Morals in Transition

Imaginaries and American National Identity Through Three Energy Transitions

by

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ABSTRACT

This dissertation explores the functional purpose of imagination as it is enacted in the context of shaping large transitions in sociotechnical systems. Large sociotechnical systems undergoing profound transitions embody instantiations where societies experience profound changes in the 'rules of the game' that underpin the conduct of daily life. The forms of imagination that guide these transformations, known in the political theory literature as 'imaginaries,' play a profound yet undertheorized role in transition of sociotechnical systems from one configuration to another. Expanding on this relationship, the study draws on three case studies of energy systems change in the United States during 20th and 21st century. Each case study explores unique element of how actors at a variety of levels – transnational governance, regional electrification, and in-home energy marketing – define and the possibilities for ideal human and technological action and interaction through a transition. These actors defining the parameters of a new form of systems operation and configuration are as equally focused on defining how these new configurations shape fundamental ideas that underpin American democratic sensibility. Moreover, in the process of articulating a new configuration of energy and society – be that in terms of managing global resource flows or the automation of energy use in a residential home – questions of what makes an ideal member of a society are interlinked with new contractual relationships between energy producers and energy users. Transitions research could and should pay greater attention to the normative commitments emergent systems actors – as it is in these commitments we can chart pathways to redefine the parameters that underpin emergent transitions.

DEDICATION

For my beloved wife, Jacqueline Hettel Tidwell. I love you more dearly than you can possibly know. Thank you for being my wellspring of encouragement and belief through all my iterations. If I have a “why” for this project, it is you.

And for Emersyn Rose – one day we will sit down, and you can tell me whether I was right or wrong about the world we shall live in together. Perhaps Dad will help shape it for the better.

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To you, Jacqueline, my love, there are no words that can express how much I love you and how integral your love is to this document. When I read this document, I see not only the intellectual work, but the moments big and small we have shared together. I can see in my minds' eye our first drive to Verrado together and the joy we shared at the idea of a home together of our own, a place to make memories. With Emersyn in our lives and this document complete, I cannot wait to live those dreams with you.

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CHAPTER 1

INTRODUCTION

This research explores the relationship between collectively held visions of social progress and the transformation of large-scale energy systems. Specifically, I focus on how human beings construct the moral imperatives of deemed good technological transitions, and implement them through actionable changes in the 'rules of the game' that bound rational energy policy action. In this dissertation, I will explain why narratives that interweave human morality and technological materiality bridge a critical gap between the managerial and organization transformations industries experience during transitions, and the specific modifications of daily practice operators and members of the public encounter. I examine this question through a series of interlinked case studies of American society undergoing three large scale transformation of its energy systems during the twentieth and twenty-first centuries. Each case study emphasizes a different aspect of energy systems writ large – natural resources, electrification, and home energy management – but all explicate the value systems laden in the exercise of designing and charting transitions.

My journey to this project was a complex one, albeit instigated with the same general spark provided by my electrical utility, Salt River Project. As a new resident and graduate student in the southeast valley of Phoenix, I entered the energy fray as a power customer with (like many) limited resources and an insufficiently high credit score. Salt River Project (SRP) gave me two options for how I could receive electricity: I could pay a rather large up front deposit and receive a wirelessly enabled "smart" meter, or pay a much smaller sum to join their pay as you go program. Naturally, I opted for the latter

option and quickly received a small innocuous box as a newly minted member of the M-Power® program. As an in-home energy management system M-Power® puts the customer 'in charge' of their daily energy use. Rather than paying a regularly schedule bill for power consumed M-Power® customers monitor their own use and add money to their meter as needed during the year. M-Power® customers receive no other information from the utility in terms of their consumption patterns. What they do receive are a series of M-Power® customer monthly flyers with important information concerning responsible energy management and, ironically, water safety.

Coming from other utility service areas where customers received monthly bills for power used, I found the M-Power® program a very new experience. I can still remember in detail the first night that my M-Power® box began beeping in the middle of the night after running below five dollars in funds available. I began to wonder "who was this program designed for, and to what end(s) does it serve?"[1] My investigation led to a realization that M-Power® was a managerial and technological choice on the part of SRP repurposed to address the emergence a national discussion centered on the importance of cultivating a responsible energy user.

Salt River Project is a wholly owned subsidiary of the State of Arizona and beholden to the Arizona Legislature for its financial stability. During the late 1990s concerns rose about the financial stresses imposed on SRP and Arizona by customers who were failing to pay their bills. SRP was directed to develop a program for minimizing these financial risks, and the result was M-Power®, a pay-as-you go system

[1] A full treatment of this case can be found in Richter et al. (2017).

that made customers deemed financial risks responsible for identifying when and how much power they needed to consume. Until the mid-2000s the program continued to develop along this line of application, instituting various rules and procedures to protect at-risk populations (the infirm, the elderly, children), off-business hours, and maintain the sanctity of safety during key holidays (Christmas). M-Power® was an effective tool for reducing financial risks, but also served the double purpose of minimizing energy consumption in the home. By making "energy visible" customers had to acknowledge that power was not given, but a product of a constant exchange of capital and electrons between the power company and the consumer. M-Power® customers became unexpected examples of what was possible through energy home visualization tools ("in-home devices"). They represented an ideal kind of utility customer – the fiscally and technologically responsible user of the grid's shared resources.

Upon realizing the implications of this conclusion, I could not help but recognize the irony of thinking about M-Power® through the lens of technological innovation alone. M-Power® was a business choice initiated by policy discourse at the state level over the importance of fiscal responsibility that became a program of moralizing energy systems users' behaviors. M-Power®'s transformation into a tool of energy efficiency and sustainability did not exhibit any large changes in terms of its design or management, customers used the same methods for acquiring power resources they had in the past. What did change is the larger system of shared understandings that bound customers, SRP, and the larger networks of energy policy related groups within the context of a moral imperative – the responsible management of our limited resources. It was without a

doubt this narrative, and others like it that make an appearance in this research project, that led me to study the role of narratives in technological transformations.

Large scale changes in our technological systems, and more specifically our infrastructural networks, incur significant changes on the ways humans conceptualize space, work, play, right, and wrong. Energy systems are a particularly important type of infrastructure as they represent the exponential power humans have gained as geophysical agents in the age of the Anthropocene. No, they are more, energy systems as scholars have noted are the primary modality human beings leverage in the creation of their own form of history – human history. At the most extreme, thinkers such as Ian Morris argue energy defines how we bound morality itself (2015: 4):

> When we look at the entire planet across the last twenty thousand years, I argue, we see three broadly successive systems of human values. Each is associated with a particular way of organizing society, and each form of organization is dictated by a particular way of capturing energy from the world around us.

Read through Paul Edwards' work on infrastructures and society, Morris' argument registers a claim that human beings are in fact as much a product of their energy infrastructures as the constituent artifacts are of human ingenuity.

A more common refrain outlines high-energy consumption as a feature rather than driving force of "modern" societies advancing their tools and techniques of energy consumption (Smil 2005). Regardless, the undeniable fact is that humans build and use energy systems, sometimes define their daily experiences within the context of energy systems, and occasionally encounter new forms of energy use that disrupt established patterns. Take for example one innocuous technology of the twentieth century American home: the refrigerator. Ruth Schwartz Cowan's (1983) study of technology and

homemaking provides a wonderful lens for examining our banal refrigerator in its formative stages. The electrically-operated compressor refrigerator as we know it is the product of a successful series of investments, compressor technical design changes, and marketing that pushed the alternative model – a gas-cooled refrigerator – to the margins of existing markets. The electric-powered compressor refrigerator was in no way a universally superior design to that of the gas-powered one; in fact gas refrigerators were routinely noted for their efficiency and quiet operation. Gas-powered refrigerators suffered from a mix of financial, technological, and social factors all embodied in the larger shift towards electrification as the basis of modern American living. The consequences of the refrigerator and other such household technologies basis on the presence and use of centrally-managed and distributed electrical energy can be felt today through the method I use to communicate this information to you.

Cases such as the M-Power® meter and the gas-powered refrigerator represent moments in the development of energy systems where the individual norms and values within families intersect with larger visions of what makes for a desirable organization of people and technology. Within the literature on morality and energy systems these cases represent instances of homeowner's "moral economies" – their shared sense of how daily life should be ordered (Hargreaves, Nye, and Burgess 2010: 6112). As a matter of research design, these scholars are interested more in individual family reactions rather than the larger ecosystem in which said responses emerge. What is missing – and where this dissertation seeks to make an impact – is by decentering particular energy systems and technologies as the focus of research. Eschewing a social construction of technology framework for examining energy technologies and society, I am interested in explicating

how questions of what role(s) the state, the utility, and the public play in shaping a society's progress are explicated in the configuration and operation of energy sociotechnical systems. To achieve this goal, my dissertation interfaces with two salient literatures in the study of moral economies of energy systems – technological transitions theory, typified by the Multi-Level Perspective model, and theories of imagination and social order. Theories of technological transitions recognize the important role moralizing visions of social life and order play in the shaping of new technologies and networks of actors vying to bring them to the fore. These authors recognize that political, economic, cultural, and epistemic shifts in a society's *raison d'être,* its 'sociotechnical landscape,' create the possibilities that underpin colossal shifts in the operation and maintenance of incumbent sociotechnical systems like petroleum, electrification, and transportation.

What has been missing, and that I propose to address here, is a functional approach for interfacing sociotechnical landscape elements with the behaviors and technologies of actors engaged in creating new sociotechnical system configurations. I argue that it is through the imaginative capacities of these actors—and specifically their ability to create discourses at a multitude of levels within a society, in policy, in business, and in domestic life—where it is possible to observe the contours of emerging visions of technology and social order. In the context of energy systems, this dissertation shows that above all else designing an energy system is a deeply moral exercise. Energy systems draw on just as many intellectual resources pertaining to the operations and maintenance of large technological systems as they do on from the practices actors leverage to interpret the core norms and values of the societies they build for.

Fantasy, Imaginaries, and Technological Change

The complex systems of understanding that underpin how individuals and societies come to understand and describe new ways of framing right and wrong are interwoven with the production and maintenance of sociotechnical systems. These narratives are a form of modern day "fairy tales," complete with their own heroes, villains, and landscapes of wonders both fair and frightful. Take, for example, the case of Richard Scarry's books, specifically *What Do People Do All Day*? As Clark Miller, Jennifer Richter, and Jason O'Leary (2015) note, Scarry's fun and fanciful images of daily life serve as an orienteering guide to modern life. A comfortable and modern society has fireman, police, homes replete with pipes and power lines running throughout, and, of course, those in society tasked with generating the power to make things go. We find in Scarry's book good and bad characters aplenty, all engaged in the process of defining what makes a good society. The electrician wires the house and reminds us never to touch the fuse box, while the power company mice hook up the main power line to the utility pole. Farther up the power line we find our utility friends' associates at the "Buried Sunlight Coal Mine" (Scarry, 1968: 71) working happily away blasting, drilling, and excavating fresh coal seams for the local power plant. Finally, we reach the power plant where coal is turned into electricity to light the homes, run the televisions, vacuums, and panoply of other appliances the people of Busytown use every day. Everyone in Busytown has an important role to play in life either as hero or villain, and all (including King Coal, the Beaver) have a place at the community picnic.[2]

[2] The one exception is Busytown's lone "lazy fellow" – clearly a vagrant (pig) fallen asleep under the railroad tracks. This vagrant pig makes a momentary entrance in our

Narratives such as Scarry's are an important type of "fantasy" that, as Bormann notes, serve a critical role in the organization of large-scale social interaction (Bormann, 1985: 5): "The technical meaning for fantasy is the creative and imaginative interpretation of events that fulfills a psychological or rhetorical need." Scarry's rhetoric of a society that produces and works together is a good society has and continues to provide children a pre-ordained framework for binning what kinds of lives and things they should seek to do and be in life. Bormann calls these types of fantasies "life style rhetorical visions" and attributes their unique power to how widespread these fantasies are in a given society.

Another related field of study on the role of fantasies in organizing societies is the burgeoning literature on "imaginaries" or "social imaginaries" and techonscience. Imaginaries like fantasies serve to make sense of the world, but unlike fantasies emphasize the importance of narratives for making what is unfamiliar seem rational (Volger, 2002: 625): "Crudely put, imaginaries are complex systems of presumption--patterns of forgetfulness and attentiveness--that enter subjective experience as the expectation that things will make sense generally (i.e., in terms not wholly idiosyncratic)." Imaginaries are a shared framework for navigating moments of encounter between individuals, groups, and others be they political, social, or economic institutions, or others who do not share their same history. They are not false narratives insofar as imaginaries do not serve to intentionally mislead daily conduct – rather they are

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story of heroes and villains only to disappear just as quickly. Scarry clearly had less respect for those who do nothing than he did those who do wrong such as Wild Bill Hiccup, the stereotyped "Native American" raccoon that cannot drive.

interpretations of larger political and social commitments directed at specific kinds of interactions. A salient example stems from Sheila Jasanoff and Sang-Hyun Kim's explication of those imaginaries directed at the construction and maintenance of sociotechnical systems, what they refer to as 'sociotechnical imaginaries' (2009). In the post-World War II United States, policymakers leveraged the idea of containment as a metaphor for how to address emergent material, financial, and political risks surrounding the development and sustainment of a nuclear complex deemed necessary for maintaining global power. Jasanoff and Kim's examination of imaginaries highlights an important distinction between imaginaries and fantasies; where the fantasy emphasizes a focus on creation and experience, the imaginary takes what is fantasized and translates it into a structure for knowing how to encounter new experiences in the world. Imaginaries thus possess power in the sense that they draw from the cultural reservoirs of the societies in which they emerge, and circulate throughout via the wider diffusion of technologies, be they techniques of calculating economic growth or the introduction of cellular phone technologies in sub-Saharan African states.

Scarry's books themselves are a form of fantasy – a creative exercise that frames what children learn about the world. The book on its own, however, is not an imaginary, as that would assume a nearly seamless interpretation of the book by children. Children who read Scarry's books (myself included) learn to "see" the world through specific arrangements of his characters: police and firefighters do good, builders work together to make houses (and money), miners work hard, and everyone gets along. These patterns of reading, interpreting, forgetting, and improvising on given templates for social

organization are where imaginaries emerge and begin to shape the ways individuals encounter future life.

In this project, I focus on the importance of thinking about how the stories we tell about a "better life" through science and technology are replete with instances where we can (and should) ask ourselves "is this what tomorrow *should* look like?". Read though this lens, my dissertation is less an inquiry into energy systems transformations ("energy transitions") per se and more a study in how societies make and make sense of their sociotechnical world(s).

For those familiar with conversations in Science and Technology Studies on the intersection of ways of knowing the world and ways of living within it, my statement above certainly hints towards Sheila Jasanoff's idiom of "co-production". I fully admit this work is informed by Jasanoff's emblematic (and enigmatic) claim that "the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it" (Jasanoff, 2004: 2). Yet, like Jasanoff's turn to the imaginaries literature in *Dreamscapes of Modernity* (2015), I am more interested in understanding the function imaginaries play in shaping the coded 'rational' discourses surrounding advancements in science and technology. Echoing Jasanoff, stating knowledge and society are interlinked is not enough. As we enter the fifth decade since the Strong Programme in the Sociology of Science (Bloor 1991) asked us to question the social production and transmission of scientific knowledge, our examinations of the role humans play in their own technoscientific futures should seek to fill in the gaps in our own existent theories. Sociotechnical imaginaries played a formative role in the initial work I did on fantasy, imaginaries, and energy transitions (Tidwell and Smith 2015;

Smith and Tidwell 2016). Many pieces in that vein of work will reappear throughout this research project, and I am indebted to Jasanoff, Kim, and their associates for initiating this vein of inquiry.[3]

My research, however, is not a study of sociotechnical imaginaries and energy systems. Rather, it is a study of the imaginaries that actors shape in the creation of alternative visions of energized social life and order. On first pass, this choice seems peculiar given this dissertation is about energy systems and the ordering of American society. As I explain below, my choice to focus on advancing theories of imaginaries as they pertain to the study of sociotechnical transitions as opposed to sociotechnical imaginaries is a direct response to the overemphasis in recent energy scholarship on the technologies being imagined, rather than their wider social and cultural context. Put bluntly, what is missing from many studies employing sociotechnical imaginaries today is an analysis of the social and political context(s) under which technological systems become representative of specific visions of societal advancement.

Sociotechnical imaginaries as defined by Jasanoff and Kim emphasize the role of policymaking as their field of study on how visions of positive social change through science and technology manifest (Jasanoff 2015a: 4, emphasis added):

> [W]e redefine sociotechnical imaginaries in this book as collectively held, institutionally stabilized, and publically performed visions of desirable futures, *animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology*.

[3] In particular, I want to thank my colleague Tess Doezema for riding out one too many conversations about this subject together. I hope you find some of my insights here useful for your work.

"*[A]nimated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology"* (ibid). Since *Dreamscapes* came out, I have struggled with how to address, on one hand, Jasanoff and Kim's revised definition, and on the other the burgeoning literature examining the imaginaries of energy transitions. Sociotechnical imaginaries is at its core an attempt to create an actionable framework for studying how exactly questions of social life and order are interwoven with questions of scientific advancement – what Jasanoff calls the idiom of "co-production" (Jasanoff, 2004). Imaginaries as tools for coordinating policy action and technoscientific advancement towards common goals represents an understanding of society consonant with the last five decades of advancements in the study of the sociology of scientific knowledge. Both Jasanoff, Kim, and the contributors to *Dreamscapes* acknowledge the wider societal context in which advancements in science and technology become encoded with larger political, social, and economic commitments. Recent energy research employing sociotechnical imaginaries as an analytical lens emphasizes the interface between technologies and their vision in the context of policymaking (Ballo 2015; Levidow and Papaioannou 2013; Kuchler 2014). What is missing in these and other studies is a careful examination of the context in which debates over the role of science and technology advancements in shaping future life emerge and become embedded in sociotechnical systems.

I would posit this disconnect between the literature as it appears today and the vision of sociotechnical imaginaries in *Dreamscapes* has a great deal to do with the context in which Jasanoff and Kim's sociotechnical imaginaries analysis is situated in the 2009 paper versus the 2015 book. Jasanoff and Kim's (2009) argument for sociotechnical

imaginaries in 2009 leveraged a cross-national comparison of visions surrounding the role of nuclear technology in the shaping of government priorities and government-society interactions in the United States and South Korea, respectively. In the case of the United States, Jasanoff and Kim argue that the emergence of nuclear weapons at the conclusion of World War II was co-produced with a narrative of containment that, throughout the Cold War, came to encompass all facets of daily life, the conduct of policymaking, and the management of public engagement. What was missing from their analysis was a treatment of the larger shared understandings Americans possessed surrounding the idea of containing existential risks; for example, the containment of Japanese-Americans throughout World War II. Policy priorities surrounding containment within the United States did not emerge *de novo* in response to the development of nuclear weapons. The management of nuclear weapons shares a common social and political history with how Americans have addressed the 'other' in a variety of political, social, and economic contexts. An unintended consequence of this lack of context seems to be an expectation that the study of sociotechnical imaginaries should focus explicitly on the interaction between groups in society and technological advancements as opposed to the contexts in which they are arranged. As a network directed towards the future by a shared vision, an imaginary, for what the 'good life' should look like, sociotechnical imaginaries provides a starting point for addressing a serious weakness in the analytical effectiveness of co-production. Divested of these social and political contexts, however, the sociotechnical imaginaries literature as it stands says little about how groups in a society navigate shared values in the context of emergent new forms of living such as those encountered during a sociotechnical transition. It is at this intersection between

commonly held understandings of how a society understands its forms of daily life and the activities undertaken to envisage other forms of living, specifically in terms of energy systems in the United States, that my work seeks to make its impact.

Technological Transitions

I will approach this question of how to study the norms and values that intersect discussions of possible sociotechnical futures through bringing the imaginaries literature into conversation with soctechnological transitions theory. Building on the work of historians and sociologists of technology, in particular Thomas Hughes' theory of "technological momentum", and Wiebe Bijker and Trevor Pinch's Social Construction of Technology (SCOT) theory, technological transitions research focuses on the multi-scalar co-evolution of large assemblages of technologies directed at specific types of material and social outcomes. This "multi-level perspective" (MLP) approach to technological transitions demarcates the world into three categories of interest: sociotechnical landscapes—the larger social, political, and increasingly ecological pressures on human societies; specific regimes of actors, institutions, technologies, and implicit "rules of the game" that bound the field of rational behavior (Geels 2002: 1260); and specific emergent technological "niches" where novel ideas and technologies are developed and emerge.

Research in the MLP approach to transitions and transitions management emphasizes the role sociotechnical regimes play in shaping transitions (Fuenfschilling, Lea and Truffer, Bernhard 2014; Geels 2014; Sengers 2016). Regimes are where actor groups' power is established and ossified into the obdurate features of society – its rules, its infrastructures, and constellation of actors. Emergent technological niches can and

have successfully uprooted previous regimes, but such change requires emergent groups to network together significant political power of their own. Moreover, these oppositional groups cannot rely on artifacts alone, as they need to draw on powerful narratives that allow agents of change to speak of and show what life could and should be like (Arranz 2017). Through the process of articulating and constructing alternative visions and futures actors embody the new field of acceptable practices (Shove and Walker 2014): they experience what it means to live with different notions of comfort, health, and of course energy.

