the beginning of the shale gas boom but have remained high in other parts of the world. The boom collapsed the price of gas in US markets to $2.54 per thousand cubic feet in June of 2012 (US Energy Information Administration 2013e). Meanwhile, the price of liquefied natural gas (LNG) sold by the US to Japan reached almost $18 per thousand cubic feet at the same time (US Energy Information Administration 2013h). Consequently, natural gas companies have been seeking permission from the federal government to sell shale gas overseas (Maykuth 2012). Interestingly, one MSAC commissioner who had also framed Pennsylvania's boom in terms of national energy independence also invoked the global market for LNG. He/she said, "We're not going to have to worry about importing liquid natural gas from Nigeria or any other place. In fact we can even look at the Northeast beginning to *export natural gas to the world market*" (emphasis added, interview with MSAC commissioner, 7/24/12). The commissioner was clearly contradicting the energy independence frame for shale gas but not without reason.

US LNG exports are in contention between gas companies that want the added business and a mandate of the federal government to maintain adequate supplies for US citizens. Voices in favor of exporting LNG from the US to international markets cite its abundance and cheap price (Cockerham 2013). Critics claim that exports will increase development and cause more environmental damage (Associated Press 2013). At the moment, pending export deals seem likely to be approved (Billones 2013; White 2013). The MSAC claimed that shale gas could

somehow deliver energy independence while companies profit from exporting gas out of the country. These national and international scale frames work in opposition to each other, but that was not a concern to the MSAC. The MSAC were attempting to stack up enough scale frames of shale gas that this project would appear to benefit everyone. Exporting LNG to the "the world market," even as it stands in contradiction with the goal of energy independence, was simply one more layer of economic benefits that would accrue from shale gas extraction.

The commissioner's comments revealed how international and national scale frames of shale gas development in Pennsylvania could be used "strategically" to win political support (McCarthy 2005). Reconciling the contradiction between energy independence and LNG exports was not a major concern for the MSAC. However, associating shale gas development in Pennsylvania with a solution to national problems and an international business opportunity was an end in itself. Along with local, state, and regional scales, the national scale was one more beneficiary of a project that could appear universally beneficent as the frames were stacked up. Along with LNG, the MSAC scaled shale gas in terms of another world scale through the global climate.

Bridge Fuel

The sole scientist on the MSAC cast the impact of shale gas on the global climate in a positive light. "On an intermediate timescale, natural gas can play a big role in slowing down the emissions of greenhouse gases largely because a b.t.u. (a British thermal unit) of natural gas releases about half as much carbon dioxide into the atmosphere as does a b.t.u. of coal. That's why natural gas has been called a *bridge fuel*" (interview, emphasis added by author, 7/5/12). In this statement, the commissioner cited a well-known fact about natural gas, its superiority to coal in terms of CO2 emissions. Coal is burned to generate electricity, a major source of climate-

changing CO2 gas (US Environmental Protection Agency 2012a), and natural gas produces less CO2 for an equivalent unit of energy during combustion (US Environmental Protection Agency 2012b). This fact has inspired some to call natural gas a "bridge fuel," meaning that gas could be the transitional fuel for industrial societies to span the distance between the fossil-fuelled present and a renewably-powered future (Barringer 2012). Indeed, increased natural gas usage seemed to have influenced a recent drop in US CO2 emissions as a result of cheaper natural gas.

Framing shale gas a bridge fuel was an attractive justification for development in light of its ability to postpone the dangers of climate change. In April of 2013, the US Department of Energy (US DEP) attributed a recent drop in US energy-related CO2 emissions to cheaper natural gas that was replacing coal for use in electricity generation (US Energy Information Administration 2013i). However, from the statement of Patrick Henderson, the energy expert in the governor's cabinet, potential solutions to climate change were not a priority in Pennsylvania's governance of shale gas:

> Coal, nuclear, natural gas, renewables, hydro, solar etc., they all cost different amounts to produce the electricity but … they all get paid the same price because *an electron is an electron* and *it's sold in a free market*. *With the price of natural gas so low, a lot of generators have been looking and switching into natural gas* and that has led to forty percent lower prices in electricity today than in 2008. … if you run a business where electricity or natural gas is a big part of your budget, [for instance] in the manufacturing business, you use a lot of electricity [and it] is a big part of your budget. *That makes you more competitive*. If you're competing against somebody out of state and *you can reduce your energy costs to make the widgets that you make, you get a lot more competitive* (interview with Patrick Henderson, emphasis added by author, 6/26/12).

Henderson, and others, have explained the shift from coal to natural gas for electricity generation as the result of utilities responding to "irresistible" free-market forces (Mufson 2012; Porter 2013a). Indeed, according to Henderson "an electron is an electron," regardless of the pollution created while generating its flow from power plant to electrical sockets. From this point of view,

nuclear, hydroelectric power, or even coal, were each equivalent sources of energy and concerns over emissions were less important than making energy cheaply.