Frans Berkhout defines these narratives of alternative regimes, or future visions, as "*collectively held and communicable schemata that represent future objectives and express the means by which these objectives will be realized*" (Berkhout 2006: 302). Much like Jasanoff and Kim's definition of sociotechnical imaginaries, Berkhout emphasizes the functional role of future visions and their moral valences in terms of how they organize the "rules of the game" that direct material action. Both approaches to the role of futures and sociotechnological change also emphasize the implementation of narratives/imaginaries as tools of power. What is lacking is an understanding of (1) what resources actors draw upon to construct imaginaries, and (2) how these imaginaries relate to larger social, political, economic, and epistemic shifts within a society. The fact that imaginaries shape the activities of governments, corporations, and individuals only captures the consequences of imaginaries, rather than examining the resources actors draw on to create imaginaries informed and informative to unique sociotechnical regimes.

To redress this existing gap in our understanding of narratives/imaginaries and technological change, this dissertation shifts the focus of analysis away from the

sociotechnical regime and up towards the overarching sociotechnical landscape. Sociotechnical landscapes are currently conceptualized as the reservoir of exogenous factors that can drive technological change. Wars, environmental disaster, and political upheaval are some of the salient categories of world events that were it not for the sociotechnical landscape category would have little to no relationship to the MLP model of technological change. Following an understanding of social and technological change in the coproductionist vein, I argue that the sociotechnical landscape is less a reservoir of emergent social boundary conditions, as the milieu from which actors build their narratives and articulate visions of social and technological change. This distinction is necessary, as studies of sociotechnical transitions in the MLP model ascribe sociotechnical landscapes a secondary role to those of regimes and niches, rather than recognize that social and political context for innovations does not end beyond specific sociotechnical systems and actor-network groups.[4]

Outline of the Research

My dissertation posits that imaginaries and their moral and material dimensions are expressions of sociotechnological landscapes rooted in the pragmatic necessities of producing material transformations of sociotechnical regimes. Energy systems are conspicuous among other large technological systems in terms of the salience and persistence of the idea that they can and will be transitioned from one configuration to another over time. The empirical material for this dissertation draws on three instances

[4] For a more complete set of critiques pertaining to the under-theorization of sociotechnical landscapes see (Lawhon and Murphy 2011).

where monumental transformations in the ordering of American society led to the emergence of specific imaginaries pertaining to the role(s) novel energy systems would play in shaping new understandings of security, the public interest, and the home. My focus is on how ideas about these constitutive parts of American life and social order become articulated and materialized through the co-production of new imaginaries and configurations of energy systems.

In Chapter Two, I provide a more in depth discussion of imaginaries/fantasy and technological transitions, and outline a project of studying the role of moralizing visions in defining what is technological and social advancement through a transition. This chapter should help anyone who is also interested in finding a way to discuss the role of imagination and fantasy from perspective that captures the larger body of work in this field.

Chapter Three presents a previously published work "Morals Materials and Technoscience: The Energy Security Imaginary in the United States" (Tidwell and Smith 2015) which examined the way mid-century U.S. policy makers constructed the problem of energy security within the context of geopolitical imperatives. This article demonstrates energy security as we understand it within the context of American policymaking depends as much on a material anchoring in 1960s and 1970 energy challenges as it does on the articulation of American political norms and values for a global stage. Considering "energy security" as a sociotechnical imaginary helps to situate our focus on how transitions between energy system configurations begin in the ways actors see the role of these new systems at the associated scales of impact. Situated within the context of a genealogy of security and American society, Chapter Three provides a

nation-state level account of how actors seeking to understand energy systems within the context of the emerging concept of global security articulate a vision of security that is uniquely networked through energy systems and their associated financial and political institutions. For those most familiar with the transnational and nation-state analyses common in the co-production scholarship vein, this chapter serves as a useful point of departure along the larger dissertation's focus on the construction of imaginaries from the larger social and political reservoirs of a nation-state's identity.

Chapter Four focuses on the role of constructing the public in the articulation of a key early twentieth century transition: the emergence of electrification as the primary modality of illumination and motive power for manufacturing. Turning to the lectures of one of the industry's most important business minds, Samuel Insull, I examine how Insull situated the emergence of electrification as a question of the moral standing of Illinois society. Emerging from the financial and technological instability of Chicago's late nineteenth century energy infrastructure, Insull name has become synonymous with big utility power and greed. My analysis suggests that Insull was also concerned with how his industry was perceived to behave in relationship to its investors and the public writ large. Building on Thomas Hughes's (1983) examination of Insull's many technological and managerial advancements, I study Insull's story from the perspective of his visions of what was an appropriate public-utility relationship. Insull emphasized throughout his career that electrification companies should be monopolies, and that the responsible regulation of the electrification industry was necessary from a fiscal and public relations perspective. This could only be achieved, Insull argued, by shifting regulatory oversight to a state policymaking body. Comprised of men of good moral standing, a state public

utility commission would act as a responsibilizing force, holding his company and others culpable for the public benefits they should ostensibly provide.

Chapter Five looks at a more contemporary and emergent case of an energy system in transition, the emergence of the home as a site of energy production and management. Though early American homes produced their own energy through the burning of biomass or fossil fuels, few homes use these forms of energy today for illumination or motive power. In an almost ironic twist of history, contemporary calls for home owners to become active managers of their energy use have intersected with larger visions of what role the home serves in American society. What has resulted is a series of emergent sites where one can observe the moralization of energy consumption *within* the context of these larger home owning and homemaking discourses and practices.

One important site where visions of the ideal home life intersect with energy efficiency and management discourses are the model homes builders develop for new home developments. New home development models, like museums, are sites where people and place are imagined and brought into a contextualized focus. Unlike museums, the intent of the new home model is to enroll the individual in a unique vision of what life could be like through alternative "modern" living. Drawing on a visual analysis of new home build sites in the Phoenix metropolitan area, I examine a subset of builders who have begun emphasizing the role self-energy management can play in "constructing" better lives through new homes. As I show, the moralizing visions that inflect on energy transitions in progress both draw on existent narratives and establish entirely unexpected ways of experiencing daily life. I argue the intersection of these two experiences within

the context of the model home is what gives us the perception of "innovativeness" so fundamental to our ability to situate it within the context of social progress.

To conclude, I return to the question of how moralizing visions of society shape technological transformations and the story of ideal societies made cultural icon through Scarry's work. Like Scarry I see the value narratives play in shaping the reservoir of images and metaphors bounding how we collectively see tomorrow. Yet, I see the limited potential they can play in a world dominated by the all-too-easy separation of innovations from their societal implications. At the intersection of these visions and the construction of scientific facts and technological artifacts lies a fruitful yet underexplored intersection for imaginaries research and the development of novel approaches to science, technology, engineering, and mathematics education (STEM). Opening the pedagogy of STEM to examination from an imaginaries perspective affords several opportunities for imaginaries scholars to think and act towards understanding how transitions occur and might occur otherwise. As we consider the articulation of new visions of social life and order in response to environmental, social, political, and economic global change we must consider the role Science and Technology Studies can play in shaping how we both understand where and to what ends links between science, technology, and society emerge, and how we might blur the lines between what are still problematically held as separate categories.

CHAPTER 2

LITERATURE REVIEW

Reflecting on Richard Scarry's fantasies of American social life and order I am always struck by how *little* my own child will recognize the worlds he paints with words and drawings. The coal-fired power plant, for example fueled by the "Buried Gold Mine" represents a configuration of electrification systems in the United States built on shipping large amounts of raw energy resources—coal specifically—to centralized power stations to generate large sums of energy for distribution over large geographical territories. It is a system built on visions of social progress through electrification and illumination, of comfort and warmth in the home facilitated by an increasing number of technologies to ostensibly shift labor from women. Scarry's books represent the kinds of lived experiences consonant with the communities, industrialists, and individuals explored by David Nye, Thomas Hughes, and Ruth Schwartz Cowan. Like Muncie, Indiana, Busytown is replete with the possibilities for comfort, safety, and modernity facilitated by the increasing power and influence of the Edison family of power and light companies who have in Busytown clearly pushed predecessor gas and biomass energy providers from the fore.

My own child will grow up in a very similar, yet entirely different configuration of electrical power generation. She will know of a power sector supplied through a combination of resources—gas, wind, biomass, nuclear, and solar. As opposed to her father, who grew up on stories of life (and death) in the company towns of Appalachian coal production, she will hear from her mother and maternal grandfather about working and living as an expert tasked with producing safe and reliable energy from atomic

fission. Schoolwork will include references to carbon emissions and the importance of protecting our natural resources—made possible through a variety of games and exercises taught in teacher's college programs today. Her parents will speak at home with friends and family alike about the challenges of producing a 'safe, reliable, and environmentally responsible' mix of energy sources, and she will see on her friend's houses and garages the possibilities afforded to homes that choose to produce, store, and consume their own energy through photovoltaic solar.

The shift between what my own personal experiences with energy as a child were, and what my daughter's energetic life will likely be, are representative of the scale and power through which humans modify the sociotechnical systems that shape their worlds. Transitioning from one group of actors, technologies, rules, norms, and narratives— what scholars call a 'sociotechnical system'—to another implies tremendous shifts in how individuals come to understand and act in the world. Emergent sociotechnical systems possess a great deal of uncertainty in their nascent years, as these new interlinked networks of technological artifacts, organizations, epistemologies, and 'rules of the game' have yet to reach an equilibrium with other existing sociotechnical systems (T. P. Hughes 1983; Meadowcroft 2009).

At the level of individual technologies and technological artifacts, new sociotechnical systems are replete with various groups of actors—inventors, business professionals, market analysts, operators, and users—each of whom conceptualize the risks and benefits of artifacts within their larger understandings of the role of sociotechnical systems in society. Richard Kline and Trevor Pinch's (1996) study of the introduction of automobiles into the rural American landscape are representative of how

specific social groups such as dandies joyriding, farmers with horse and buggy, and farmers needing higher concentrations of motive power (engines) understand, adapt, or resist specific artifacts in the process of meeting their needs. Exhibiting what Wiebe Bijker and Trevor Pinch (1984) called "interpretive flexibility", rural user groups shaped the purpose, structure, and associated marketing models surrounding early vehicles, leading to the emergence of what we now know as the pickup truck.

Similarly, actors engaged in the construction of electrical power systems accustomed to smaller generators for turning steam into electrical energy encountered and worked with power technology developers to design and implement large turbine generators, increasing the thermal efficiency of their central-station power facilities well above the ability of competitors (T. P. Hughes 1983). Actors, chief amongst these early power company operators such as Samuel Insull of Commonwealth Edison in Chicago (who will make an appearance later in this dissertation), were less concerned with their own social network groups' needs and wants as they were with shaping how groups of artifacts, financial models, and policies made possible new models of generating capital with electrical power generation and distribution.

Thomas Parke Hughes refers to these 'systems builders' as actors who "construct or to force unity from diversity, centralization in the face of pluralism, and coherence from chaos" (Hughes 2012: 47). A systems builder's "story" of how successful or unsuccessful they were can be found in the strength of the network of knowledge, technologies, and people arrayed together (Latour 1988: 140):

> *Understanding* what facts and machines are is the same task as understanding who the people are. If you describe the controlling elements that have been gathered together you will understand the groups which are controlled.

> Conversely, if you observe the new groups which are tied together, you will see how machines work and why facts are hard. The only question in common is to learn *which associations are stronger and which weaker*.

The power to shape and bring about a sociotechnological transition is ensconced in the very individuals, technologies, and understandings of the world that make its existence possible.

Bringing about new sociotechnical systems is a "co-evolutionary" process in the sense that, similar to how Jasanoff (2004) discusses the simultaneous emergence of ways of constructing knowledge and ways of living in the world, sociotechnical systems are inexorably linked to the emergence of the constituent parts which comprise their existence. Arie Rip and Frank Kemp (1998) refer to these constellations of actors, institutions, technologies, and guiding rules and norms as a "sociotechnical regime." In both the literal and metaphorical sense, a sociotechnical regime is where the stuff of our technological society happens (such as writing a dissertation on a laptop) and where we turn our sense of how the world should work *into what we do in it*. Actors within a regime have the task of making sense out of what otherwise would appear to be a complex set of interacting individuals and technologies; their ability to shape the world to achieve specific goals thus depends upon creating narratives and practices that produce coherence in how the "game" should be played (Geels 2002: p. 1260).

Not all actors have the same amount of power over the narratives that shape a given regime, and the relationship between actor groups and overarching institutions play a significant role in the coordination and subordination of dominant/non-dominant interpretations of given regimes (Fuenfschilling and Truffer, 2014). Dominant societal

institutions can exercise great power over deciding who and who does not matter within a given sociotechnical regime; for example, non-whites in South Africa exercised little to no influence over the country's coal-based electricity systems while whites and other global development institutions inscribed a Euroamerican model of centralized distributed power onto a deeply divided cultural landscape (Baker, Newell, and Phillips 2014). Deciding who and who does not coordinate the pattern of these rules requires examining both the scale(s) at which sociotechnical regimes act, where in the world we find them at work, and how they fit into larger sociocultural, economic, and environmental patterns.

Geography and locality matter, whether those spaces are nation-states or individual urban settings. Where a regime resides is its "medium of action" (Raven, Schot, and Berkhout 2012), the material and social reservoir that directs the co-evolutionary process between a society and its unique sociotechnical systems. What however exists beyond the medium and shapes the possibilities for a transition to occur? To return to systems builders, Hughes conceptualized the exogenous factors that influence the possibilities for new sociotechnical systems as the "environment" of innovations. The environment is a semi-stable set of one-way interactions between factors outside of a given sociotechnical system that directly affect system behaviors and those factors the system itself influences (Hughes 1983: 47). Recent scholarship seeking to operationalize Hughes' concept of the environment refers to these exogenous factors as the "sociotechnical landscape" – the larger social, political, economic, and environmental changes and stabilities a sociotechnical regime must inevitably adapt to for survival (Rip and Kemp 1998).

Hughes understanding of the environment opens a great deal of ambiguity as to where sociotechnical systems begin and end, a consequence of his model that has only increased in salience during the decades since he wrote *Networks of Power*. Much like my daughter confronted with her mother monitoring and scheduling power use via her smartphone delineating between large technological systems based on the characteristics of their constituent artifacts (smartphones versus transformers), let alone the multivalent interlaced political, social, and ecological implications of telecommunications enabled energy use are difficult at best.

It is almost ironic that Hughes' understanding of the interaction between systems and their environments appears quaint when confronting a multitude of new intersections between longstanding sociotechnical regimes such as telecommunications, energy and transportation, amongst others. Hughes posited that systems could develop a sort of "momentum"—becoming increasingly durable as they began to take on the qualities of an environment. As systems array larger and larger groups of individuals and technologies directed towards specific visions of the future these systems become massively influential (T. P. Hughes 2012). Some become so large that, like electrification systems, they become the conduits that direct our collective energy (metaphorical and literal) towards acting as geophysical agents.

What then makes a transition, and more specifically an energy transition, possible? According to one dominant theory known as the Multi-Level Perspective, innovations in protected niches build larger and larger networks of supporters (human and technological artifact) until, usually through some significant change in the sociotechnical landscape, an opportunity emerges for radical transformations in the

dominant sociotechnical regime (Geels 2002). A sociotechnical transition is an evolutionary process by which competing niches adapt to new environmental pressures, and through building stronger and stronger networks can and do overthrow existent and even ossified regimes. Not all innovations succeed, most fail gloriously, and all must inevitably confront the latent institutional networks and modes of governance that define and re-inscribe through daily practice the "rules" defining appropriate living. As I outline in the next section, a model of sociotechnical change that starts from the perspective technology and society are simultaneously constructed offers a needed remedy to over a century of models positing energy as the driver of social change. Approaching energy systems as question of rules, norms, and practices emphasizes that my daughter may in the future have a materially more efficient and less polluting energy experience than I did, but that these changes are not the product of a naturally occurring march towards ever better (and efficient) forms of civilization.

Energy as Society?

During the Second World War the anthropologist Leslie White published what stands as one of the most interesting explorations of the intersection of energy, technology, and social change. Responding to World War II, "Energy and the Evolution of Culture" (White 1943) approaches the question of cultural change as a process of providing increased security for a society through the transformation and use of energy sources. Framing this idea within the context of the field of Cultural Anthropology writ large, White argued the study of culture itself was a study of energy systems (ibid, p. 335):

> Man, being the only animal capable of symbol-behavior, is the only creature to possess culture. Culture is a kind of behavior. And behavior, whether of man, mule, plant, comet or molecule, may be treated as a manifestation of energy. Thus, we see, on all levels of reality, that phenomena lend themselves to description and interpretation in terms of energy. Cultural anthropology is that branch of natural science which deals with matter-and-motion, i.e., energy, phenomena in cultural form, as biology deals with them in cellular, and physics in atomic, form.

White was certainly not the only person to posit culture in terms of energy—as Anson Rabinbach explores in *The Human Motor*, early 20th century Euroamerican culture was obsessed with the idea of humans as engines of work, and the associated problem of human fatigue (1992). William Stanley Jevons (1865) would couch similar concerns about the energetic nature of a society in terms of its raw resources available. In *The Coal Question*, Jevons (1865) argued that a country's energy resource supplies were part and parcel to its very identity as a nation.

These and more recent interpretations of the role of energy in society continue to emphasize the role of energy as a factor in the organization of what kinds of ways of living are right and wrong. If they have changed in any ways from their forebears, these recent scholars of 'energy as social order' posit a society's energy system regimes create and maintain social and political order (Morris 2015: xix):

> It is not that individuals are caused to adopt values by their society's mode of energy capture. Rather, over the course of long stretches of history, and as a result of innumerable social experiments by inventive humans, the societies that are best organized to exploit available modes of energy capture--by their social structures, economic and political institutions, culture and values--will tend to prevail over and displace other societies that are less well organized.

Morris's model of cultural progress as the co-evolution of advances in energy capture and institutional development appears, on first pass, much like the model of sociotechnical transitions discussed above. Yet there are flaws, not least of which pertain to the

centrality of one sociotechnical system over all other possible ways of organizing humans and technologies.

Energy systems are important facets of how societies become ordered to achieve specific industrial, social, and political outcomes, but these systems are not all encompassing. Take for example the problem of sustainability; viewed through the lens of energy systems as social order one could see the problem entirely as a matter of developing sustainable transportation and fuels. This could lead to changes in the material components that comprise specific sociotechnical regimes, *but not a realignment of the ways actors approach energy problems.* Miller et al. (2015) recognize this challenge when they acknowledge that even as global institutions and transnational energy organizations recognize the critical importance of "transitioning" to more sustainable forms of energy production and consumption, problems of energy in terms of policy (a form of 'rules' of the game) are entirely couched in techno-economic terms. Stirling (2014) takes this critique one step further to argue that speaking of transforming energy systems—nearly passé in global conversations obsessed with innovation and change—can and do routinely become subverted by existing power arrangements entrenched within dominant regimes.

Sociotechnical regimes surrounding energy are, it would seem, much more complex than the glacial "march of history" early works of energy and social change would imply. Energy sociotechnical regimes, be they electrification, fuels, transportation, or mining, are deeply resistant to change as incumbent powers have tremendous embedded political and economic power. Incumbents have little reason to change from an economic perspective, and what change would benefit them can already be found in the

incremental improvements in the overall efficiency of energy extraction, production, and distribution during the latter part of the twentieth century.

Change, as is no surprise, occurs when pressure is exerted from the outside of a dominant regime. Pressures are complex and multivalent, emerging from a variety of "landscape" level shifts in how a society understands itself and the world it inhabits. Energy systems due to their global reach and power are impacted by a large number of influences that vary in their size and scale of impact (Foxon 2011: 1205):

> Landscape factors include public awareness of climate change and willingness to accept and undertake changes in response, government commitments to meet national and international targets for emissions reductions and promotion of low carbon energy sources, ideological commitments to liberalized energy markets, concerns over security of primary energy supplies, external factors leading to high oil and gas prices—and concerns about energy affordability and fuel poverty, and factors which threaten physical disruption of external supplies (war, terrorism, foreign governments limiting supply, etc.), as well as changes in the international economic and financial situation.

A common thread amongst these landscape factors is the importance of how individuals frame material and epistemic commitments to a given society's way of living. Take for example the question of ideological commitments to liberalized energy markets: in the context of contemporary discussions of the role distributed energy sources such as photovoltaic solar can play in addressing carbon emissions and energy justice, the commitments a society has to implementing new energy systems through market means can and do have tremendous effects on system development and operation. One can hardly think of a model of rooftop energy analogous to that of Tesla/SolarCity outside of a commitment to the idea that financial models that create systems of debt/debtor relationships allow individuals to exercise their economic choice over what energy sources they utilize.

Does this mean our sociotechnical regimes are forever caught in ideological lock-in, doomed to reproduce existing inequities in new and exciting ways? Likely not, if for no other reason than the distance between visions of governance and life within new energy regimes is quite significant. Narratives such as those arrayed in support of a Tesla vision of distributed energy provide the currency through which actors in emerging niches can articulate specific visions of what is and should be possible through their novel technologies. However, these visions are malleable and change as different groups of actors enter the conversation, increasing both the breadth of locales where change is imagined and the depth to which actors see the possibilities for structural change.

In this respect, guiding visions and narratives are important tools of governance; they represent a key strategic approach towards arraying support behind alternative modes of arranging the relationship between people and technologies (Späth and Rohracher 2010). Visions and narratives oriented towards the future coordinate action at a variety of scales and in different organizations (Rosenbloom, Berton, and Meadowcroft 2016). Actors close to a given novel technology see the relationship between it and larger social and political issues, while those farther away from the epicenter of development may conceptualize the innovation as disruptive, dangerous, or out of sync with the culture's values. The visions of actors within specific sociotechnical niches become the conduits of exchange between communities of actors engaged in technoscientific development and their larger networks and communities (Borup et al. 2006: 286). Narrative structure matters a great deal, as visions completely detached from the material realties of the surrounding communities will come across more as fanciful dreams than viable future ways of living.

Frans Berkhout (2006) addresses the problem of imagining alternative futures via sociotechnical transitions by reframing the conversation in terms of the role and structure of future visions. Future visions are "collectively held and communicable schemata that represent future objectives and express the means by which these objectives will be realised" (302). For Berkhout not all expressions of what the future could be like are necessarily expected outcomes for society. Actors must commit to seeing the world and acting in it through the vision—their schemas for understanding what is and should be an appropriately organized society embody and perform this future vision. Future visions are 'bids' in the process of building support from other actors—in doing so these actors modify the initial vision to suit other existing needs within the population of individuals who may uptake and spread the vision.

Importantly, there are only a limited number of potential actors who can and will bid on a future vision—and all have their own understandings of how the world does and should work. Vision must be functional and pragmatic, and from a narrative structure perspective exhibit a moralized character (Berkhout 2006, p. 300). Like Scarry's stories of an orderly society, effective future visions are clear expressions of utopic or dystopic societies entirely possible within the lifetimes of the actors engaged in existing sociotechnical regimes. A pertinent example is the idea of Moore's Law—what was otherwise a prediction about transistors in memory chips has come to represent a collectively held belief that all computing technologies will exhibit exponential growth in capacities into the foreseeable future. The utopia of Moore's Law is the very idea that society will do nothing but infinitely benefit from the continued reinvestment in semiconductor research, development, and mass consumption.

Where do actors draw their inspiration for the moral valences of specific future visions? Despite the work of scholars examining the role of narratives in sociotechnological transitions, there remain two significant flaws. First, the locus of narratives of what the future could or should hold is invariably within specific niches and sociotechnological regimes. Narratives are couched as instrumentally useful and theoretically relevant techniques actors array to communicate about how to shape a sociotechnological transition. Why and how these narratives emerge within discourse remains unclear. Second, despite the clear linkages between narratives of what the future should hold and our current understanding of the sociotechnical landscape as the reservoir of what constitutes a "good society" no scholars have actively sought to understand the relationship between narratives of the future, and how they are situated within larger social, political, economic, and environmental commitments to social life and order.

To this end, I propose that a fruitful conversation venue for exploring these question lies at the intersection of sociotechnical transitions theory, specifically the multi-level perspective (MLP) and the burgeoning work on social imaginaries. I choose the MLP as my focus of interest for this study due to the growing body of MLP-influenced scholarship shaping the theoretical and practical conversations surrounding energy sociotechnical system transitions and pathways towards sustainable living (Burnham et al. 2017; Lawhon 2012; Sengers 2016). These scholars have drawn on a multitude of resources, most recently ongoing conversations prompted by Sheila Jasanoff and Sang Hyun-Kim (2009, 2015) about the role of visions of technoscientific futures made real through policy actions—what they call "sociotechnical imaginaries"—and the shaping of

energy transition pathways. As this current body of literature explores, imaginaries like future visions impact how actors come to understand the worlds they inhabit, as well as those they could construct through material transformations to existent regimes. Imaginaries, however, function less like a currency and more like the system of monetary policies that underlie how members of a society come to understand the exchange of goods and services. The rules are implied in the 'conduct of conduct' – how members of a society come to understand what role(s) they should play in the pursuit of overarching societal goals such as security and growth.

What these current interactions between transitions theory and imaginaries do not address is how actors' imagined futures construct the highly moralized narratives they bring to bear in discourse. How we talk about and understand potential transitions—especially energy transitions given their scale—have tremendous implications for society. Timothy Mitchell (2011) recognized the importance of asking 'for whom does an energy system live and die' when reflecting on the relationship between specific sociotechnical systems and the possibilities for a society (266-267):

> The lesson from *Carbon Democracy* is that one cannot predict democratic possibilities directly from the design of socio-technical systems - as the internet itself demonstrates, with its capacity for open communication always threatened by the monopolistic commercial powers of the largest software, computer and internet businesses. The point, rather, is that in battles over the shape of future energy systems the possibilities for democracy are at stake.

It is these possibilities for how the moral, material, and technoscientific changes inflect on and inform what a society understands as the appropriate organization of institutions, markets, and the body politic writ large that a study of imaginaries in the context of sociotechnical regimes affords us. The final section of this chapter outlines the idea of

imaginaries, and the relationship between the technologies of imagination and how they reflect deep changes in the ways a society collectively sees right, wrong, friend, foe, comfort, and work.

Imaginaries

A story of imaginaries starts, oddly enough, with a bedfellow category: the fantasy. How they relate tells us much about both the amazing power of imaginaries as techniques of social and sociotechnological change, and the serious limitations of current interpretations in the MLP literature. Fantasies in the broader vernacular sense imply things that are not real, fanciful, unbounded to the material accoutrements of daily life. If this simple definition were true, there would be no reason to assume that fantasies, visions of the future, or any sort of narrative directed towards answering the question 'what could life otherwise be like?' would have any serious relationship to reality. Yet we know, almost intuitively, the fantastical is only distant from daily life so insofar as we situate it as a complex system of metaphors to explore the permeable boundaries between what we see as natural and orderly, and the uncanny expressions of what exists.

Bormann (1985) explores this idea of fantasy as an agent of change from the perspective of how they create shared understandings accessible to a variety of actors. Like the images of Busytown in Richard Scarry's books, fantasies provide a narrative structure comprehensible to many within a society that allow actors to understand their world in its terms. Fantasies, like future visions in Berkhout's (2006) terms, explore a deeply moralized territory and find their strength in the breadth rather than depth of interpretation they allow: "Fantasy themes are always slanted, ordered, and interpreted;

they provide a rhetorical means for several communities of people to account for and explain the same experiences or the same events in different ways" (Bormann, 1985: 9-10). Serving as a common currency, these fantasies allow individuals to exchange experiences, forge common understandings, and importantly meet problems that involve collective responsibility with a united sense of how the world could and should work.

Sharing common understandings between individuals and larger groups, as these fantasies are uptaken by large institutions, increase the power and agency they have over societies. Achieving these scales of impact depend on more than individuals talking to each other. We rely on a system of complex and interlinked metaphors to describe that which is not necessarily rational nor easily bound to a system of quickly identifiable artifacts. While the metaphors themselves may describe complex intersections of human and non-human interaction, humans in specific social and cultural contexts leverage materiality as a modality for conveying metaphors *en masse*. Marina Warner's (2008) exploration of the 'logic of the imaginary' manifest through a variety of medium—wax, shadow, film—shows the importance of these technologies of imagination as structurally necessary for building widely held and longstanding conceptualizations of fantasies. In reflecting on the role of these technologies of imagination, Warner (2008) highlights both how we intuitively understand what visions they represent, and the fact that we are not innately born with these frames of reference (12-13): "Nobody, except a child seeing a baroque angel for the first time, finds it strange that a naked boy could hurl himself *sotto-in-su* from heaven's ceiling on a swan's white pinions, or that lost loved ones should return with their arms stiffly held by their sides and wrapped head to foot in the shroud in which they were buried." Understanding how an individual wrapped in linen cloth,

gauze, or the occasional toilet paper roll represents the unstoppable march of those who have defied our mortal coil, or how its bedfellow the monstrous creature of Dr. Frankenstein is synonymous with the dangers of impure science, depends on the continued reinforcement of a frame of mind that situates these fantasies in material reality.

Mummies and Frankenstein are not our concern here—yet these technologies of imagination highlight an important relationship between the future visions humans create and how they become manifest in our daily lives. Humans, almost intuitively, build systems for collective sense-making and to forge relationships amongst disparate groups. Nationhood, for example, depends as noted by Benedict Anderson (1991) on convincing large groups of humans spread across space and time that they share a common set of stories and values that make them distinct. The importance of distinguishing self and group from the "Other" is a critical technique upon which human power relations are forged, and by association the idea one can speak of an unbroken line of people stemming back to antiquity with a common identity is exponentially more effective at achieving the outcome. Building this sense of 'nationness' relied on certain advances in print-capitalism, lexicography, time, and mapping during the 17th and 18th centuries. Techniques of conveying to large groups a unified sense of self make the idea of being a nation an "imaginary"—and like fantasies their imaginative capacities are linked to what they *do* in the world (Anderson 1991: 6): "It [the nation] is *imagined* because the members of even the smallest nation will never know most of their fellow-members, meet them, or even hear of them, yet in the minds of each lives the image of their communion."

Communion and the intimacy that word implies emphasizes the power technologies of imagination have in creating a physically and psychologically close bond between individuals through shared understandings of what is and what could be tomorrow. Imaginaries have by association a personal feeling about them distinct from the shared fears and hopes of fantasies—a fact made real in moments of conflict and chaos between nation-states. Imaginaries framed in Anderson's perspective take on distinct institutional characteristics; states become in their physical space and narratives a reflection of those identities, and what it implies for determining what serves the greater good. With institutional force, imaginaries become powerful agents for shaping the 'rules of the game' and the appropriate association of actors who, engaged in the practices of dominant sociotechnical regimes, redefine the governance of individual/collective behavior (Appadurai 1996: 31).

Regimes are however comprised of more than the technologies of imagination Anderson describes. The majority of artifacts, power lines, turbogenerators, statistical analysis software packages, have in fact little to do with telling the story of why certain sociotechnical regimes should persist. Yet, we couch stories of how particular advances in science and technology should occur in terms of the larger narratives of which Anderson speaks, and the specific artifacts and systems that should grow and/or change.

Jasanoff and Kim (2009) explore this peculiarity of the "technologies" in the technologies of imagination by looking at how metaphors of technological systems become themselves representative of larger narratives societal advancement. Looking at visions of nuclear technology in American and South Korean society, Jasanoff and Kim note how the American sociotechnical regime of regulated and monitored flows of

nuclear materials was represented through the technical and metaphorical idea of 'containment.' Containment, on one hand, represents a commitment to American-led international diplomacy and oversight across the nuclear material fuel and weapons life cycles. On the other, it is a philosophy that states global security is best left in the hands of the nation-state that has the necessary value systems and technological advances to protect others from backwards and rogue nations. This intertwining of imagined futures and sociotechnical regimes is represented through the idea of "sociotechnical imaginaries," or (Jasanoff and Kim 2009, p. 120): "collectively imagined forms of social life and order reflected in the design and fulfillment of nation-specific scientific and/or technological projects."

Refining this idea, Jasanoff and Kim's more recent definition recognizes that, much like Anderson's technologies of imagination, sociotechnical imaginaries gain power through their authorization via specific acts of state power (Jasanoff 2015a: 4):

> [sociotechnical imaginaries are] collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology.

Desirability and attainability oriented towards policy change—one of the key currencies that define the "rules of the game" within a sociotechnical regime—play a significant role in framing why Jasanoff and Kim argue imaginaries should be viewed within the context institutionally-oriented acts of political power. Broadly utilized techniques of communicating the system of metaphors that embody a future vision's moral commitments do not explore the powerful roles science and technology play in shaping contemporary daily life. Like the medium of film in the reinterpretation of our most

classic of Euroamerican monsters—vampires most of all—the large sociotechnological systems that shape daily life and moreover the emergence of new paradigms of science and technology are canvasses all their own.

Sociotechnical imaginaries present an intriguing direction for considering the intersection of how actors engaged in large-scale discussions of sociotechnical regime change create the environment(s) where it is possible for new rules and norms to emerge and solidify. They share Berkhout's emphasis on defining the objectives by which explicit visions of what society should be like through transitions, and the overarching rules by which it operates. What remains undertheorized, however, is how these visions fit within the larger political and social commitments of a society. Put more specifically, we lack a theoretical placement and understanding how societies develop the structuration of reasoning and cognition that as both Taylor and Anderson note implicitly shape a society's dominant epistemologies.

Imagination takes influence from material advances in science and technology. As Anson Rabinbach documents in *The Human Motor* (1992) engines and the thermodynamic limitations became a metaphor embodied through organized human action to represent the possibilities for humankind. If we look beyond the metaphors of machine and man, however, what we encounter is that questions of human organization, motive power, and efficiency link more broadly to questions of social organization. Rabinbach's late 19th century subjects share a common story with those of Scottish and British scientists Thomson, Maxwell, and Joule situated within ongoing conversations of Christian free will and the finite nature of man. Shared between these two stories are a common larger transformation of energy systems and democratic institutions towards the

increasing centralization and utilization of denser energy resources at the expense of the strength of labor movements to organize against forms of oppression (Mitchell 2011: 233).

In this way, we can see that imagination plays a significant role in the shaping of sociotechnical transitions that extends beyond explicit moments of policy action or what Jasanoff and Kim call "active exercises of state power" (2009: 123). These transitions include deep changes in how political norms and values are interpreted through the material and discursive structuration of a society and its built environment(s) that are not in and of themselves exclusively representative of specific *advances in science and technology*. Yaron Ezrahi's *Imagined Democracies* is particularly informative on this point, and it is here I wish to both embrace aspects of Jasanoff and Kim's model of imaginaries and sociotechnical order, and revise on interpretations of the work. Ezrahi's model of imagination and political order provides a much wider band interpretation of how visions of how a society should work become situated within the practices of generating knowledge and producing technologies.

As Ezrahi and Jasanoff and Kim both note science and technology are powerful spaces for expressing and making real immaterial social commitments (Ezrahi 2012: 15):

> Precisely because religious and political beliefs depend largely on the habit or the willingness to regard as real objects and agents that lack a self-evident visual manifestation (or other direct stimuli of sense experience), religious and political authorities are always eager to use the cultural resources at their disposal to establish and indirectly sensualize, concretize, and generally enhance the reality or the presence of such entities and events as God, angels, revelation, incarnation, transfiguration, hell, paradise, prophecies, the people, the nation, the state, the promised land, the founding fathers, the free market, the individual.

The power of imagination in shaping societies can be found in the ability to make real and imbue with power representations or systems – be they institutional arrangements or power lines – that can shape daily life. Yet, as I have indicated earlier, both Ezrahi and Jasanoff and Kim recognize these imaginings as thoroughly social acts expressed through shared cultural resources. Though the authors may disagree as to what level and extent these resources become shared – can we like Ezrahi and Charles Taylor think of 'western imaginings' as a coherent group of ideas – a common understanding is that to the extent that science and technology matter as techniques for ordering society, questions of social and political order are paramount.

Herein lies both the problem and the solution: advances in science and technology matter when considering the role of imagination in contemporary life and social order through all societies and cultures, but they are in and of themselves situated expressions of shared norms and values. Put within the context of the sociotechnical transitions model proposed by the Multi-Level Perspective theorists, imaginaries are expressions of how the larger sociotechnical landscape of a culture – through all its complex twists and turns – becomes both a fictionalized *and* material manifestation of idealized future life. This interpretation implies two key modifications that intersect both transitions and imaginaries research.

First, transitions research should embrace cultural models of interpreting social and political values in the examination of how the larger cultural landscape of a society inflects on the emergence and contraction of existent sociotechnical systems. To a certain extent, Smith and Tidwell (2016) discussed this point through introducing the concept that imaginaries could 'contract' or not be uptaken when the overarching social and

political support for sociotechnical systems changes or disappears. I would take this further, and say that the contraction of imaginaries and sociotechnical transitions are one and the same phenomena.

By linking the contours of imagination and specific sociotechnical systems, scholarship at the intersection of imaginaries and technoscience should attend more readily to the forms of imagining present during transitions than specific technologies. Scenes of complex transformations in society such as massive shifts in sociotechnical systems extend beyond specific technologies to embrace larger understandings of how individuals and communities work, find leisure, experience private and public spaces, and understand their positionality vis-à-vis others. The following chapters follow this approach, exploring how three key ideas in American society – security, the public interest, and the home are articulated and reshaped through the envisioning of alternate forms of energy geopolitics, regulation, and individual consumption. Each form represents a moment of historic or ongoing transition in the operation of energy systems in the United States, instantiations where as Volger (2002: 627) notes individuals array cultural resources to make sense of complex and shifting understandings of who they are and to what kind of society to they belong.

CHAPTER 3

MORALS, MATERIALS, AND TECHNOSCIENCE: THE ENERGY SECURITY IMAGINARY IN THE UNITED STATES

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Abstract

This article advances recent scholarship on energy security by arguing that the concept is best understood as a sociotechnical imaginary, a collective vision for a ‘‘good society’’ realized through technoscientific-oriented policies. Focusing on the 1952 Resources for Freedom report, the authors trace the genealogy of energy security, elucidating how it establishes a morality of efficiency that orients policy action under the guise of security toward the liberalizing of markets in resource states and a robust program of energy research and development in the United States. This evidence challenges the pervasive historical anchoring of the concept in the 1970s and illustrates the importance of the genealogical approach for the emerging literature on energy and sociotechnical imaginaries. Exploring the genealogy of energy security also unpacks key social, political, and economic undercurrents that disrupt the seeming universality of the language of energy, leading the authors to question whether energy security discourse is appropriate for guiding policy action during ongoing global energy transitions.

Introduction

In 1961, Frank M. Porter, head of the American Petroleum Institute, the largest American oil and gas industry group, was testifying before a House committee on the matter of how growing petroleum imports, specifically from the burgeoning fields of the Middle East, were detrimental to American small business. Discussing the ever-growing problem of new reserve discovery, Porter argued, ‘‘[It] is an equally inescapable fact that the foundation of our future energy security is based upon the success of continuing exploration, a highly speculative venture’’ (United States House of Representatives 1961: 143, emphasis added).

Porter’s 1961 testimony stands as one of the earliest uses of ‘‘energy security’’ in American policy discourse. His use of the term challenges conventional wisdom on energy policy in the United States—in particular that ‘‘energy security’’ as part of American policy lexicon does not appear until the early 1970s (Smernoff 1973). One can see Porter’s appeals to continuing technoscientific advancement in energy production methods echoed today in the energy policy discourse of the Obama administration (The White House Office of the Press Secretary 2013):

> America’s scientists are a national treasure. Every day, idea by idea, innovation by innovation, they are developing new technology that will help secure our energy future. If we want to keep moving forward, we need scientists to keep inventing and innovating, to keep unlocking new solutions and pushing new breakthroughs. . .. The Energy Security Trust will invest in research that will make future technologies cheaper and better—it will fund the advances that will allow us to run cars and trucks on electricity or homegrown fuels, and on the technology that will enable us to drive from coast-to-coast without a drop of oil.

Focusing on the Paley Commission’s Resources for Freedom report from 1952, we explore the fundamental values and assumptions underpinning energy security as they

appear in the early 1950s. Although largely overlooked in later analyses (Mitchell 2011; Vietor 1984), the Paley Commission's ideas were, in the words of Senator George Malone, ''[to be] regarded as an authoritative text and guide to United States mineral policy'' (United States Senate 1954: 2).

Tracing the genealogy of ''energy security,'' and in particular how it organizes the relationship between the state, natural resources, energy technoscience, and markets, leads us to argue that energy security is best understood as what Jasanoff and Kim (2009) call a ''sociotechnical imaginary,'' a form of social understanding embedded in policy action that elucidates how certain forms of technoscience and political order are coproduced (124). As a sociotechnical imaginary, energy security orients policy action by enrolling a well-ordered ''moral'' resource-efficient society within the overarching paradigm of unfettered economic growth as supplied through the state-aided advancement of energy technoscience. These moral and material issues are understood to be the underpinnings of US national security and the ''freedom'' of the world. Concern for the environment and the local and regional scales of energy security do not factor into these discourses; debates between various actors instead focus on federal policies supporting research and development and establishing efficient flows of raw materials from states where they are produced (either internal or external to the state) to where they are needed for efficient consumption.

Approaching energy security as a sociotechnical imaginary advances research in the energy policy, resource economics, and geopolitics literatures that seek to establish ''definitional clarity'' (Chester 2010: 893) in the process of theorizing what constitutes energy security. Focusing at a multitude of societal scales—community/regional,

national, and global, these scholars (e.g., Chester 2010; L. Hughes 2009; Luft and Korin 2009; Sovacool and Mukherjee 2011; Sovacool et al. 2011; Sovacool 2011) argue that a variety of different factors such as cost of energy, physical security of pipelines and sea faring transport, distribution of ecological burdens from energy production, and overall access to energy can or should determine energy security. This article continues the process of clarification, and through examining the historical context of energy security in the United States, establishes the specific sociotechnical linkages that underlie the relationship between ‘‘energy’’ and ‘‘security.’’ Furthermore, this article seeks to emphasize the value of sociotechnical imaginaries as a process of challenging the basis for key concepts in policy discourse. Such an emphasis is doubly important for energy research, as the very ontological uncertainty of energy lends itself to discourses that reify the importance of energy consumption to human civilization (e.g., Basalla 1980; Hornborg 2013).

Our article begins by outlining current research on energy security, highlighting major themes and recent scholarship focusing on the epistemological nature of energy security. We next briefly outline sociotechnical imaginaries to provide a basis for considering energy security as one, emphasizing the importance of an imaginary's genealogy to understanding and thus challenging the histories that pervade energy security discourse (e.g., Yergin 2011). We then proceed to analyze the Paley Commission's report, emphasizing the importance of efficiency, morality, and security throughout the document and the influence of these concepts on energy policy discourse into the 1970s. Finally, we outline the advantages of considering energy security as a sociotechnical imaginary and propose pathways for further research. Viewing energy

security as a sociotechnical imaginary with a particular history illuminates key features of the concept that go largely unspoken in current debates. Energy security is, at its core, a strategy for linking research on energy-producing resources (oil, coal, and uranium) and the basic science underlying each of these productive enterprises to the places of (implicitly domestic) resource consumption and, critically, to a ‘‘moral’’ sensibility of resource economics built on liberal economic principles. Such an underlying sensibility of what policy action is necessary presents serious questions in relation to sustainable development in resource-rich communities and the challenges posed by climate change. In concluding, we strongly question the value of continuing to theorize about energy security as though it is a necessary and attainable material aspect of our world.