Although framing shale gas as a bridge fuel helped legitimize the scalar fix, a prominent member of the MSAC had implied that increased energy usage was fine as long as Pennsylvanian industries could be made more competitive. Unfortunately, regarding climate change, the problem is not finding more supplies of cheap fossil fuels, but quitting the ones we have already found (Bridge 2011, 320–321). Additionally, a month following the DEP's announcement that the US had produced less CO2 emissions, a new report showed that coal usage had bounced back, in response to increasing natural gas prices (US Energy Information Administration 2013j). The MSAC had also purposefully ignored critical research on methane leakage that had cast doubt on the emissions benefits of natural gas.

Natural gas is principally methane, a molecule that traps heat in the atmosphere much more effectively than carbon dioxide. Although the exact global-warming potential (GWP) of methane is not universally agreed upon, the Intergovernmental Panel on Climate Change estimates the GWP of methane is between seven to seventy times more powerful than carbon dioxide (IPCC 2007). Leaky pipes in the natural gas supply chain could eliminate the emissions advantage of natural gas combustion over coal, a point that has been bitterly contested in the scientific community (Howarth et al. 2011; Hultman et al. 2011; Cathles et al. 2012). The leakage rates from pipes, compressor stations, wells, trucks, and other industry infrastructure are estimated in these studies. Additionally, no conclusive research has shown exactly how much methane is "fugitive" in the journey between the well and the burner tip (Schoof 2012; Porter 2013b). However, infrared aerial imagery of natural gas infrastructure in Australia has shown levels of methane three times the normal background rate (Williams 2012). In addition, air

samples from gas fields in the Denver-Julesburg basin in Colorado showed that 2-8 percent of the gas produced there was lost to the atmosphere (Tollefson 2012). The actual leakage rates in Colorado were even higher than the estimates used in the controversial Howarth et al. study. Whatever the implications of Howarth et al. might have been did not affect shale gas governance in Pennsylvania because the MSAC made it a point to disregard the Howarth et al. study. According to reports from their meetings, the MSAC set aside the critical study because Howarth et al. were thought not to support the use of natural gas (Puko 2011). In sum, although the MSAC framed shale gas in terms of a bridge fuel to legitimize its scalar fix, Henderson's statement, and the commission's ignorance of critical research, revealed an uncommitted approach to mitigating climate change.

Conclusion

In closing to this chapter, the scaling of shale gas development in Pennsylvania as a fix to national and global energy supply quandaries was not unintentional. The massive increase in shale gas drilling in the late 2000's followed a period of increased consumption by rapidly-industrializing economies and financial speculation in energy markets (Yergin 2011a). The results were high gasoline prices and high natural gas prices, and wars that were believed to be fought for cheap oil. The hazards of climate change, including the inability of the international community to find a shared solution, made natural gas seem like a pragmatic compromise. At this conjuncture, the Pennsylvania state government could have confronted both climate change and energy security by beginning the transition towards energy conservation and renewables. Instead, it cut funding to renewables (Hopey 2011) and put its full support behind shale gas, using its neat stack of scale frames to gain the public's consent for a fixed scale of accumulation, extraction and degradation.

Chapter Five: Conclusion

Location alone cannot explain why it is that shale gas boomed in Pennsylvania. Instead, this thesis has argued that the governance of shale gas was instrumental in pushing forward this particular accumulation strategy. Profit for an elite group of industries and corporations was prioritized over the risks to the environment and human health from shale gas extraction. These conclusions were reached after an analysis of two scalar dimensions of Pennsylvania's shale gas governance.

Two scalar dimensions of the state's environmental governance of shale gas perpetuated the shale gas boom in Pennsylvania. First, the state was used as a scalar fix in the wake of the 2007-2008 subprime mortgage and general financial crisis. Shale gas extraction was a profitable investment following the bursting of the housing bubble, and governance institutions in Pennsylvania assured a homogeneous regulatory landscape for that enterprise. Secondly, shale gas boomed in Pennsylvania because development benefited a powerful set of political agents whose interests had "permeated" the internal structure of the state (MacLeod and Goodwin 1999, 516). These interests were operationalized through a set of neatly-stacked "scale frames," which were used strategically to legitimize profits for corporations and industries (Kurtz 2003). These conclusions bear significance in the debate within geography over the proper use of scale.