Conceptualizing Energy Security

In paradoxical and often contradictory ways, since 2001, the boom in energy social science research has created a large body of work that addresses energy security. Most of this work attends to energy security as a static concept, invoking the term to justify certain policy actions or decision-making tools (e.g., Dhaka 2009; Ferguson 2009; Kumar Singh 2013; Margonelli 2009). Others, most notably Daniel Yergin, criticize the use of the concept itself as embedded in nationalistic resource grabs that attend more to ‘‘energy independence’’ than ‘‘security’’ in a liberal economic sense of global interdependence and mutual growth (Mallaby 2006; Noël 2008; Yergin 2007, 2006a, 2006b). A second set of critiques comes from the geopolitics realm of inquiry and examines the role of state exercises of power, namely, military action, in the securing of natural resources (namely, oil). These authors (e.g., Klare 2007; Toft and Duero 2010)

analyze the use of military force by the United States to exercise physical security—that is, the control of pipelines, refineries, and shipping channels—across the globe. While these scholars also treat energy security as a static concept, they focus on questions of power rather than consumptive economies. Finally, a small group of scholars rejects energy security outright as being too ‘‘vague’’ (Lomborg 2011) to initiate meaningful policy action on climate change in a world of increasing energy consumption.

More recently, scholars have begun to examine the question of energy security from an epistemological perspective, collecting both qualitative and quantitative data to compile, criticize, and refine factors that pertain to energy security and its situatedness in society writ large. These critiques (Ciută 2010; Cherp 2012; Cherp and Jewell 2011; Chester 2010; Littlefield 2013; Toke and Vezirgiannidou 2013; Valentine 2011) note the ‘‘polysemic’’ nature of energy security across policy research and analyze the epistemological methods used to determine what is and is not relevant to being ‘‘energy secure.’’ In combination, the authors highlight a number of key factors. First, energy security is not a ‘‘security’’ matter in the sense that it is bounded by an academic ‘‘domain of meaning and practice’’ (Ciută 2010: 124) readily differentiated from other geopolitical issues. The only way in which energy security does fit this space is that it is primarily a nation-state situated discourse (Ciută 2010; Littlefield 2013; Toke and Vezirgiannidou 2013), which draws from security discourse embedded in conceptualizations of hegemony through technoscience (Falkner 2005; Jelly-Schapiro 2013; Masco 2010). Second, energy security research currently focuses on examining the concept via quantitative or qualitative methodologies that start from the initial assumption that energy security is something nation-states (or the world) can and should

achieve. Finally, Toke and Vezirgiannidou (2013) note that through inductive analysis scholars can observe that action on climate change is incongruous with current energy security discourse.

This final point is important, for it highlights the possibility that ‘‘energy security’’ is in some way embedded in a dialogue that is incongruous with policy discourses that recognize the ‘‘climate’’ as a site for policy action. Other scholars, notably Cox and Béland (2013), argue that through the framing of ‘‘sustainability’’ energy security can serve to build unlikely coalitions (such as between wind supporters and oil tycoon T. Boone Pickens) and enact policy change in support of alternate systems of energy production and consumption, but they fail to clearly define ‘‘energy security’’ nor explain the underlying political–economic consequences of sustainability to energy security discourse. Like Cox and Béland, Toke and Vezirgiannidou’s analysis touches on the question of climate discourse and energy security, but does not meaningfully ask (1) why ‘‘energy security’’ exists as a subject of debate in policy making and (2) where this interest comes from. Reorienting discussions surrounding energy security away from analyses concerned with definitions based on current research and policy discourse toward the examination of how energy technoscience, the state, and society writ large were discursively organized, such as is possible through treating energy security as a sociotechnical imaginary, provides an opportunity to reexamine the landscape of current energy policy discourse.

Energy Security as Sociotechnical Imaginary

As ‘‘collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific and/or technological projects’’ (Jasanoff and Kim 2009: 120), sociotechnical imaginaries provide lenses for understanding, valuing, and attempting to bring about a ‘‘good society’’ through particular technoscientific projects. Sociotechnical imaginaries are less explicit, issue-specific, goal directed, politically accountable, and instrumental than policy agendas, as they ‘‘reside in the reservoir of norms and discourses, metaphors and cultural meanings out of which actors build their policy preferences’’ (ibid.: 123). Like narratives and discourses, they guide interpretation and frame the boundaries of the thinkable, but sociotechnical imaginaries are more specifically associated with ‘‘active exercises of state power’’ (ibid.), such as through the selection of policy priorities, fund allocation, and infrastructure investment.

Sociotechnical imaginaries induce the active exercise of state power, which means that they are situated within a discursive regime that coproduces perceptions of a good society and the forms of knowledge that organize it. Research demonstrates the influence of sociotechnical imaginaries over energy policy, including the concepts of growth and containment in nuclear energy (Jasanoff and Kim 2009, 2013) and localized bioenergy substitutions of non-mineral energy sources for oil imports (Eaton, Gasteyer, and Busch 2014; Levidow and Papaioannou 2013). Other studies use the framework of sociotechnical imaginaries to investigate the linking of national and regional identity with particular energy sources, most prominently in oil and gas (Bouzarovski and Bassin 2011; Ruijven et al. 2014), with attention to the usefulness of the imaginaries concept for translating between local, regional, and national scales (Eaton, Gasteyer, and Busch

2014; Teschner and Paavola 2013). The scale of these political spaces varies from nongovernmental organizations and scientific advisory boards to corporations and entire states (Program on Science, Technology & Society 2014). The question of scale draws attention to the possibility of multiple and competing sociotechnical imaginaries being simultaneously at play in any one context, as actors can hold ‘‘different visions and goals’’ (Eaton, Gasteyer, and Busch 2014: 2; see also Jasanoff and Kim 2009, 123; Levidow and Papaioannou 2013).

In addition to spatial situatedness, sociotechnical imaginaries invoke a temporal dimension by providing specific, policy intervention–oriented visions of the future. These imaginaries invoke what the world is and what the world should be, as they are ‘‘imbued with implicit understandings of what is good or desirable in the social world writ large’’ (Jasanoff and Kim 2009: 122; see also Eaton, Gasteyer, and Busch 2014, 4). Although the forward-looking orientation dominates Jasanoff and Kim’s (2009) original conception of sociotechnical imaginaries as well as much of the research it inspired, Eaton, Gasteyer, and Busch (2014) point to significance of the past, as ‘‘definitions and contestations are related not only to imagined futures but to different interpretations of environmental histories’’ (3). Varying interpretations of the past shape the visions for the future encoded in imaginaries.

Sociotechnical imaginaries are profoundly real in the sense that they underlie the exercises of power and policy making through which actors produce concrete effects in the world (Eaton, Gasteyer, and Busch 2014: 6; Fairclough 2010: 480; Levidow and Papaioannou 2013: 38; Teschner and Paavola 2013; Tsing 2000). As such, they mediate the ‘‘understudied regions between imagination and action, between discourse and

decision, and between inchoate public opinion and instrumental state policy'' (Jasanoff and Kim 2009: 123). Imaginaries are thus performative in the sense that they enact the world they describe, though this enactment is complicated by the messy sociotechnical discourses and systems with which they articulate (Weszkalnys 2011).

This article builds on the emerging sociotechnical imaginaries literature by highlighting the importance of tracing the genealogies (Foucault 1984, 2008) of said imaginaries. With the exception of Jasanoff and Kim's study of nuclear energy imaginaries in the United States and South Korea, few scholars have traced the genealogy of their imaginary within the greater context of the sociotechnical system they seek to analyze. The transactions between the state, knowledge production systems, and everyday lived experience that produce stable discourses around the characteristics of an ''energy secure'' state are a fundamental part of understanding what types of societies are possible within this paradigm; ignoring them leaves the fundamental assumptions that underlie the ontological consequences of these imaginaries in political order unchallenged. Levidow's study of biofuels policy in the European Union (EU) during the 1990s provides an example of this. Focusing on the transnational level as opposed to the histories of individual EU-member states obfuscates how state-level biofuels policies, such as the transition from ethanol to petroleum-based vehicle fuels during the twentieth century in France (Carolan 2009) influence how actors decide to link technoscientific projects and political order. While we acknowledge the necessity of such constraints within publication, we argue that in the case of energy security, a concept we have already shown appears over fifty years ago, questioning the ''naturalness'' of energy security as an organizing principle for policy making is crucial for mapping out how this

sensibility of social order maps people, resources, and states. We argue that the 1952 Paley Commission report serves as a valuable site to begin exploring the three elements brought together within energy security discourse— energy-centric technoscience and resources, ‘‘security’’ for the state as a product of resource extraction, and the ‘‘moral’’ underpinnings of a globalized energy market.[1]

Energy Technoscience and Liberalism as ‘‘Foundations for Growth and Security’’

> The United States, once criticized as the creator of a crassly materialistic order of things, is today throwing its might into the task of keeping alive the spirit of Man . . . In defeating this barbarian violence, moral values will count most, but an ample materials base must support them. (The President’s Materials Policy Commission 1952a)
>
> Indeed the strongest and most versatile single resource in the fight against scarcities of materials is technology. (The President’s Materials Policy Commission 1952b)

In a 1951 letter to CBS Chairman William Paley, President Truman outlined a presidential committee to ‘‘make an objective inquiry into all major aspects of the problems of assuring an adequate supply of production materials for our long-range needs’’ (Truman 1951). Consisting of five volumes and covering questions of both

[1] In this way, our analysis parallels the work of Mitchell (2011) by focusing on the intersection of national security, ‘‘the economy’’ as a concept in liberal economics, and energy resources. This project goes further, however, in analyzing ‘‘energy security’’ rather than ‘‘energy crisis.’’ Although we acknowledge these as intertwined concepts, we argue that understanding the emergence of energy as an object of state intervention as it is coproduced through the techniques of ‘‘economentality’’ (Mitchell 2014) that are emerging at roughly the same time (1948-1953), requires attending to the object of energy security as used in policy discourse. Energy crisis may create a space for state intervention, but energy security is the imagined form of a suite of policy actions geared toward addressing the linkages between energy and society, both in the present and into the future.

domestic and foreign resources (bounded within the context of the ‘‘free world’’), the Paley Commission’s Resources for Freedom report would ‘‘put to rest’’ (Mitchell 2011: 177n10) domestic concerns over material resources. In this section, we overview the context in which the Paley Commission’s (‘‘the Commission’’ hereon) report emerges to situate our argument for how energy security functions as a sociotechnical imaginary and what particular technologies of governance were imagined as appropriate to make this vision possible. The 1950s represent a pivotal moment in the history of American policy discourse where both ‘‘materiality’’ as the historicized pattern of mounting American natural resource consumption and ‘‘materialism’’ as a ‘‘barbarian’’ (and implicitly Communistic) political–economic philosophy are opposed to the ‘‘security’’ of the state. American overconsumption is viewed as a failure of cultural values— values which require the scientific rationalization of consumptive behaviors to correct. Rational management of consumption, however, does not explicitly provide any space for the role of the ‘‘market’’ as a site of truthmaking within society. Furthermore, a purely scientifically managed society is the exact type of ‘‘barbarian’’ political–economic suite of policy actions the Commission directly opposes. In this light, the key question the Commission must contend with is this: how does the state link new forms of sociality around energy resources, the necessity of ‘‘natural’’ activity within liberal economic society markets, and ‘‘national security’’?

Expanding on Eli Jelly-Schapiro’s (2013) genealogy of ‘‘security’’ in Western society, we contend that the process of creating a notion within policy discourse of ‘‘energy security’’ requires discursively constructing a space for market intervention, asserting the role of state-funded ‘‘energy technoscience’’ within this process of

marketization, and articulating particular notions of what a good American society must behave like as the social fabric which will maintain this arrangement of disparate elements.[1] Energy, as opposed to particular natural resources such as oil, coal, natural gas, and so on, is this site of intervention. Securitizing particular resources, such as oil, was a technique of governance prior to the 1950s; the management of domestic resources, the production of geographies of oil production in relation to the shoring up of military power (Shulman 2003), and imagined military action stemming from the loss of particular resources (*New York Times* 1927) assume state intervention at the sites of individual resource production and consumption. Intervening on ''energy,'' however, received only cursory attention prior to the Second World War (Energy Resources Committee 1939). The distinction between a particular resource and ''energy'' as a site of securitization is important— energy does not exist in the material world insofar as one cannot ''bottle up'' pure energy. It lacks a clear ontological basis (Mitcham and Smith Rolston 2013) and as a consequence one must produce a site for energy to intervene within a sociotechnical system if the concept is to have any practical meaning.[2] To create

[1] We use the term ''energy technoscience'' here to designate how the Commission constructs a cogent body of research and development focused on the rational and efficient exploitation of natural resources toward the production of energy, in the form of transportation (cars, ships, nonelectric trains), heat, or electricity. Case in point: the structure of the volume Resources for Freedom devoted to ''energy sources'' addresses the energy found in oil, gas, coal, and electricity. Here, resources and technologies alike are subsumed, at least discursively, to the larger category of ''energy'' which, as the report notes, is the locus of state intervention.

[2] Energy has in many ways always carried a polymorphous set of meanings. As noted by Crosbie Smith (1998) in *The Science of Energy*, early energy technoscience was eminently concerned with the rationalization of all elements of Scottish life. Later political economists of natural resources, such as Stanley Jevons (1865), would acknowledge the ''vast store of energy'' within various combustible natural resources,

a site for the intervention of energy, one first needs to create a sensibility of a particular kind of technoscience devoted to the study and production of energy. Energy technoscience, as a realm of state intervention, draws on the linkages between science, technology, and society established through the Manhattan Project experience and articulated by Vannevar Bush in *Science: The Endless Frontier*. Energy security, by the very emphasis on the ‘‘interdependence of moral and material values’’ (The President’s Materials Policy Commission 1952a: 1), establishes certain expectations for what a good society should look like, the explicit role of energy technoscience in such a society, and the importance of well-directed social policies to bring it into existence.

‘‘Lavish’’ versus ‘‘Efficient’’ Energy Societies

Summarizing the state of materials policy, the Commission notes Americans ‘‘think about raw materials last, not first’’ (The President’s Materials Policy Commission 1952b: 2) when considering questions of productivity and economic growth. History, from the Commission’s perspective, lends itself to this narrative, with all persons from the first Euro-American settlers to the present day citizenry misinformed that the United States was and is capable of supplying all of its raw material needs. Efficiency and interconnectivity of resource systems were the proposed solutions to this misguided culture of ‘‘lavish’’ waste (ibid.: 23):

> As prudent householders our first necessity is to use the remaining resources with the highest efficiency we can achieve, but only as fully as is permitted by the principle of buying materials at the least cost consistent with assuring supplies required by the national security.

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but they would continue to focus on particular resources as the site of state and market intervention.

Three elements stand out in this statement, each of which we will address in turn: the individual within society (as the atomized ‘‘householder’’), efficiency as a product of resources and technoscience, and material national security. First, consumption of materials and, as a consequence energy technoscience, is a matter for society as a whole. Morality, as mentioned earlier, is a fundamental part of the fight against the ‘‘crassly materialistic order of things’’—it is the duty of each individual to overcome the materialisms (consumptive and Communistic) mentioned earlier. Where, however, is this morality rooted? As described by liberal economist Wilhelm Röpke (1998, 125), each individual within society must exhibit these morals, lest the market and the state fall prey to materialistic influences:

> Self-discipline, a sense of justice, honesty, fairness, chivalry, moderation, public spirit, respect for human dignity, firm ethical norms—all of these are things which people must possess before they go to market and compete with each other. These are the indispensable supports which preserve both market and competition from degeneration.

Efficiency is, by definition, a form of self-discipline—one that emphasizes the rationalization of material consumptive practices and aims toward a linear relationship between consumption and productivity.[3]

[3] These are analogous to ‘‘technologies of subjectivity’’ and ‘‘self-government’’ as opposed to ‘‘technologies of subjection’’ that Aihwa Ong (Ong 2006; also see Smith Rolston 2010) discusses in relation to the organization of economies and states in Southeast and East Asia. The comparison between contemporary zones of economic development there and the state of American resource economics at the end of the Second World War is appropriate, given that these forms of managing populations toward the formation of economies are just emerging in the natural resource (soon to be energy) sector.

Noting that the rapid growth of productivity in terms of total economic output occurred at over three times the rate of population growth, however, the Commission argues that ‘‘the combination of increased energy and improved technology today provides the main promise of further economic growth within the physical limitations of natural resources’’ (The President’s Materials Policy Commission 1952b: 103). Contemporary resources (i.e., fossil fuels) solve immediate needs, but the finite nature of these resources meant that innovation held the keys to ‘‘civilization’s energy needs’’ (ibid.: 106). This process of innovation has, by and large, occurred outside of the purview of state policy; however, for technology to continue ‘‘dwarf[ing] all the previous accomplishments’’ of the twentieth century (The President’s Materials Policy Commission 1952a: 51), especially in relation to the material constraints on energy resources, the state must uptake the morality of energy technoscience innovation through policy action.

To this end, the Commission advocates for a comprehensive energy policy, one that supports ‘‘awareness on the part of all those dealing with energy policy of the close relationship of energy to the broader problems of materials, economic growth, and national security’’ (The President’s Materials Policy Commission 1952b: 129). Drawing from Vannevar Bush’s emphasis on science as fundamental to ‘‘our health, prosperity, and security as a nation’’ (Bush 1945: 1), the Commission argues that ‘‘an intensive program of basic scientific research and technical development be undertaken on techniques and instruments of exploration for minerals’’ (The President’s Materials Policy Commission 1952b: 29) to tame the ‘‘headless’’ (ibid.: 144) force of uncoordinated research initiatives across multiple agencies and, to a lesser extent, outside

of government. Continuing the theme of linking individual material behaviors, energy technoscience, and state policy to the question of creating a moral and efficient energy technoscience-based economy, the Commission emphasizes the role policy must play in overcoming material deficiencies (ibid.: 18):

> Most Americans have been nurtured on the romantic notion that technology will always come to the rescue with a new miracle whenever the need arises . . . But isolated solutions of problems relating to individual materials are no substitute for the broad frontal attack which technology needs to make on the materials problem as a whole.

A moral energy economy, within the context of the United States alone, depends on both overcoming a naive sensibility about the ‘‘natural’’ abundance of resources consumed for energy and enrolling the necessary disparate elements of society via policy action into a visible system of production and consumption. There is, according to the Commission, nothing natural about the United States’ material consumption practices—they are a product of a materialistic culture that has so far prospered without consideration of these facts. Energy technoscience and the pursuit of technological innovation, unacknowledged until now, has made this possible. A new economy of energy must depend on both the rational individual consumption of energy producing resources and a necessary (but limited) intervention on the part of the state to support energy technoscientific research. By focusing policy actions on activities related to the development of new knowledge pertaining to the production and consumption of energy, and the physical production of objects of energy technoscience (on a limited scale), the state will facilitate the necessary conditions for new, efficient, ‘‘moral,’’ realms of social behavior and market activity.

Energy, Liberalism, and Global Security

A morally efficient, market-based society, however, is not necessarily a secure one. What the Commission has to say explicitly about ‘‘national security’’ pertains to questions of wartime mobilization and reserves capacity. In relation to energy policy, this is the easiest to observe in what the Commission has to say about oil and national security. Following along the lines of ‘‘oil security’’ as conceptualized throughout the early twentieth century (e.g., Sheldon 1948), security pertains directly to questions of supply lines, modes of transportation, and nation-state actors. However, while these issues are ostensibly nationally oriented with an eye toward production during wartime, the Commission notes that ‘‘the problem of wartime supply and consumption for which preparation must be made is, therefore, a single comprehensive pattern for the entire free world’’ (The President’s Materials Policy Commission 1952c: 10). National security (or what we can now call security more generally) in this sense is much like the question of energy efficiency, morally situated and embedded in the rhetoric of the Cold War.

Understanding how the relationship between morality, security, and efficiency works in relation to energy technoscience means stepping back for a moment to take in a larger perspective on the nature of the Cold War as it pertains to economic growth and industry. Sovietologist and economist Peter Wiles (1953: 566), in a piece contemporary to the Commission’s report, notes the centrality of economic competition as ‘‘the most important thing, for in the end the country that grows most becomes biggest, and every economic advantage belongs to it.’’ It follows that the Commission’s analysis should also focus on facilitating the ‘‘efficient flow of energy supplies between surplus and deficit

areas in order to contribute to general economic growth and to bolster the security of all nations'' (The President's Materials Policy Commission 1952b: 122). Emphasizing the centrality of morals and materials to defeating Communism (The President's Materials Policy Commission 1952a: 1), the task of global security as it pertains to materials becomes a question of liberalizing global markets, removing trade barriers, and facilitating an efficient flow of resources from producer to consumer states. This is doubly so for energy materials, where the complexity of global networks for resources, and in particular oil, posed one of the ''gravest problems'' (The President's Materials Policy Commission 1952c: 10) in terms of wartime security during the Second World War for the United States and its allies in western Europe. Within this network of liberalized trade, the Commission notes, ''the United States is in a particularly effective position to lead in the removal of barriers and to stimulate the flow of raw materials'' (The President's Materials Policy Commission 1952b: 77).