The hierarchical understanding of scale supported by the theory of the scalar fix, aligns this study with Neil Brenner's work on scale (even though Brenner seems to have moved past this obstructed field). It was observed that the MSAC supported the fixing of the state scale to ease the perpetuation of shale gas development. By admitting that this process was a scalar fix, this study shows how that scale is hierarchical. Indeed, hierarchy is what makes scales different from other geographic ideas like space and place (Brenner 2001, 597). This is directly counter to

Marston et al.'s (2005) argument that hierarchical theories of scale are somehow no longer relevant. Accordingly, it was found that the notion of a "flat ontology" would not adequately capture the process of environmental governance of shale gas (Marston et al. 2005). This thesis also contributes to a wider set of literatures outside the scale debate.

This thesis contributes to studies of governance, and contributes to our understanding of neoliberal environmental governance, because the MSAC was a public-private partnership, a prototypical neoliberal governance project. This thesis also adds to literature in energy governance by integrating aspects of political economic theory that problematize the role of the state in capital accumulation. Specifically, this thesis strengthens studies of energy governance that confront the political economies of fossil fuels and industrial manufacturing, which permeate energy policy and guide the production of new fossil fuel landscapes.

This thesis contributes an empirical study of shale gas governance to new geographies of energy. Other literatures in geography have focused on different types of energy sources and natural resources other than shale gas. This study is one of the first to confront unconventional types of fossil fuels supported by interview data. The empirical basis of its claims pushes geographies of energy past idiographic reviews of energy resource types and locations. Additionally, I hope this study can contribute to geographies of energy that will engage with critical theories of the state and capitalism. Having touched the contributions of this thesis to the discipline, we turn to some wider implications for energy policy in US politics.

Wider Implications

While interviewing public officials about shale gas development, I noticed a particular narrative start to emerge. The story I heard would usually begin with an assumption, although it

was often unspoken. The assumption was that to be comfortable, the northeastern US requires natural gas. Entering into a conversation about anything with pre-formed assumptions forecloses a debate that would allow for discussion about alternatives. Energy is an absolute necessity. Warmth and light in the drab and blustery regions are not up for debate, nor should they be, for anyone. However, the question of how to achieve that goal is indeed debatable. There are techniques of using energy much more efficiently while providing the same comfort. Unfortunately these are not currently being explored at any large scale within the US. Luckily, there are other places we can look to for inspiration.

If you hopped on a train from Frankfurt am Main to Heidelberg, you would pass by the burg of Darmstadt, Germany. It was here in 1991 that the first "passive house" was constructed (Rosenthal 2008). These structures were designed with energy efficiency in mind, with thickly-insulated walls and heat-trapping windows and doors. The air is not stagnant or cold because a heat exchanger in the basement recycles heat from the inside while drawing in fresh air from the outside. Since the first batch of passive houses were built in the Northern Hemisphere, the windows were oriented south, to let in as much heat from the Sun as possible. The Sun, combined with waste heat from appliances, and the warm bodies of the cozy residents, provides enough energy to keep the temperature pleasantly comfortable in winter. In 2008, a passive house cost only five-to-seven percent more to build than a normal home in Germany (ibid.). Unfortunately, a branch of the German "Passive House Institute" lists less than two thousand passive house construction projects across the whole of the US (PHIUS 2011). With approximately 130 million housing units in the United States (US Department of Commerce 2009), passive houses have not made much of a dent in the overall market share. In a world of rapidly-increasing greenhouse gas emissions, and increasing demand for energy from

industrializing economies like China and India, why are US homeowners uninterested in passive houses?

Natural gas has recently become much cheaper, crushing the demand for energy efficient homes. In 2008 the price of one thousand cubic feet of natural gas reached an all-time high of nearly eight dollars. In 2009 the price had been slashed by more than half, to less than four dollars (US Energy Information Administration 2013e). The price has dropped even further since then, to 3.35$ in December of 2012 (US Energy Information Administration 2013e). Shale gas development has been so productive that it created a glut in the natural gas market, supply had outstripped demand, and the price had collapsed (Malik 2012; Associated Press 2012). However, homeowners were not responsible for stoking the energy boom because they do not set energy policy.