The case of Venezuela in the report is indicative of the spoke-hub model employed by the Commission in its appreciation of the role of resource producer states. Openly rejecting the desire of producer states to opt for economic diversification, the Commission regards natural (energy) resource production (via American energy technoscientific innovations) as an acceptable modality for development, since ''[w]idening the use of modern technology and skills in materials production and processing provides technical training and experience essential to progress in other areas of the economy'' (The President's Materials Policy Commission 1952b: 73). In the Commission's assessment, the overarching conclusion that ''the security interests of the free world requires expansion of materials output'' (ibid.: 62) means the primary role of

US foreign policy is to improve business opportunities in these states through liberalization of trade policy and the facilitation of capital and technical expertise to develop the economy of the producer state. Producer states that facilitate the transfer of raw materials to consumers (i.e., the United States) will see the benefits of imported technologies and bolster global security (The President's Materials Policy Commission 1952d: 99, emphasis added):

> By developing her [Venezuela's] rich material resources, mainly with the aid of private investment capital and technical know-how supplied by the United States, Venezuela has achieved in a short span of years an almost unparalleled record of economic and social advancement . . . Not only have rising Venezuelan materials exports stimulated world trade, but *the security of all free nations* has been increased by Venezuela's immense and growing capacity to produce oil—an essential for peaceful production and defense.

As such, energy (via oil) production, facilitated by the United States through capital and energy technoscience transfer, increases the overall ''security'' of the free world by ensuring that the necessary raw materials for peacetime and wartime production and defense reach where they are needed in the developed ''free'' world. This is not simply a question of economics, but of morals, as the ''materialistic'' threat of Communism demands that both the United States and the rest of the ''free world'' maintain economic growth and development. Economic growth, via efficient flows of resources and capital, supplemented by American government funded energy technoscience at home and abroad, are the moral and material underpinnings on which global security and ''freedom'' depend both now and into the future.

After Resources for Freedom

The Resources for Freedom report functioned as a site of policy discourse in government, academia, and the wider public from its publication in 1952 through the mid-1970s. Resources for the Future (RFF), a think-tank Paley would establish the next year, carried the conversations initiated by the Commission into the Eisenhower Administration (The Washington Post 1953), continuing to emphasize the necessity of a system of energy policy making rooted in energy technoscience research, liberalized markets, and a morally ‘‘efficient’’ society (Resources for the Future 1954: 251):

> So as we progress, our energy needs increase by leaps and bounds. Everything about our industrial civilization tends to higher and higher consumption of energy. All we can do in the way of conservation is to see that energy is used as efficiently as can be to accomplish the results that we are after.

Although many respected energy scientists and business leaders were present during the inaugural RFF conference in 1953, many of the New Deal era cooperative utilities organizations elected to boycott the proceedings, accusing the organizers of stacking the meeting with anti-public/ anti-cooperative private corporations (Graves 1953). This shift away from New Deal politics, in particular centralized planning of infrastructure, suggests one of the essential tensions arising from the Commission’s report. With the rise of neoliberal economic theory in the United States and the erosion of planned economies in western Europe over the next twenty years, the extent of the state’s role in facilitating what we can now call nascent ‘‘energy security’’ is problematic at best. As an imaginary, the policymaking power of energy security is in the emphasis on adjusting energy consumption through technoscience. Placing the onus on government to facilitate basic

research and social policy toward the efficient use of energy today and new technologies tomorrow leaves the government's role in market regulation a matter open to interpretation.

Consequently, while the Commission's report waned in terms of dictating specific energy policies during the late 1950s (Vietor 1984), it did facilitate a space for dialogue concerning the importance of energy technoscience to ''contribute to economic progress and national security for the foreseeable future'' (United States Congress 1959: 150). Similarly, contemporary coal advocates refer directly to ''Energy and National Security'' (ibid.: 240) writ large (as opposed to particular resources) and the centrality of ''energy security'' in global economic competition (ibid.: 242, emphasis added):

> Now [during this hearing] we're discussing the immediate problem of our energy resources and how they can help America surmount the Soviet challenge. For the basic necessity for *winning* an emonomic [*sic*] race is a greatly expanded output of energy fuels, the very heart of industrial production.

Winning here, much like the Obama Administration's claim of using energy security as a justification to ''build a 21st century clean energy economy and *win the future*'' (The White House Office of the Press Secretary 2011, emphasis added), puts the emphasis on competition. Porter's 1961 statement concerning energy security mirrors this; energy security is a product of a system of policies that support energy technoscience toward resource production while facilitating a competitive market that supports enterprise (such as through the many small producers Porter represented). Richard Nixon would some ten years later reiterate these points, calling for another study of the United States' energy resources position and policy (Nixon 1971):

> For most of our history, a plentiful supply of energy is something the American people have taken very much for granted. In the past twenty years alone, we have

> been able to double our consumption of energy without exhausting the supply. But the assumption that sufficient energy will always be readily available has been brought sharply into question within the last year . . .
>
> A sufficient supply of clean energy is essential if we are to sustain healthy economic growth and improve the quality of our national life. I am therefore announcing today a broad range of actions to ensure an adequate supply of clean energy for the years ahead. Private industry, of course, will still play the major role in providing our energy, but government can do a great deal to help in meeting this challenge.

One can observe the same general themes outlined here as were brought up in the Paley Commission report—Americans' consumptive materialism is rooted in a false ''history'' of plenty. Energy consumption patterns are a product of innovation and economic growth—facilitating a continuation of this pattern of consumption means government must play a part in supporting economic growth by fostering the necessary social policies, especially around energy technoscience research, which will provide the market the tools to continue to meet consumer demand. If morality is missing from Nixon's speech, it is because it has become internalized within the conception of the energy technoscientific research itself—the very rationalization of consumptive behavior through technological means and marketization. The attempted realization of this moral vision through policy making places energy security squarely in the realm of a sociotechnical imaginary.

Conclusion: Implications of Energy Security as a Sociotechnical Imaginary

Based on our analysis of the Paley Commission's report, we argue that the energy security imaginary is, as noted by Maass (1953: 208) ''a highly nationalistic drama,'' whereby energy policy action that facilitates global free markets and energy technoscience performs the doctrine of national security. The energy security imaginary

posits economic growth—achieved through the government's facilitation of markets for private industry and sponsorship of research and development—as the primary mode of ''security'' against Communist, Middle Eastern, and other ''non-free world'' actors.

Our research fundamentally questions the ontological basis of energy security, as it is conventionally used, by shifting the conversation to attend to the language and moral visions that underlie policy action. Tracing the genealogy of an imaginary is a crucial but overlooked element in recent scholarship analyzing sociotechnical imaginaries. Genealogies elucidate the complex and conflicting labyrinth by which ways of knowing about the world and human nature become policy action. Although operating at many levels and in a multitude of contexts, sociotechnical imaginaries do not simply drive state exercises of power but produce order in the world. Containment and energy security, both critical imaginaries for understanding the global technoscientific order surrounding energy in the twenty-first century, persist because they are embedded not only in policies but also in how the social body of experts and policy makers enmeshed in these sociotechnical systems construct the world. Thus, analyzing sociotechnical imaginaries should go beyond exposure to consciously recognize the emergence of such ways of knowing and challenge the political order(s) they produce. Genealogical analyses, such as we have provided in the case of energy security, illuminate tenacious formations of state–market–technoscience networks, as Obama's statement on the Energy Security Trust in the introduction makes clear.

Nowhere is this more important than in the case of energy policy discourse, as the ontological ''mystery'' (Mitcham and Smith Rolston 2013) of energy lends itself to a ''moral'' economy at the base of neoliberal economic policies. In attending to energy

security through the evaluation of various factors relating to the state of being ‘‘energy secure,’’ scholars have (whether intending to or not) facilitated the ontological grounding of energy security by ascribing theoretical heft to the concept. Approaching energy security and other energy-related policy terminology (energy justice, energy ethics, sustainable energy, renewable energy, and the like) through an emphasis on the genealogies of these ‘‘imaginaries’’ would emphasize the social, political, and cultural contexts of energy policy discourses. All too often ‘‘energy’’ is taken at face value, as a term that emphasizes the same physical science meanings regardless of context. As such, our emphasis is not on categorization, but disruption of the boundaries between ‘‘energy security’’ policy problems and the larger questions of market construction and state-funded technoscience. Such an approach to the current debates in energy security scholarship challenges efforts to ‘‘imagine’’ consensus on the governance of global environmental problems and problematizes international cooperation on energy resource management.

Tracing the genealogy of energy security also raises implications for grappling with energy security in relation to current questions of social justice. First, if we take two key components of the establishment of climate and environmental issues within the national consciousness—Rachel Carson’s (1962) *Silent Spring* and the 1965 Presidential Science Advisory Committee report on climate change—as markers of the introduction of global environmental issues, we must confront the possibility that ‘‘the environment’’ as an object in energy policy has no bearing on being ‘‘energy secure.’’ Despite Nixon’s protestations for environment-friendly energy in 1971, the consensus was that energy security is national security through energy market means. Nixon (1973) seems to have

had little will to enforce the former point, as after the 1973 Organization of Petroleum Exporting Countries oil embargo it disappears from his ‘‘Project Independence’’ energy policy campaign. Likewise, we can also agree with Toke and Vezirgiannidou’s (2013) assessment and say there is little space in the energy security imaginary for sustainability decoupled from liberal economies.

Second, energy security privileges national scales and state-level actors, making it difficult to attend to local dimensions of energy security and regional geographical differences in the energy mix. Contemporaries of Resources for Freedom also noted the ‘‘Commission’s failure to consider problems of materials production and use in their regional setting’’ (Ackerman 1953: 174). For the Commission, integration of energy and material systems across the country would deal with the problems of energy access. This approach also obscures salient issues pertaining to the equity of community development around and through energy resources and procedural and distributive justice as it applies to knowledge about energy systems.

In our constructive criticism, we hope to facilitate the conversations Valentine (2011) sees as valuable to further articulating energy security. Future research along the path of energy security as a sociotechnical imaginary should take the lead established by Jasanoff and Kim and expand our approach to the nascent energy security conversations in other parts of the world, paying attention to the similarities and differences between American discourse and those in other places that are animated by different visions of a good and ‘‘secure’’ society. Other projects should seek to further explore how these large-scale imaginaries work at the regional/community level, as Eaton, Gasteyer, and Busch (2014) have begun for bioenergy in Michigan. Understanding the interface

between sociotechnical imaginaries and lived experience will provide valuable insights into how these imaginaries shape social order.

As a sociotechnical imaginary, energy security has influenced the exercising of vast amounts of state power and capital toward global resource integration and energy technology development. Furthermore, it is rooted in a particular, Western, sensibility of the moral behaviors of individuals and states—sensibilities that are by no means universal. Stepping back to observe the genealogy of energy security forces us to ask the following question: do we have the right imaginary to ‘‘imagine’’ an energy equitable world?

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CHAPTER 4

THE VALUES OF ELECTRIFICATION: SAMUEL INSULL AND THE VISION FOR A RESPONSIBLE ENERGY PROVIDER

The public interest is an oft quoted term within the context of the regulation of electrification utilities. Certainly, it use can be read as organizations engaged in economic self-interest within the context of a contentious debate over who has the right to engage in the generation from electrification regulation. This belies, however, the fundamental role speaking to the public interest plays in identifying the core norms, beliefs, and visions of the future that are made durable and authorized through the exercise of policy action, namely the setting of utility rates and structuring cost models. But what are these core norms and values that make "speaking to the public interest" structurally critical to the organization of electrification systems? Put more simply, what do we mean when we talk about the public interest in the context of charting the future of our electrification systems?

As I demonstrate in this chapter, imaginaries in the context of the public interest in regulation represent the intersection of larger norms and values concerning the idealized organization of society and its sociotechnical systems. Within the context of an energy transition, the authorized regulation of electrification systems in the public interest highlights a key scale of interaction that embodies a specific historical and material context through which these values and systems are co-produced and achieve contemporary salience. To establish an understanding of how energy transitions represent alternative value-system propositions, we must first understand what it means to provide electric power service through investor-owned, state regulated utilities.

Constructing the Public Interest

The public interest as an organizing concept for understanding the relationship between tangible policies and the values embedded in a society has a checkered past. Bozeman (2007) notes that during the mid-20th century, public administration scholars seeking to establish an empirical basis for the study of effective governance increasingly rejected the concept of "public interest theory" as unsuitable for scientific study. Referring to such work as the embodiment of individualistic values and rhetoric, these mid-century scholars argued the earlier work of political philosophers such as John Dewey as giving precedence to the contextual emergence of values as undermining the objective assessment of a state and its policies. While rejecting public interest theory, public administration theorists created a paradox; even as they spoke out in scholarly communities against the concept, it became ever increasingly a cornerstone of how governing bodies (legislators, regulators, courts) justified active exercises of state power *through policymaking*.

Dewey and others, such as Richard Flathman, by contrast argued that fundamentally a study of the public interest began within the context (historical, political, ethical, moral) from which understandings of "the good" for a society emerge. Thus, as Flathman would argue, scholars of politics would do well to focus on the connection between a society's values and its larger political projects (Flathman 1966: x):

> The student of politics must be aware that political life is value-laden, and it is his task to discover what the values are and to analyze their relationship to other facets of politics. But questions of value are not amenable to rational, transsubjective, scientific analysis, and it is no part of the student's professional to adjudicate between the values he discovers in political life. If this point of view is valid, it is valid not just for political study but for questions of value wherever they arise.

Choosing to give preference to certain values – be they freedom, entrepreneurialism, justice, or equality – within the context of analyzing the role of the public and its interests in the organization of societies represents a commitment to dubious methodological choices. In the context of mid-century public administration and political science research, it meant giving preference to authorized "shared" values of democratic governance and economic individualism vis-à-vis perceived impressions of non-western forms of governance. Political life, here in Flathman's context meaning the systematized practices of democratic governance, are built upon more than broad philosophical commitments. They inhabit the ways individuals, engaging in a variety of behaviors and actions, construct their fundamental individual and shared impressions of what "good" governance should look like.

For the purposes of studying values and the public interest in the context of electrification systems, Flathman's normative point provides effective guidance for directing our attention towards a study of how certain values and sociotechnical system arrangements are co-produced as authorized expressions of a society's interests. Firstly, we must situate our studies of the public interest within the appropriate historical, material, and political context in which they emerge. As studies of infrastructural sociotechnical systems have noted, a distinguishing feature of these systems is their obduracy. Infrastructures live on well beyond the lives of their creators, inflecting upon daily life in critical ways that shape how societies conceptualize the "good life." Second, we must not assume a priori where political debates over the values a society shares

occur.[1] Science and Technology Studies scholars have explicated this point well, as it pertains to the values that impinge on the production of scientific knowledge and the rational management of states (Mitchell 2002; Jasanoff 2007). Knowledge production, much like politics, does not live simply within a series of demarcated institutions; it inhabits the ways people live, work, and above all experience moments of social and technological "progress" (Marx 1987). It stands to reason that as we seek to understand the relationship between the collective values that represent our conceptualization of the good life, and the politically-authorized organization of sociotechnical systems we should keep in mind that our values inhabit the walls of our buildings as much as public utility commission hearing transcripts.

To understand these values underpinning energy transitions, the purpose behind why they are regulated, and how they intersect with alternative values and sociotechnical systems, we must first understand what we mean by regulation in the public interest. Electrical utilities are a unique case in the regulation and transformation of large infrastructural systems; unlike railroads, which were forcibly regulated at the federal level through the Interstate Commerce Act of 1887, the dominant electrical utility operators, many part of the family of companies established by Thomas Edison, sought

[1] It is in this respect my study differs from Clark's (1987) examination of energy transitions government regulation over energy resource industries (coal, natural gas, petroleum) in the early 20th century. Where Clark situates appropriate policymaking within a preexisting structure of shared values (equity, justice, and liberty) I argue it is more appropriate for the values expressed by actors situated within such debates to emerge as a product of close analysis. As historians of knowledge and social order have noted time and again, to impose a temporally discordant system of values on the actions of others reduces the study of how societies organize themselves to a critique of the past in celebration of the long march of progress.

out state-level regulation. Under the auspices of functioning as "public service companies" these utilities, in particular Chicago's Commonwealth Edison and its president, Samuel Insull, appealed to state governments, their shareholders, and the public in general that state-level regulated utilities given geographically bounded monopoly rights to provide power could best serve the greater public interest.

Insull's role as systems builder and chief executive of the United States' first large electricity utility has drawn considerable attention from scholars of electrification policy and sociotechnical systems. As Thomas Edison's personal secretary, Insull was party to much of the developments stemming from Menlo Park, including Edison's first power plant, the central station plant on Pearl Street in New York, as well as the founding of General Electric and the Edison family of electrical utilities. Leaving General Electric in 1908 to become president of the Chicago Edison Company, he quickly became focused on building a comprehensive system of integrated light and power throughout the city. Hughes notes that unlike many of his contemporaries, Insull had the advantage of relatively weak local political powers in Chicago. Despite the system of largesse Aldermen utilized to maintain city-region specific control over electrical light company contracts, Insull was able to forge a utility that by 1921 produced 11 percent of all the commercial electrical power in the United States and extended throughout northern Illinois. Leveraging considerable statistical information concerning the load patterns and characteristics of their customers, Insull and Commonwealth Edison balanced various customer group loads to minimize power production variation throughout the day. In doing so, Insull would emphasize to his employees and other electric utility executives how the minimization of interest accrued on infrastructural investments (in particular

central power stations) was fundamentally linked to bringing in a diversity of power demand characteristics.

While these characteristics of Insull's role in establishing the electric power industry are well understood, how he constructed Commonwealth Edison into the largest power producer in the nation – and importantly how it fundamentally links to the value system underlying state-level regulation of electric power utilities—demands more attention. Hughes, for example, notes the role Insull played shaping public opinion about electric utilities and their regulation, but suggests that these activities were secondary to his primary role as a utility manager (Hughes 1983: 208). Insull functions for Hughes, as he does for many other students of his life and eventual fall from grace in 1934, as a paradigmatic "systems builder." Insull in this narrative structure arrays capital, technical artifacts, scientific knowledge (statistics in particular), and state-level political support to design an efficient and financially productive utility company from the chaos of dozens of competitors. This tells us little about *why* he argued for this regulation as necessary and good for the public writ large. As I have outlined above, the values he espouses are equally as important as his technological and managerial feats; they underlie how he constructed the relationship between large infrastructural services "public service companies" and the financial, political, and technological resources needed to operate them.

These situated values, and their relationship to the infrastructural system Commonwealth Edison built, fundamentally underpin how Insull, the State of Illinois, and a multitude of other utilities and state utility commissions constructed the role of the public interest as tool for adjudicating the role of electrification systems in American

society. To explicate these values and their coproduction with Commonwealth Edison's sociotechnical system, I provide a close reading of how Insull through his public speeches framed why it was *necessary* for electricity utilities to be proactive in seeking regulation over their sector. My analysis focuses on his public speeches given between 1894 and 1922, and published in a series of collected speeches and memoirs. In this respect, I follow Hays' (1959) call for a sociological treatment of the patterns and experiences which drive individuals to construct and advocate for particular arrangements of society, technology, and economic activity in the "public interest." Conservationists were more than idealistic servants of the public, and executives such as Insull more than paradigmatic industrialists committed to a model of scientific management.

Insull's calls for protecting the people who relied on and invested in Commonwealth Edison emphasized the collective responsibility utility managers had to those who they wished to enroll in the process of electrification. Managing in the "public interest," and as a "public service company," in this respect meant financial, technological, and political success of electrification systems fundamentally relied on a coproductive act where the value of electrification was found both in the cost-service relationship of electrification, but trust in the fact that electricity utilities could provide fundamental social benefits to improve human life that were only possible through monopolization.

A Moral Utility – Insull and Constructing the Responsive Monopoly

1880s and early 1890s Chicago was a city undergoing immense growth, and in doing so embodies many of the larger questions of the role of government in managing

and bestowing contracts upon "public service companies." At its core, Chicagoans trusted the barons of industry that had turned a swampy outcropping of Lake Michigan and the Chicago River only slightly less than their own corrupt and conniving representatives. What separated these two dipoles of Chicago society was the former had risen to become established powerful agents of change in the city, while the other continually sought to re-center power in the hands of locally-situated aldermen. Early battles, such as Peoples Gas Light and Coke Company lobbying Mayor Harrison to deny a franchise to Chicago electricity pioneer Charles Brush leveraged questions of public safety and the specter of the 1883 fire to hold electrification at bay (Platt 1991: 43). As electric light and power systems continued to expand, questions shifted to the ethical character of such businesses, punctuated not least by ex-convict Yerkes' rise to power as the master of all electric rail in Chicago. Chicagoans trusted the men in charge of these "public service corporations" and their amalgam of political supporters little (McDonald 2004: 83-4).

By the time Samuel Insull stepped into the role of chief executive of Chicago Edison, there were 18 central station power plants in operation and dozens of individual consumers, electric light companies, and other various configurations (such as real estate developer J. Lewis Cochran's illuminated suburb, Edgewater) through the city and surrounding area. Unlike his mentor, Thomas Edison, whom Insull had worked for in one capacity or another since 1881, Insull was entirely focused on exercising a vision of fiscal and technological responsibility on what was otherwise a fiscally limited company in an ever-increasingly crowded sociotechnical system. The formation of Chicago Edison into the Commonwealth Edison Company – now the core of what is Exelon – was an exercise in Insull shaping a vision of regulated and responsible utility management that,

paradoxically, sought to exclude politics from the management of public service companies by seeking to enroll local members of the public and state-level bureaucrats in establishing a regulated service enterprise system.

Insull's choice to advocate for, both as executive of Commonwealth and as president of the National Electric Light Association (NELA), state-based regulation by trained experts drew on his own philosophical beliefs as a member of the emerging managerial class concerned with the "scientific" management of organizations. Yet the nature of utility infrastructural systems, their constituent components, and importantly the different groups in society that draw on their services are critical elements of the larger technological (in the Hughes sense) and sociotechnical function of the system. Unlike the new managerial class of manufacturing facilities, those who were adherents to the principles of Taylor and Gilbreth, Insull and other utility operators interest in classifying and ordering the character and capabilities of society were concerned with defining the optimal "mix" of technical competence, social confidence, capital, and power consumption.