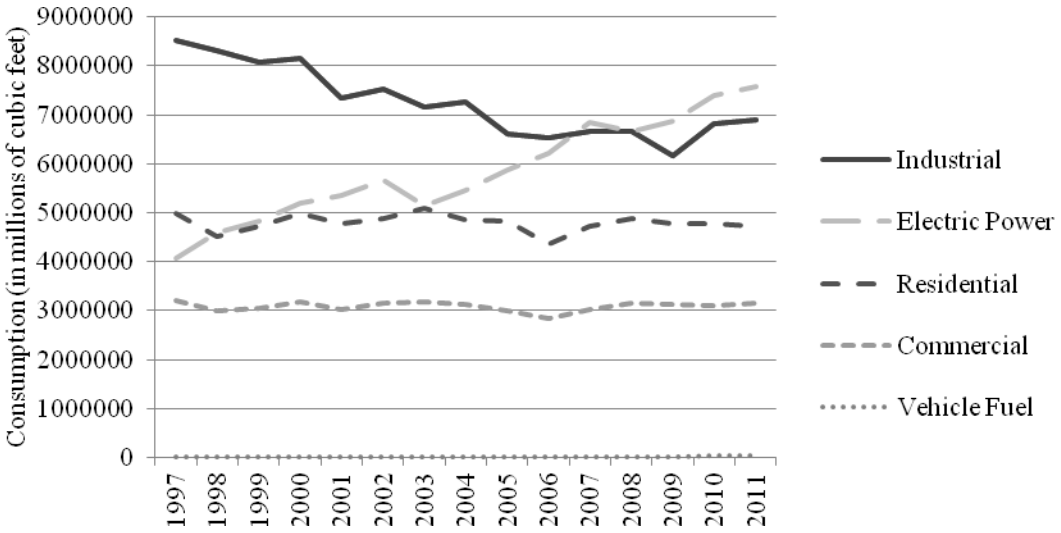

Figure 5: US consumption of natural gas by sector (US Energy Information Administration 2013k)

Industries, utilities, and gas companies have stood to gain much more from cheap natural gas than homeowners and have made their voices heard to bring shale gas development forward. Although the amount of gas used to heat American homes is considerable, residential

consumption is dwarfed by the amount used by industry and in electricity generation (see figure 5). Natural gas is useful as an industrial feedstock and also for drying and heating during industrial processes. Dow and Shell have recently decided to invest in new petrochemical manufacturing facilities in the US because of the attractive price of natural gas (Davidson 2012). Utilities have switched from coal to newly-cheap gas for electricity generation (Koch 2012; Mufson 2012; Porter 2013a). Although homes in the US do use a great deal of gas for space heating, industries and utilities have taken far greater advantage of the gas glut by virtue of their greater combined demand for concentrated energy. For that reason, in governance institutions like the MSAC, it was these heavy consumers that made Pennsylvania's energy choices for the entire state. The problem of who governs whom speaks to a larger problem in capitalism.

In the current state of political economy, the largest and most powerful buyers, like chemical corporations and utility companies, carry the most political clout. As long as neoliberal environmental governance institutions like the MSAC craft energy policy, whoever rules in the market determines the future of energy for the rest of us. Although some just and sane environmental sacrifice for energy is a worthy cause that our political representatives should be advocating for, that ideal is not reflective of current energy policy.

Institutions that guide energy policy do not frame energy production at a scale that engenders an ethic of conservation. Industries and states are beholden to an ethic of competition for capital that demands perpetual growth. Specifically, the "high energy economy" that provides the "American way of life" is a historical holdover that needs to give way to a new social-economic arrangement (Huber 2013). Moving forward, energy must be scaled at levels that engender an ethic of conservation. These levels of social organization must cooperate to ensure that social and ecological sacrifice for the benefit of a few cannot be accommodated. This thesis

contributes to the history of the socio-political system that came before that transformation, and to its geography in Pennsylvania.

Appendix: Interview Questions

1. Could you please state for me your name, job title, and professional affiliation?

2. What are your primary professional duties?

3. How long have you worked within this organization?

4. What is your organization's involvement with shale gas development and hydraulic fracturing?

5. Government offices and NGOs receive their funding from a mix of sources, some public and private, and some local and national. I realize that funding is always complex and I was hoping you could help me situate your organization's funding within this web. Where does the funding for your organization's involvement in shale gas development come from?

6. How has your organization adapted to the rise of shale gas development in Pennsylvania over the past decade?

7. What is your general opinion of hydraulic fracturing, a.k.a. fracking?

8. How would you say your opinion relates to, or is/is not representative, of your organization's general stance on hydraulic fracturing?

9. What do you see as some of the opportunities or challenges facing hydraulic fracturing here in Pennsylvania?

10. What do you think makes Pennsylvania a unique place in the history and development of shale gas compared to other places? Other states, like New York, have been much slower in developing their shale gas. What makes Pennsylvania different from New York State?

11. What perspectives do you see coming out of the government on shale gas development at a local level?

12. How about at the national level?

13. How do you think shale gas development in Pennsylvania is influenced by any statements or claims made about it in other places?

14. How do you think shale gas benefits local communities in Pennsylvania?

15. Alternatively, how might it not directly benefit local communities?

16. How do you think shale gas benefits the northeastern US, or other states surrounding Pennsylvania?

17. Alternatively, how to you think shale gas might not benefit this region?

18. In what ways do you think shale development and hydraulic fracturing might influence human health in places in Pennsylvania? Some possible effects could be thought of in terms of direct or indirect costs and benefits.

19. How do you think shale gas development in Pennsylvania relates to the search for energy sources going on in the United States?

20. How do you think shale gas development in Pennsylvania relates to the search for energy sources around the world?

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