Central power stations required significant up front capital investment and knowledge of electrical and mechanical systems to efficiently operate, yet as sociotechnical systems their growth relied on the system's increased permeation of home, businesses, and government facilities. By extension, the confidence of members of the public, business community, and government officials became increasingly necessary. Manufacturing and performing public confidence extended from the rearrangement of state policies concerning the locus of utility regulation, shifting authority from cities to ultimately state regulatory agencies empowered under the Public Utilities Holding Act of

1934. Simultaneously, as Insull would argue, it was necessary for all members of the utility be they engaged in connecting new homes or operating increasingly more complex power generation technologies to engage in professional conduct commensurate with a corporation serving the public.

In this respect, Insull's Commonwealth Edison exhibited what late-20th century managerial theorist Peter Drucker (2006) would call the practices of an 'innovative' entrepreneurial organization. Rather than passively accept new technologies to marry with managerial practices, Commonwealth Edison directly sought to construct knowledge of the characteristics of their consumers, shape and respond to changes in their values concerning the role of electrification in social progress, and design market devices to transform individualized wants and needs into financial stability through economically-based regulation.

In the following sections, I outline how Insull imagined and designed a framework for regulation that turned social malaise at the role of government and monopoly companies in Chicago society into a vision of prosperity for the consumer, laborer, and capitalist through rational state-level regulation. As I show, regulating in the "public interest" in purely economistic terms was an exercise in purifying local politics from the necessarily rational pursuit of transforming "interest" in all of its senses – personal and organizational values, competing political groups, and interest accruing on capital intensive power production equipment – into classes of measurable and actionable variables for determining acceptable power cost rates. To speak then of public values being outside of the realm of power regulation is an oxymoron; it is in fact central to the concepts function as a technology of infrastructural systems governance.

Values and Regulation

As actors within a given market (energy services) Commonwealth Edison constantly sought to position themselves between the constellation of consumers, politicians, and capitalist financiers to achieve stable and predictable returns on investments. Providing a service – and a capital intensive one at that – required different approaches to the relationship between perception of goods and services that demanded a stabilization of the quality of the financial exchanges and the distribution of power. It required thinking about the ways electrification systems as physical entities connecting producers and consumers through a growing infrastructure also linked customer values to the acquisition of favorable loans. Electric light producers depended heavily on large loans to purchase central station plant turbines, generators, and other technologically complex and expensive pieces of equipment. Running these pieces of equipment incurred a series of interlinked costs – the original loan itself, operations and maintenance of the plant, payroll, home installations, and importantly the interest on the capital equipment loan. Interest, as a particular technology of financing electrification equipment created links between how and when consumers used electricity, when the utility provided these services, and the cost of the service provided. Meters and utility rates were how customers experienced interest as early electric light utilities had negotiated pricing for electricity on a case-by-case basis and at a fixed "flat rate." While effective for encouraging early adopters to electrify rather than continue to use pre-existing sources or build their own power facility (as business and individual homeowners both had), rates did not always align with customer use patterns observed at the meter. Classifying customer groups into knowable categories of power consumption (both total energy

usage and maximum power usage) provided critical information for understanding how each group related to the entire financial viability of the company.[2] Capital equipment interest and customer class intersected at the point of utility rate structure. Overall each customer class utilized analogous grid "services" (production, transmission, metering); what differentiated them was how much power they used (Insull 1898: 40-41):

> For instance, take the two probably extreme classes of customers to whom the central-station company supplies electricity for lighting purposes. On the one hand, you have an office building whose tenants use artificial illumination for only a short space of time each day and only during the winter. On the other hand you have a basement customer whose use of your product averages nearly one-half of the day of twenty four hours during the whole year. Your investment to take care of each of these customers is practically the same; therefore your total interest cost must be the same in both cases; but if you distribute this interest cost over the actual units consumed, you will find that the tenant of the office building costs you for interest per unit of energy sold many times more than does the occupant of the basement. There are of necessity as many different grades of customers between the two extremes I have mentioned as there are different classes of business and different characters of structures in which these businesses are conducted. Surely, if the cost of production varies according to the different conditions under which your customers use your product, it is but fair that the selling price per unit should vary correspondingly.

During the mid 1890s most electric light utilities were serving relatively small territories, incurring interest on smaller loans for low efficiency, low power equipment. A given utility's "load factor" – the total consumption of power produced – rarely crossed 40%. Insull, by contrast, oriented his business model towards incorporating ever larger and more efficient power generation equipment into the Commonwealth Edison network. Adopting some of the first turbine engines produced by General Electric, Commonwealth

[2] This was especially relevant when electric light customers primarily used the power for illumination. As other customer groups with differing needs (motive power for manufacturing) began to utilize central station power their new infrastructural needs and power demands would in turn transform.

Edison increased efficiency at the cost of loans significantly larger than the equipment purchased by competitors. Identifying power consumers, and large ones, became a top priority for the company, as was a rate structure that would encourage these new potential consumers to sign contracts. Financial tools such as rate structures played a crucial role in shaping the fortunes of Commonwealth Edison, and importantly for this study how its vision of public utility company relationship with the public would proceed (Insull 1910: 149-150):

> It was not until the early nineties [1890s] that some of the managers of the large central-station properties of the country appreciated the fact that if they desired to place their business on the basis of a general public necessity it was necessary for them to rearrange their rates on such a plan as would give the long-time consumer, the man who used the central-station company's investment most steadily during the year, the lowest possible price; and the recognition of the necessity of meeting this condition may possibly have had as much to do with reducing operating costs and reducing interest and depreciation costs as have the wonderful work of the inventors and the marvelous skill of the engineers.

Arthur Wright, who had developed a system of ratemaking in England based on a "two-tiered" approach to pricing deeply influenced Insull's thinking on this matter.[3] Electric light classified and cost based on (1) the total energy consumption of the customer, and (2) the maximum power used by the customer at any point. In effect, the Wright ratemaking model decoupled the relative portion of daily operations costs (including fuel and personnel) directly linked to each kilowatt-hour of energy consumed from the interest associated with operating the necessary power equipment and infrastructure to supply the customer. Interest, following the physical infrastructure linking each customer class into

[3] At a dinner in honor of Wright and others, Insull would remark that "I do not think it is any exaggeration to say that Mr. Wright first taught us how to sell electricity" (Insull 1911: 217).

the central power station represented an inexorable material link between the practices of the company as it pertained to acquiring capital for development and the services a customer could afford.[4]

Decoupling energy consumption from the interest-power demand made it possible to speak of bringing the benefits of economies of scale into alignment with the perceived desires of customers to acquire low-cost illumination. As Harold Platt (1991, pp. 83-87) notes, it led Insull in his role as head of Commonwealth Edison and President of the National Electric Light Association to campaign vigorously for the potential benefits electrification for all could provide. Campaigns, however, are not a substitute for tangible action. Building a culture of mass consumption that was reflexive to other social values – not least of which was distrust in large corporations and local governments – required reorienting the positionality of utilities vis-à-vis local governments and the public writ large.

Serving in the Public Interest

Insull, the son of marginalized English Congregationalists and avowed temperance followers possessed a deep appreciation for the rational managerial techniques of his homeland and a desire to use electrification as a tool of social change (McDonald 2004: 10). Much in the keeping of other Progressive minded leaders of the early 20th century, Insull was deeply concerned with social malaise and inefficiency of resource use, not least of which was the capital of his consumers. Chicago and its system

[4] Neufeld (2000: 72) note an associated benefit of the Wright pricing scheme was it effectively made it more economic for manufactories to connect to the utility's grid rather than develop their own power facilities.

of local political spoils had an immediate impact on his ability to grow Chicago/Commonwealth Edison, pushing him over his career to move from advocating for any responsible regulation (municipal or state), to speaking in favor of state-level regulation alone. A critical moment during the development of Insull's views on regulation occurred during the "Home Rule" movement of 1914. Local politicians and citizens, seeking to reassert municipal power over key social and industrial sector issues progressive leaders had invested state and federal power in managing directly targeted the public service utilities as organizations that the City Council of Chicago should regulate. Preceding the creation of Illinois Public Service Commission in 1914, Insull emphasized the necessity of technically competent regulators who would maintain the financial stability of the state (Insull 1911a: 247):

> How are these industries [public service companies] regulated here? They are regulated in campaigns for the election of aldermen to the City Council, when you come down to the finality of the thing. It is not a question of a man's ability to deal with the technical subjects that come before him; it is a question on the one side of a man being able to deliver the greatest number of speeches to get the greatest number of votes, and, on the other side, of proclaiming that he is the only honest man in the community. It is this class of men who regulate $450,000,000 of capital, 60 to 70 per cent of which is owned right in this community and commonwealth, whose business is vital to the success of the community, and whose constant flow of money into this community in the way of additional investment from year to year is a very important factor in the industrial enterprise of the city of Chicago.

Elected city officials, bound to local interests and incapable of understanding the nuances of infrastructural systems management (in particular electricity utilities), lacked the commitment to large scale social transformation effective regulation demanded. As a "class" of actors whose value systems were decided at a profoundly local level vis-à-vis the state writ large, their influence through the oversight of tremendous capital

investments was disproportionate to their political and social responsibility.

For Insull, this imbalance suggested such a "class" of actors in society were poor stewards of the possibilities electricity afforded. Chicagoans had experienced these possibilities during the 1893 Columbian Exposition. Nicknamed "The White City", the exhibition center became a symbol for the model of progress through illumination and consumption. Insull, like other Chicagoans had the opportunity, as a senior executive with Edison/General Electric to be a player in making these possibilities real – however, his visions of the world made prosperous and healthy through electrification extended beyond urban boundaries. Musing on the opportunities a "wise system of production and distribution of energy" (Insull 1913: 402) built on monopoly electricity system could bring to Illinois and the Mississippi Valley, Insull drew on another popular image of prosperity and progress – idyllic and lush Arcadia – to outline a vision of manufacturing worker and yeoman farmer in harmony (Insull 1913: 396):

> But as this state and other surrounding states become studded with manufacturing establishments the necessity which compels the work-man to dwell in large centers of population, when living conditions are most unfavorable, will cease. He will be able to establish himself under conditions where he can get healthful environment for his family. Instead of living in overheated, ill-ventilated, small tenements of the big city he will have the opportunity to establish himself practically amid the desirable conditions that those living in the country ordinarily enjoy. Surely if this can be accomplished, if the living conditions of our people can be improved, if their children can be brought up under circumstances which give them the foundation of good health, which will give them the opportunity of association in our country schools with that portion of the population--the farming population--which is the very backbone of the country, it is reasonable to expect greater satisfaction on the part of the workmen with their conditions and better relationship, because of a closer community of interests with employers, and, in general, a better chance for the workman and his family.

Suburban communities, such as Edgewater in Chicago, were exclusive enclaves of the city's wealth and upper middle classes. Able to afford the comforts of almost countryside

living while leveraging electric rail transit to the city center, management had as Insull saw it become distanced from the conditions under which those they employed labored. Monopoly electrification, managed by utilities with sufficient transmission infrastructure and scale (geographically and in terms of power production) could enable opening such environments for workers as well, moving the center of manufacturing out of the city.

Electrification on this scale demanded state-level regulation, as the interests of local politicians and the utilities they franchised – either in Chicago communities or in other localities – did not seek to nor could provide these benefits (Insull 1922: 31):

> My own personal experience [with municipal utilities] is that they go along, using their plants in their own little local territories, without making any effort toward the development of the region surrounding them. In fact, they are rather jealous of such development, if it is outside of the corporate limits. As a public local utility (and it matters not whether a utility is publicly or privately owned, it should be judged as a local utility) the municipal plant stands in the way of the progress of the community.

Social and financial progress for the workmen, capitalist, and consumer alike necessitated the fiscal and technological demands of the city (where else was there enough of a concentration of labor and capital to consume the necessary amounts of power?) – yet these demands could not override the critical importance of economy of production. Nor would it make sense to do so, as Wright's rate management system had shown it was possible to balance the opportunity for electrification to a variety of customers with the responsible and efficient management of financial and material resources. Customers were afforded opportunities for lower rates as appropriate for their use characteristics. Diversity in consumer classes and characteristics signaled systemic efficiency and the possibility of lower costs. Insull would show throughout his career charts explaining how diversity in customer classes cut down the difference between seasonally daily loads and

the system's peak load (highest power use at any given moment during the year). Inclusiveness in customers using power across time (day, season, year) yielded lower rates for all.

Managing these tremendous opportunities required a class of skilled administrators who would seek to regulate and govern "on a basis of what is economically fair, what is just to the user, the consumer, and what is just to the man who puts up the money, the capitalist" (Insull 1911c: 188). For Insull, these men were idealized in the form of British Board of Trade administrators who, executing Parliamentary legislation maintain public trust and financial stability for public service operator and user. Rational management under a system of competent technocrats typified Insull's vision of an appropriate regulatory group (Insull 1913a: 442)

> I would very much rather operate under a low rate and know that that rate had the endorsement of some administrative state body, and know exactly where I stand, than to be harassed by, say, a board of aldermen, who are mainly governed by political considerations, whereas an administrative board, when it understands the business, if its members are honest men, gives us a fair return on the money we have invested, provided that money has been judiciously spent and provided that the business is judiciously run.

The oversight of public service company management by administrators setting transparent rates and assessing for company financial viability suited Insull and his vision of public-utility relations. In a race to the bottom of rates, Insull's "cost plus reasonable profit" (1898: 44-45) model of public regulation based on the Wright model of ratemaking gave a critical advantage, in terms of growing service area, to the company who could enroll the largest and most diverse number of customer classes. A public service electricity utility was, as he would argue, best organized to serve the public as a natural monopoly with demarcated territories, regulated under the auspices of a state-

level regulator with technical knowledge and distance from the challenges of local politics. It would not be a political actor in the sense of earlier franchised utilities; purified through the process of public regulation, the electrical utility would serve the body politic directly. Nor would it be a monopoly in the sense of the large infrastructural corporations of the late 19th century. The utility was instead an agent of shaping the people's wants and desires, reaching into the home and throughout the community to provide lowest possible cost power, while only asking for a limited profit margin and long-term financial stability.

Social Values and Power

> "If our business is to be permanently successful; if we are to obtain and hold the good will of the communities in which we operate; if we are to be allowed by the governmental bodies having charge of such matters, whether legislative or administrative, to extend our monopolies -- we must defer to public opinion. I think that all our people should try to achieve the highest possible standing in the community in which they live. They should bear in mind that their personal conduct for good or ill is an addition to or subtraction from the good will which the public bears towards the business on which we are all dependent for our livelihood." (Insull 1912: 356)

The values consumers bring to bear when considering how to consume energy, when to consume it, and what sources to use, are generally the foci of analysis when considering the intersection between individual consumers and the energy service provider. Studies of home and work energy consumption – both historical and contemporary – emphasize how power companies and the technologies they bring to bear directly influence these patterns of relation. In the case of Insull and Commonwealth Edison, much time has been devoted to explicating how his method of gathering statistical data from customers yielded the various "customer classes" – defined power

consumer types – still more or less in use today. Certainly Insull's use of consumer data was unique within the context of public service utility managers in the other energy industries. Much of Insull's pragmatic interest in this data can be explained through the concept of "load." Power loads represent the aggregate power consumption within a given electrical system at a given moment in time. Enabled through the development of electric meters by Wright these meters and the data they provided utility managers an understand that their industry was fundamentally organized differently than other public service companies. Electricity utilities experience shifts in load demand on a much shorter timescale than other analogous energy sources such as gas. The inability to effectively respond to shifting electricity demand across the day can lead to limited available power ("brownouts") or a complete loss to particular regions of a grid ("blackouts"). Electricity utilities in this sense are innately physically linked to their customers – knowing their behaviors meant knowing how to effectively manage the grid. For Insull, however, who had spent time during his tenure with Edison understanding customer wants and desires, his vision of an economically regulated utility required the utility to embrace a critical paradox. Freedom from local political manipulation and the ability to set stable rates and grow within a demarcated territory would necessitate coupling knowledge of the customer's behaviors with an organization-wide commitment to fostering goodwill between power producer and power consumer. In effect, though Insull would routinely advocate for utility employees and executives to "keep out of politics all you possibly can" (Insull 1910a: 122) his success was made through situating Commonwealth Edison as a political actor more readily committed to the visions of progress his customers shared than their local representatives.

Achieving this relationship between community served and the utility would require a twofold process – both running against the predominant views of large manufacturing management. Traditional monopoly public service companies had dominated the landscape of Chicago, extending from gas supply to traction and long distance shipping via railroad. In essence, Chicago was a city unaccustomed to thinking much of service providers – a fact Insull was acutely aware of as he addressed his peer utility operators in Canada (Insull 1911b: 204):

> The old method of doing business was to assume that the public utility belonged to a class of overlords that could not possibly make a mistake. If the community in which it operated was not satisfied with its methods, why the people must just put up with those methods just the same. I care not how good may be the franchises under which you operate, how long may be the grants you have, so far as the engineering side of it is concerned, or how good may be your engineer and how perfect your plants, unless you can so conduct your business as to get the good will of the community in which you are working, you might as well shut up shop and move away.

Operating an effective monopoly utility required being able to generate a form of reasonable financial stability for customers that performed – if not exhibited in material reality – a commitment to providing the service at the lowest possible price. Flying in the face of executive backlash to government regulatory interference, Insull challenged calls for a return to a zero-sum game commitment of unregulated free competition on the grounds that it was neither financially sound nor in the best interests of the company (Insull 1910a: 119):

> While as an abstract proposition I think it is very laudable for us to cheer the idea that we should go out and fight any curtailment of our liberty of action, as suggested by Mr. Dawes, yet, as a practical, everyday proposition, and as a necessity, we have to face the views of the various communities of the states in which we are engaged. We should bear in mind, above everything else in the operation of our business, that we cannot afford to place ourselves in opposition to public opinion. If we are to maintain values of the securities for which we are

> responsible, and to increase those values, we should rather bend our energies to find some means of operating our business to meet the condition that will undoubtably[sic] confront us in most of the states, certainly the states in the Mississippi Valley.

Insull was not opposed to the concept of large aggregations of capital, a point he had spoken on consistently since the late 1890s. However, within the context of a democratic polity, defending the limitless behaviors of public service corporations to do as they please was tantamount to supporting irrational and individualistic management of electrification resources. An electrification grid, he argued, achieved its best scales of economy when a variety of classes of customers drawing from large-scale high efficiency central station power plants balance the aggregate load across the day. Economies of scale were beneficial not only for the producer, but for the customer as well. Customers who consumed more were charged less on a per unit of energy consumed basis, while those who consumed less were charged more, but not as much as they would have been charged in an environment where the public service company had lower efficiency facilities and a more limited diversity of customers. Producers achieved a more even consumption of electricity throughout the day, and avoided the political turmoil that had ousted other energy tycoons of Chicago, such as Yerkes, from control of key services.

In tandem with this call for economic management of utility resources and public good will, Insull called directly on another class of actors – managers and engineers – to exhibit the traits of the progressive class of technical experts in their interactions at all levels and in all contexts with society (Insull 1910b: 157):

> We central-station managers ought to look upon ourselves as semi-public officials and so conduct our affairs with the community as to give us the advantage of a reputation for absolutely fair and impartial dealing. We should preach the same doctrine to our subordinates and insist upon the same policy being carried out in

> their dealings with the public. If such a course is pursued, we will not only be helping to improve the opinion of the community of corporations generally, but will be establishing our own business on so firm a basis as to add to the permanency of our investment and give promise of prosperity in the future.

Aligned with the overarching principles of scientific management which inflect on Insull's thoughts, his call to public leadership highlights the importance he put on generating good will between the corporation and the public through separating its activities from the realm of traditional politics. It was the job of the utility executive, employee, and investor, to be a teacher to the masses about the value of a regulated large-scale monopoly utility. Much as Taylor (1915) would call for a more harmonious relationship between workmen and management – each to their own abilities – it was the job of the utility employee to provide honest information while the public need only provide its perspective on the quality of service they have received. The actual consumption patterns would be read from a meter.

The Public and its Interests

After World War I, Insull would leverage the massive growth of utility shareholders in the public would strengthen this "harmonious" relationship between utility and public values. As the intersection of capital equipment interest, ratemaking, and infrastructure linked power consumer's visions of the opportunities electrification afforded to the financial viability of the company itself, the purchase of utility stock by residents throughout the state of Illinois made the utility both a servant of the public and it's (in a limited sense) property. Utility employees had been encouraged to actively seek out and understand the public's will as it intersected with the industry. As owners of the company customers were transmuted into political agents of the company's rights (Insull

1922: 43-44):

> The second reason for putting into effect this plan [customer ownership] is the desire to influence public opinion. People have a very great respect for the property they own. Every man and every woman thinks that everybody except himself should pay a little more than his full share of taxation, for instance. It is a perfectly natural thing for every man to think that his house is the best along the block, the one he built and put his money in, and for a woman to think, if she is tasteful in her attire, that her bonnet is the best of those she sees at church; and it is equally natural for the man, or the woman, or the boy or girl, to think that his electric light and power company is all right, if he owns stock in that company. We have deliberately started to influence public opinion in that way and are succeeding very well.
>
> In the state of Illinois we have today 500,000 owners of utilities securities. If you figure only four to a family, that means nearly one-third of the population of the state, to say nothing of all the banks and trust companies that own utility securities. One-third of the population of the state are interested in these utilities receiving fair treatment at the hands of the people's representatives in the Legislature.

Transmuting customer visions of an affordable and electrified future into the political and financial stability of its public service companies was a realization at a state-wide level of what he had argued tied Chicagoans and Commonwealth Edison together some ten years earlier (Insull 1911d: 186-7):

> If you figure five to a family, you will find that nearly ten per cent of the population of this large city is dependent for its daily bread upon the prosperity of the public-service corporations of this community. I therefore say that with these figures before us, considering also the enormous capital investment employed, the millions expended from year to year in improvements and extensions, the tremendous disbursements in wages (disbursements to labor exceeding, probably, the profit which capital receives for its money), we may realize that one of the most vital questions, one of the most serious questions, to a community like Chicago, is its relation with the public-service corporation.

In effect, through linking individuals and other statewide institutions to the financial success of the utility, Insull sought to create political pressure through popular support in favor of policies friendly to his monopoly utility. Oppositional to the self-interested and

local-situated aldermen, municipal company, or tycoon, the utility was a form of property that could be constructed as shared in both the political, financial, and material sense. Flowing from power lines and through cash infusions via the sales of securities, customers and the utilities that served them became actors engaged in the building political alliances towards a culture of populist mass energy consumption.

Regulation in the interests of the public thus served to make durable and formalize through standardized ratemaking practices, cost models, industry-government communications, and public relations a vision of mass energy consumption enabling the end to a variety of urban and rural ills. These ills were products of what Insull saw as irrational self-interest in defiance of the best principles of fiscal and technological management. A successful transformation of the energy public utility service system implied not only lower rates for all customer classes, it formalized Insull's belief that a class of individuals competent in the operation of utilities were best suited to provide the public key values – competence, judiciousness, social responsibility, fairness, transparency, and honesty. It was these values the previous energy and motive power public service companies – natural gas and railroad in particular – had lacked.

Conclusion

If Insull's vision of a regulated public utility behaving in the public interest seems fanciful, it seems worth noting his dramatic fall from grace upon the folding of his utility holding company after the 1929 Stock Market Crash did indicate the standards he and others embodied in campaigning for regulation carried heft. With the failure of Insull's holding company, many of the Illinoisans who he so proudly noted would speak in favor

the utility's (and by association the public's) interests lost critical portions of their savings. Fleeing to Europe and eventually extradited in Turkey, Insull's trial and eventual acquittal would both shatter the man and bring about the formalization of states as the locus of utility regulation. The Public Utility Companies Holding Act would force upon the geographical and administrative boundaries of states, enforcing the breakup of holding companies into individual utilities with the exception of where the companies utilized a common grid. Instilling effective regulation – combating the lack of transparency and judiciousness in ever more complex holding companies – was central to federal intervention in the regulation of utilities.[5]

The transformation of America's urban and rural illumination and motive power systems from natural gas and some remaining coal to that of electrification of the consumer embodied a vision of progress through transforming the values on which public service companies operated. The public interest as a framework for adjudicating truth claims in the space of utility regulation represents more than a call towards abstract values or self-interest. Following the material infrastructure of electrification, the fiscal mechanisms that dictate rate setting and investment potential, and embodying the complex morass we call visions of progress through electrification, the public interest in electrification policy represents the idea that those who provide a society's key services are beholden to embody these values in the systems they operate. Dominic Boyer (2014) has hinted at the deep social and political consequences of power (in the political and electrical sense) flows through the walls those spaces the body politic designates both

[5] PUCHA was in effect from 1935 until 2005 when it was repealed as part of the Energy Policy Act of 2005 (United States Congress 2005).

"private" and "public." Understanding how the public interest functions within the context of electrification regulation takes his argument one step further they demonstrate that acts such as ratemaking and establishing new cost model boundaries are a consequence of their positionality within the regulatory regime debates over the values a society embodies when and how it chooses to use electrical power.

Insull's vision of a responsible utility serving in the public interest was, at its core, directed towards speaking about individual customers in apartment flats and single-family homes, but other than as investor and users of power they play little to no role in his argument. Reflecting on the population of early twentieth century Chicago, the lack of individuals and their experiences at the point of energy use becomes even more stark as we consider the deep socioeconomic divide between those engaged in the labor of Chicago's industries – overwhelmingly uneducated and new to the country – and the leaders of business living in Edgewater. Insull's vision may have been *about* Chicagoans and Illinoisans as a whole, but in essence most functioned as a population encountering electrification and its benefits in a hypothetical rather than real setting.

Acting upon, in meaningful ways, the alignment between utility behavior and public values and perceptions needs to also walk into these spaces of lived experience, and understand what visions of progress and social order made possible through electrification. In the following chapter I follow this line of inquiry, examining how Phoenicians and those who seek to embody their private value systems – homebuilders – construct the place of existent and emerging forms of electrification in terms of 'the good life.'

CHAPTER 5

OH, GIVE ME A HOME, WHERE THE INNOVATIONS ROAM

As I demonstrated in Chapter Four, Samuel Insull's role as network builder was linked to how he shaped the purpose and outcome of electrification systems in shaping American turn of the century national identity. Americans were rational individuals, embedded in specific communities and beholden to serve their neighbors responsibly. They, so Insull argued, sought to provide their neighbors with the best services possible, and knew enough to entrust individuals deemed to be of good character to sort out the details. Alternative systems of large scale energy production and distribution could no longer provide these values – it was thus only logical that all energy should be put towards charting a path towards the "White City" that had once dazzled Illinoisans. To achieve this goal required a complete belief in the idea that a 'regulated public utility' was both possible and more importantly achievable through transitioning to large scale electrification use.

Episodes of tremendous shifts in how individuals and states conceptualize identity, nationality, progress, and the "good life" represent the tremendous power sociotechnical system transitions have on modern life. They represent constitutional moments (Jasanoff 2003) – periods in space and time where the very fabric that underlies how a society understands and defines itself are opened up, interrogated, and reconfigured. Such questions of national identity extend beyond what sociotechnical regime theorists conceptualize as the "rules of the game" into the overarching social, political, economic, and cultural landscape of a society. Insull's concerns, by extension, have as much to do with how to load balance Commonwealth Edison's grid as they do

with charting a story of his company that situates it as an agent rather than enemy of social progress.

Insull's vision of social progress through electrification represents how larger conversations about national identity enter into conversation and inflect on particular interpretations of what is possible through sociotechnological transitions. National identity is not, however, the purview of actors such as Insull alone; all individuals within a society carry shared understandings of what constitutes community, family, and importantly for this chapter home. Homes represent important sites of energy use – in the United States 6 percent of total energy consumption occurs within residential properties (United States Energy Information Administration 2017). The technologies and social practices that shape how energy is used and conceptualized within the home strongly inflect how members of a society understand energy's 'social value'. Shove and Walker (2010) recognized that when contextualizing energy consumption, especially within residential settings, scholarship should recognize that individuals live within spaces replete with the energy technology choices of others. Those residing within a given domicile experience come to understand through daily practice what it means to use the refrigerator, turn on and off lights, and call a solar panel cleaning service.

It is no accident more recent work at the intersection of social science and engineering has taken an interest in how forms of understanding the values latent in energy systems can be reshaped through various home energy management tools. In-home devices (IHDs), such as the M-Power® box I described in the introduction, represent a particularly interesting expression of the idea that through redesigning how individuals experience energy systems in the home larger energy management changes

can be achieved. Hargreaves, Nye, and Burgess (2010, 2013) studies of UK families testing "smart" energy monitors noted that while individuals responded early on to the new 'moral economy' of energy consumption made financially visible, other features such as total energy consumption did not factor into specific household practice changes. Moreover, users who had made changes to their energy consumption rarely continued these practices, reflecting a larger trend in IHD research that indicates simply knowing one's energy consumption does not lead to permanent changes in daily activity.

Despite the deep interest amongst energy scholars in the role new technologies of the home can play in shaping energy consumption patterns, little attention has been paid to how these transitions link to the larger purpose of the "home" within American social life and order. The 'home' as feminist scholars remind us is a "social edifice that embodies meanings, values, and attributes that reflect the differing experiences and beliefs of its builders" (Bowlby, Gregory, and McKie 1997: 347). Homes are spaces where dominant and transgressive relationships between families are performed outside the public sphere. In the United States, the home is a deeply personal space that possesses its own narrative of protection enshrined in legal codes and our collective sense of where the state does and does not belong.

Ruth Schwartz Cowan's (1983) classic study of gendered labor and technology in the American home attends in great detail to the intersection of energy transitions, technologies of the home, and the very idea of the home itself. As Cowan notes, the industrialization of the American home divided the organization and understanding of female and male labor. Home work, or housework as we refer to it now emerged from the commercialization of a variety of in-home tasks concurrently with the exit of men from

the house and into the larger market. The result of this simultaneous industrialization of American private and public life was a panoply of new technological artifacts and associated tasks that required first new sources of labor (hired) and, eventually, more technologies of home management. Ovens, lighting, and heat amongst other technologies promised to progressively reduce household labor while improving on domestic quality of life. Regardless, these technologies did little to destabilize the amount of work within the home; worse yet, the labor of the house became equivocated with the absence of laboring as American society centered on the exchange of capital as the primary modality of productivity.

Through all of these transformations Cowan succinctly brings to the fore how powerful the idea of 'the home' is within American society (1983:149-50):

> When push comes to shove, most people will opt to increase the possibility of exercising their right to privacy and autonomy: so that they can sleep, eat, have sexual relations, discipline their children, clean their bodies and their clothes without interference; and so they can construct long-term emotional relationships with people of their own choosing. And when further push comes to shove, when decisions have to be made about spending limited funds, most people will still opt for privacy and autonomy over technical efficiency and community interest.

Energy transitions intersecting at-home social relations and behaviors will invariably be transformed by the highly stable understandings of what home is embedded in American political, economic, and social life. Attending to how visions of what the home is and can be through specific transformations in domestic energy systems brings into focus these where proposed alternative ways of living with energy intersect dominant narratives about the ordering of American society.

Chapter Outline

Turning to the imagined domicile, this chapter examines how visions of home life possible through specific transformations in domestic energy systems articulate the social, political, and economic purpose of quintessential American single-family home. Unlike the early single-family homes of the twentieth century, however, the American landscape today is dominated by a small group of large-scale commercial home builders. Beazer, Pulte, Ashton Woods, and Meritage amongst others play a significant but understudied role in shaping how American families come to understand what makes a house a home and where energy systems fit within it.

Drawing from a large-scale study of over 40 new home building sites across the Phoenix metropolitan area, I examine how over a dozen builders construct visions of alternative energy systems and practices through the design and marketing of model homes. Model homes represent deliberate exercises by corporate design staff to construct tractable visions of what home life could be like for idealized customers. As I demonstrate, not all builders explicitly market their visions of home life in terms of energy systems; however, those that do strongly frame visions of domestic labor and leisure in terms of energy management. How energy management systems shape labor and leisure for these builders depends on what market(s) they design homes for – single families or retired persons.

Energy management technology research has paid little attention to generational understandings of energy and the home, yet as my work shows builders impart very different interpretations of the role of energy management in the home for older individuals and younger families. Builders oriented towards designing homes and

communities for retired/semi-retired individuals imagine energy management and alternative energy sources (such as rooftop photovoltaic solar) as a pathway for providing their customers tools for financial and temporal management. Those designing single-family homes however see energy management and alternative technologies as part of a suite of innovations ready-made for home application. Weaved in between these two visions of what the home is and does is a common theme of the home as a space that produces social, political, and importantly economic value. Embedded in the walls and linked to the appliances are a variety of coded energy efficiency and energy management technologies that go beyond merely reproducing ideas of idealized families and family life; these homes also are designated as assemblages of materials, third-party energy management and production technologies, and building materials that do work on behalf of the family. For three key builders, Meritage Homes, Del Webb (a subsidiary of Pulte), and Robson Communities, the new home overcomes its inherent disadvantages as a space of non-productivity to emerge through novel technologies as a member of the family capable of improving life for inside its walls.

Why Phoenix?

Phoenix, Arizona represents a perfect intersection of commercial single-home visions with larger energy system transformations. Built on large-scale suburban development in the post-World War II era, the Valley of the Sun's suburban landscape is a patchwork of communities stretching across sixty miles of the northern Sonoran Desert. Linked to massive tax incentives for builders and defense contractors alike, Phoenix's suburban landscape screams "Americana" at its most peripheral areas where builders

craft their own “Mayberry” complete with wraparound porches and Georgian colonial styles amongst the Saguaro cacti. Complementing instantiations of Americana and the single-family home are equally as American visions of the community of tomorrow. Modern communities such as Eastmark in the eastern valley draw on the presence of Silicon Valley companies such as Apple, weaving their presence with the larger history of Phoenix being the place for modern homebuilding alongside streets aptly named Copernicus and Aileron.

Methods and Data Collection

One of the significant challenges Phoenix poses for studying the role new home build site models poses is the sheer size and scope of ongoing construction. The Phoenix metropolitan area consists of a population of approximately 4.5 million individuals spread out across a forty mile wide by sixty mile long stretch of valley, from the city of Buckeye in the west to Mesa and Queen Creek in the east. Figure 1 provides a general map of the Phoenix-Mesa-Scottsdale Metropolitan Statistical Area.

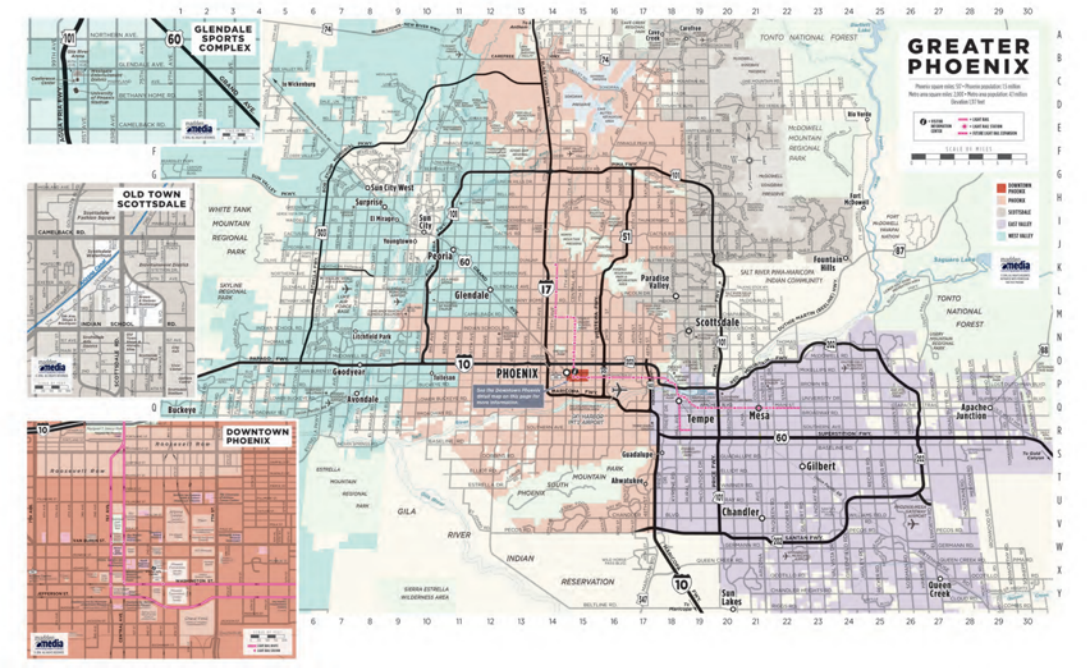


Figure 1: Map of Phoenix Metropolitan Area (Visit Phoenix 2017).

Given the sheer speed at which new developments emerge in the Phoenix metropolitan area, my analysis of residential new home build sites began with preliminary web searches of local real estate development websites in three key valley communities – Mesa, Goodyear/Litchfield Park, and Buckeye. Each of these communities has grown significantly in the last decade, possess large amounts of open and inexpensive land, and are co-located with key freeways for accessing businesses across the valley. These initial searches generated a total of 117 construction sites with a total of 27 unique builders. To account for other builders operating in the valley, I conducted a broader search of new build sites across the Phoenix metropolitan area. This broader search generated nine new build sites with eight unique builders.

New home builders in Phoenix comprise some of the largest residential construction companies in the United States today. These builders, including D.R. Horton, Pulte, David Weekly and others rank amongst the top national builders on a revenue basis. Table 1 below outlines the industry rankings of each residential home builder in Phoenix included in the study. Due to Phoenix's size and continual growth over the last fifty years, a number of large national builders are currently building multiple communities across the valley. Other builders, such as Meritage Homes, have grown from "local" builders in the Phoenix metropolitan area to nationally-recognized housing brands throughout the Sun Belt states. Phoenix's housing market and seasonal residents from the upper Midwest and southern provinces of Canada also sparked financial interest on the part of international builders. Mattamy Homes, Canada's largest single-family home builder, entered the Phoenix market during the early 2010s and is continuing to expand its presence throughout the valley through the development of 13 communities across the Phoenix metropolitan area.

TABLE 1

ANNUAL REVENUE RANKINGS OF SURVEYED BUILDERS (Professional Builder 2017)

Builder	**Ranking**	**Builder**	**Ranking**
Ashton Woods	18	Maracay Homes*	N/R
AV Homes	25	Mattamy Homes	32
Beazer Homes	15	Meritage Homes Corp.*	9
Bellago Homes*	N/R	Pinnacle West Homes*	N/R
Blandford Homes*	N/R	Porchlight Homes*	N/R
Cachet Homes*	N/R	Pulte Group, Inc.[2]	3
Cal Atlantic Homes	4	MCD Holdings, Inc.[3]	12
D.R. Horton, Inc.	1	Robson Communities, Inc.[4]*	67
David Weekley Homes	14	Shea Homes	13
Fulton Homes*	81	Taylor Morrison	8
Gehan Homes	34	Toll Brothers	6
Hovnanian Enterprises, Inc.[1]	10	Towne	N/R
KB Home	7	William Lyon Homes	17
Lennar Corp.	2	William Ryan Homes	121
LGI/Terrata Homes	24	Woodside Homes	27
Mandalay Homes*	N/R		

1 - Includes K Hovnanian

2 - Includes Del Webb (55+ Communities Only)

3 - Operates as Richmond American Homes

4 - Active Adult (55+ Communities Only)

* - Indicates Phoenix-Based Company

As part of my analysis of the new home build models, I collected information pertaining to the type of home (single family, detached; single family, attached; multi-family), their geolocation, and the price range and square footage of their online listed home models. This provided informative context about the relative income levels of each community's customer base and the concentration of new builds within specific parts of the valley. Figure 2 below was generated from a Google Fusion table documenting each of the sites I examined. The fully interactive map can be found at: https://www.google.com/fusiontables/DataSource?docid=10DrJYM4aOnzL2KPNOehw4uPUdlh4bMgbG7qf1UPm.

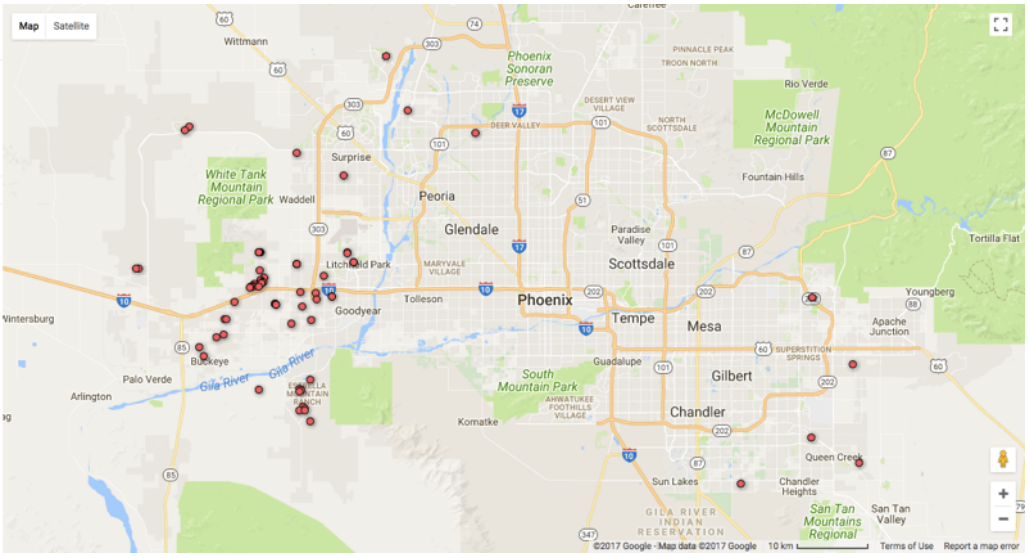


Figure 2: Google Fusion Map of New Home Build Sites

At each site, builders constructed between two and four model homes. In the most extreme cases builders designing all-inclusive communities, specifically those serving a 55 or older community only (known as 'active adult' communities), builders construct entire model home neighborhoods with up to, in the case of Pebble Creek, a community

in Goodyear, AZ, 12 models arranged as a “village” (see Figure 3). Model home villages allow sales personnel to control the flow of individuals into the models, and optimize possible moments where sales personnel could engage customers in identifying their wants and needs. For some communities, sales personnel used golf carts to drive customers from the model village to homes under construction for existing customers or ones being built from the builder’s perspective to optimize quick sale (“spec homes”).

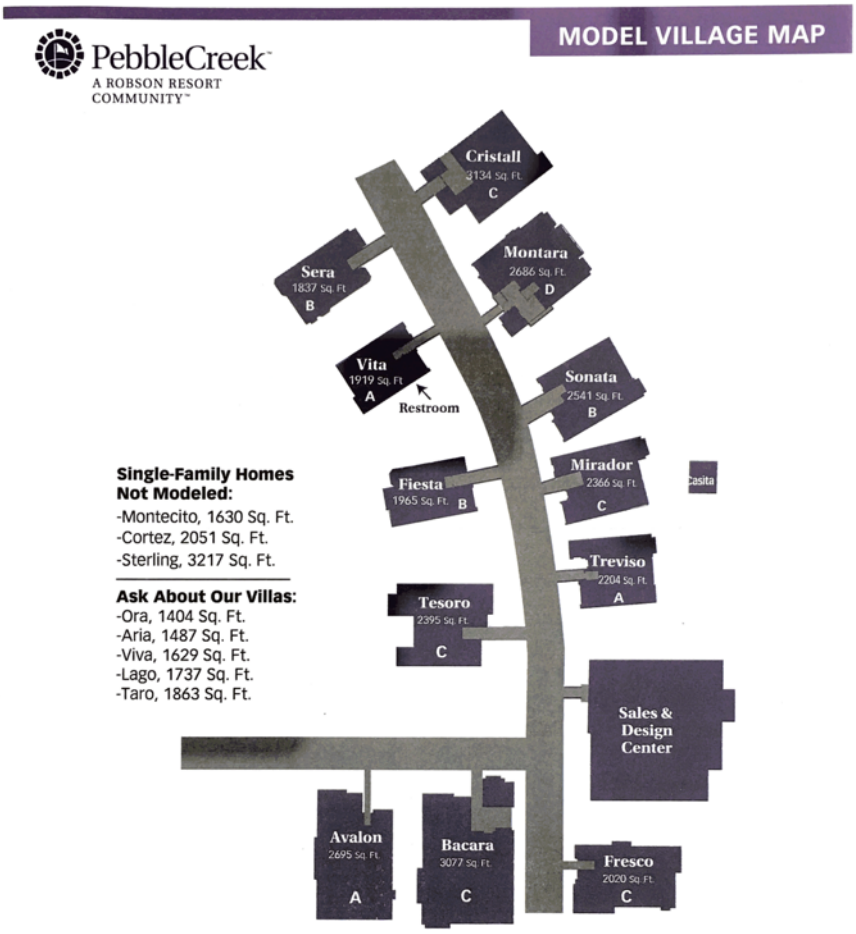


Figure 3: Model Homes "Village" Map

Experiencing a model home from the perspective of individuals and families seeking a new single family residence requires mirroring the visual, tactile, and discursive experiences embedded in the sales process. Following Rose's (2003) multimodal analysis of photographs in the construction of concepts of the 'home,' I entered each new home build experience through the lens of being a potential customer seeking a single-family home. Maintaining this frame of analysis was critical to enrolling sales personnel in the process of guiding me through the entire model home sales experience, including providing marketing documentation, asking potential customers to sign up for news alerts, and importantly the comfort and time necessary to go through each model home in detail. Alongside documentation provided by sales persons, I photographed any other marketing devices such as signage and pamphlets contained in and around model homes as well as collected any other materials intended for customer consumption. With some model home sites, builders designed immersive experiences where customers can "see" the construction options possible through their home designs. In these 'learning centers,' I recorded the experiences from the perspective of a customer entering and observing the experience.

All data streams generated from each build site were digitized, tagged, and uploaded to a master Dropbox folder within subfolders for each city. Build sites were given a location number (LOC ###) based on their city of origin during the initial model home discovery phase. These location numbers were associated with subfolders within each city's main Dropbox folder for easy access to site-specific information.

It is worth noting at this point that new home communities are heavily shaped by builder's perceptions their perceived customer base's identity. Certainly the most

important factor weighing on the inclusion/exclusion of customers are the expected financial capacities of those who enter a neighborhood. Individuals and families who are capable of affording, for example, the $500,000 or more base price homes in Toll Brothers' Vistancia community in Peoria are expected to not only have the ability to invest in homes well above the region's average, but moreover want and desire luxury finishes of which they are both capable of articulating to a design team and paying for in total loan modifications. Of the communities studied, only those in Buckeye, Arizona, and specifically neighborhoods outside of the coveted Verrado community development, ranged below $200,000. These homes, built on repurposed agricultural land, both signify the distance to which middle income families must travel to acquire affordable single family housing, and the role of these new suburbs in separating lower income populations on already marginal lands. Other communities draw on similar lands at a higher price point, specifically the Estrella community south of Tolleson, AZ, but these are situated amongst the vistas to the southwest of the Estrella Mountains along the periphery of the Rainbow Valley and, by extension, the Gila River Indian Community.

Another factor that plays into the demarcation of idealized customer populations falls along perceived family arrangements, and more specifically the presence of multi-generational homes and non-heteronormative relationships. Of the communities surveyed, only those focused on 55 or older populations included design features that explicitly marketed homes where multiple generations – usually an older set of parents and their aging children – could live together with semi-demarcated spaces. Designs, however, focused on the separation of one of the two groups from the other, generally the older parents, who would be expected to reside in the home only part of the year. In terms

of intimiate relationship configurations, only Robson Communities' models made any indication their homes were for forms of living other than heteronormative retired couples. Yet this instance – present in only one model – should not be taken as a deviation from the perception that homes are overwhelmingly for single-family heteronormative couples of varying degrees of financial ability. These factors play a significant role in how information is presented to customers, especially in terms of how visions of responsible environmental stewardship through effective home energy management are presented as the customer's incumbent responsibility.

Experiencing the Model Home

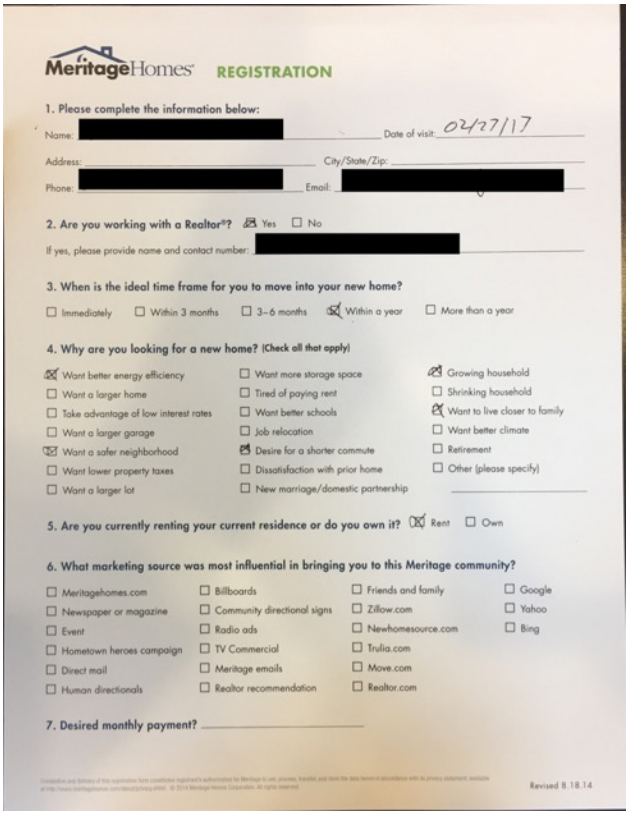
The purchase of a suburban home through a builder during the development phase differs in many ways from building a custom home, purchasing a pre-build resale structure, or renting a domicile. Custom homes imply an in-depth negotiation between builder, architect, and homeowner where a variety of exterior and interior features will be designed and with the homeowner's personal vision and financial constraints in mind. Resale homes, on the other hand, involve mediating expert parties (real estate agents) that identify homeowner wants and needs with the intent of finding properties that both meet homeowner requirements and help optimize the agents' individual return on time invested in the sales process. Working with a large builder can involve elements of both custom and resale home sales experiences, but within a highly constrained number of possible design outcomes. At the most extreme, builders such as Terrata (LGI Homes) sell only homes they have designed and constructed with no specific customer(s) input in mind. Like Henry Ford's famous adage, "You can have any color, so long as it's black",

these builders define for the customer whose imagined house can become the homeowner's 'home.'

Most builders, however, offer a variety of semi-custom structural and interior design options that are gradated based on price. These options can include pre-determined exterior designs, interior space modifications, and various technology options including thermostats, kitchen appliances, and as I will discuss in the case of some builders, pre-installed rooftop photovoltaic systems. Not all options are available to the homebuyers as options can add significantly to the "base" price for a given house model. Homebuyers are thus forced when comparing two home builder's options to consider what options are included, what options they desire, and the amount available to put forward for earnest money (to lock in a site) and the final down payment in conjunction with the mortgage. For example, at two single-family attached town home build sites in the small resort community of Litchfield Park, AZ, home buyers who are qualified for approximately $350,000 can either purchase a base model townhome through Cachet Homes or, alternatively, buy a significantly upgraded townhome of relatively the same size at a Mattamy Homes development (The Cove at Palm Valley North) nearby.

How homebuyers make decisions about which builder and home design to go with begins through the process of entering the model home sales office. Usually situated within a converted garage space, the sales office serves as the obligatory passage point for customers seriously interested in purchasing a new home. Sales offices become a part of the new home spectacle where builders exhibit their brand's identity, as well as gather critical information why their potential customers are seeking out a new home. Builders are of course interested in what structurally their customers want in a home, however,

these concerns fall secondary to the overall structure and pace of home life. Model sales offices serve in this way as a place for entering into and exchanging ideas about what the home means. Figure 4 shows how in the case of one builder, Meritage Homes, emphasis is put on structural, financial, and social factors such as distance from work, school quality, and household membership dynamics. Meritage also takes interest in how customers conceptualize the energy efficiency of their current domicile; I will address in more detail later in this chapter. For the moment, it is worth noting that, as a whole, builders like Meritage are equally as concerned with shaping/being shaped by their customers' visions of home as they are by and design or engineering concerns.



MeritageHomes REGISTRATION

1. Please complete the information below:

Name: [redacted] Date of visit: 02/27/17

Address: _____ City/State/Zip: _____

Phone: [redacted] Email: [redacted]

2. Are you working with a Realtor®? ☒ Yes ☐ No

If yes, please provide name and contact number: [redacted]

3. When is the ideal time frame for you to move into your new home?

☐ Immediately ☐ Within 3 months ☐ 3–6 months ☒ Within a year ☐ More than a year

4. Why are you looking for a new home? (Check all that apply)

☒ Want better energy efficiency	☐ Want more storage space	☒ Growing household
☐ Want a larger home	☐ Tired of paying rent	☐ Shrinking household
☐ Take advantage of low interest rates	☐ Want better schools	☒ Want to live closer to family
☐ Want a larger garage	☐ Job relocation	☐ Want better climate
☒ Want a safer neighborhood	☒ Desire for a shorter commute	☐ Retirement
☐ Want lower property taxes	☐ Dissatisfaction with prior home	☐ Other (please specify)
☐ Want a larger lot	☐ New marriage/domestic partnership	

5. Are you currently renting your current residence or do you own it? ☒ Rent ☐ Own

6. What marketing source was most influential in bringing you to this Meritage community?

☐ Meritagehomes.com	☐ Billboards	☐ Friends and family	☐ Google
☐ Newspaper or magazine	☐ Community directional signs	☐ Zillow.com	☐ Yahoo
☐ Event	☐ Radio ads	☐ Newhomesource.com	☐ Bing
☐ Hometown heroes campaign	☐ TV Commercial	☐ Trulia.com	
☐ Direct mail	☐ Meritage emails	☐ Move.com	
☐ Human directionals	☐ Realtor recommendation	☐ Realtor.com	

7. Desired monthly payment? _____

Revised 8.18.14

Figure 4: Example Customer Registration Form

Exiting the model home, the customer finds themselves on the proverbial and "literal" other side of a fenced zone between the model homes and the rest of the development. In typical single-family detached home builds, this involves a standard yard fence that prevents customers from entering individual models on their own volition. For large "model villages" in active adult communities, model homes are demarcated through a system of gates and walls that prevent customers and current residents from intermingling. Customers who have not yet purchased property and "joined" the community are thus kept separate from the actual homes and homeowners present – a fact that is reinforced as they turn away from the sales office and into the individual models.

The exterior and interior design of model homes serves to enroll as many potential groups of customers in the builder's vision of what the ideal home life consists of and serves to cultivate. Like museums, the model home is a testament to the "good life" in America at its fullest; exterior architectural choices hearken to classic hacienda, mid-century modern, and opulent Georgian colonial architectures. Lawns vary from well-organized xeriscape spaces, to grass covered yards with uncovered water features that continue to operate well into Phoenix summer heat. For all but the wealthiest of customers, these options call more to what the builder imagines their future residents see home life as, rather than the financial realities of their individual cases.

Inside, model homes continue to display visions of American home life and Americana culture materialized through structural and furnishing choices. Mid-century tables, waterfall edge kitchen islands, multiple bedrooms, and giant master bathrooms reflect the latest trends in home design (Figure 5) while maintaining that connection to the desert landscape aura that first found its way into the American imagination via

copies of *Arizona Highways* magazines (Needham 2014). The collective effect is to give the customer an uncanny sense of lived-in space; on one hand, there appears to be a family present, yet there are none of the markings of human habitation, a lack of disorganization intermixed with the sweet almost sterile scent of air fresheners.

Figure 5: A Model Home Interior in Phoenix

As a whole, the model home experience is akin to what Donna Haraway describes circulating amongst the objects of the American Museum of Natural History in New York (1984: 21):

> Behind every mounted animal, bronze sculpture, or photograph lies a profusion of objects and social interactions among people and other animals, which in the end can be recomposed to tell a biography embracing major themes for the 20th century United States.

Model homes do not possess the permanency of the museum exhibits, yet they still stand in for a multitude of commitments on the part of the builder as to who and what the home includes and excludes. All customers will at some level or another enter into the experience of seeing home life through the model home, though few have the capital necessary to afford the models themselves. This marriage of idealized home life with economic activity creates a material and social permanence to the home that public spaces lack. We may all "claim" to support at varying levels public spaces, but the private space of the home is for the American family an expression of their situatedness within the large political, social, and economic landscape of the nation writ large.

What does this indicate about the purpose of expressions of energy use and technologies in the model home? Following the idea of model homes as capitalized museums, how technologies become represented through visual and discursive rhetoric in these spaces indicates the kinds of people suburban home builders imagine inhabiting their communities. When it comes to energy systems, the very act of showing customers where power lines, smart thermostats, and high quality insulation link questions of how a family can use its means to secure financing with throwing parties for friends, baking with grandparents, and having the peace of mind to know a home is secure.

The following sections outline how builder's expressions of social, economic, and environmental values possible through advanced in-home energy technologies articulate the role of energy transitions in the construction of home identities. Of the builders surveyed, three companies – Meritage Homes, Del Webb (a subsidiary of Pulte), and Robson Communities – constructed their visions of home life explicitly in terms of the

values advanced energy systems could generate towards transforming home life. What makes their design and marketing choices significantly different from their peers – even those who include mention of advanced energy technologies – is their emphasis on the home as a network of human activities and technologies that generate value. Meritage, Del Webb, and Robson customers are in this respect "made" rather than found. As I demonstrate below, builder model home design choices situate technological artifacts in conversation with infrastructural elements of house design to emphasize specific social, environmental, and economic values. Emerging from the model home experience, customers see saving money in high efficiency windows, diverting carbon emissions through spray-foam insulation, and generating more time for leisure with home energy management systems. Rather than finding a home that suits their incumbent values, the ideal customer emerges from the homebuying process seeking to, in the words of Meritage Homes, "live better, smarter, and healthier" (2017) than a family in a conventional resale home.

Living Better – Private Values and Energy Technologies

What do energy management technologies and yoga have to do with each other? In the context of PebbleCreek, a large Robson Communities active adult neighborhood in Goodyear, energy management and in-wall technology choices represent technological commitments to living the life of leisure promised during the mid-century in retirement. These commitments to alternative ways of living through energy management play out in the community's Learning Center, a converted garage in one of a dozen models directly adjacent to the Pebble Creek sales center. A common feature amongst the three builders

surveyed in this chapter, Learning Centers serve a specific function in model home communities. Whereas the purpose of model homes is to give individuals spaces where they can imagine their visions of the good life through vaulted ceilings and quartz countertops, Learning Centers provide stylized environments to experience the infrastructural components of home design and management. They also serve as moments where corporate marketing can take front stage vis-à-vis the actual design features displayed in homes. Figure (6) shows a series of images from Learning Centers at PebbleCreek (left), Del Webb (center), and Meritage (right).

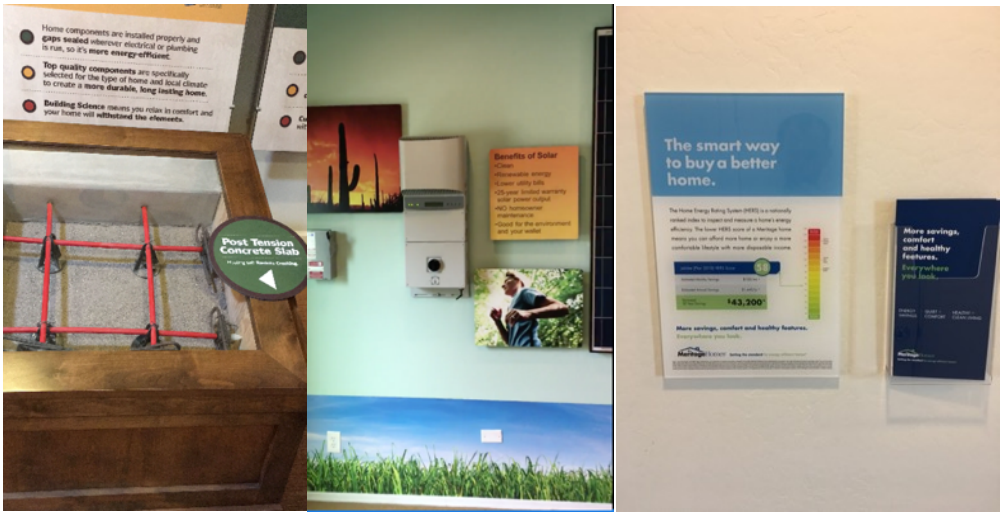


Figure 6: Various Learning Center Exhibits

Learning Centers are typically located in large unfinished spaces within model homes – either garages, large family rooms, or in the case of one Meritage build site interspersed throughout the house. Accessing the Learning Center requires passing through both the formal sales center space and the majority of public and spaces within a model home. For example, at Meritage's Sedella community, customers were directed into the first model and through the dining and living room before entering the Learning Center in a converted garage. Entering each Learning Center, customers are encouraged

to walk across the threshold out of a home and into the building technologies exhibition. This process facilitates customers moving from the highly public spaces of the home progressively into the center of the space until, upon crossing a threshold, they go behind the proverbial walls to see what makes a builder's house their hypothetical home.

For Meritage, Del Webb, and Robson the learning centers are expressions of corporate values pertaining to the relationship between customer and builder. Figure (7) below shows the entrance of PebbleCreek's Learning Center, a large "mural" like wall depicting the advantages of Robson-designed active adult living.

Figure 7: PebbleCreek Learning Center Advertisement

Value is at the center of the Learning Center narrative, linking what the home enables to how the home is designed and lived in. Customers seeking homes in an active adult community are, by Robson's measure, interested in lives driven by the ability to do as much or as little out of the house as desired.

With a variety of 'resort-style' options for daily activities, life at PebbleCreek is meant to be about what you *can* do in retirement, rather than what you cannot. Achieving these desired social outcomes – playing golf with friends, taking up crafts, or having family visit requires resources and a space designed to make *living* rather than life possible. It requires more than bare minimum finances, and by extension PebbleCreek is designed in terms of homes to facilitate the efficient use of monetary resources. How this comes about has little to do with the actions of the hypothetical homeowner, as retirement should be as little about the management of self as possible! Rather, the *house* itself can become a tool of financial management. How this occurs is through the organization of specific technological choices pertaining to building materials and in-home energy management devices in conjunction with the external validation of energy professionals. Thus, as Figure (7) above indicates, leisure and design are married together through transforming the home from an energy and financial sink into a generator of unexpected (but not un-earned) resources.

Across the Robson Learning Center are a series of physical exhibits, similar to the one depicted in Figure (7) above documenting how Robson design achieves this merger of construction and value creation. Each individual exhibit provides a variety of visual and tactile modes for experiencing Robson design choices. Figure (8) below shows one example, a 'touch-screen' series of simulated window panes comparing low-emissivity modern windows included in Robson designs and traditional vinyl sheathing windows. Behind each window is a lightbulb of ostensibly the same wattage and on each window pane printed is a place for placing a human hand. The intended effect is to use the sense of heat against bare skin to differentiate the traditional vinyl window that is hot to the

touch to a cooler new low emissivity window pane. Above this and other exhibits Robson uses a series of post-it styled images to depict how each technology both inside and part of the walls enables a suite of other 'social' goods. Replacing money spent on lost heating and cooling, Robson customers can redirect their energies to enjoying the multitude of potential hobbies and social activities available (Figure 8). Saved kilowatts become appetizers at the community restaurant, and minutes spent paying bills and managing an older home are now open for tee times at one of the community's golf courses. Energy savings rather than use are the measure of untapped leisure at PebbleCreek, while the drudgery of corporate work and checklists (depicted by the many faux sticky notes) is a thing of the past. Others, specifically Environments for Living®, a third-party energy efficiency and health home inspection service, provide level of baked-in support to make sure that even maintenance of home space is, at least for the first years, in the hands of others. Simply living in a Robson home generates leisure and value, not merely because of the builder's unique characteristics, but because they are committed to turning energy technology advances into a pathway to live with more comfort.

Figure 8: PebbleCreek Examples of Energy Marketing

Talking to Solar Panels – Making Environmentally 'Smart' Customers

Meritage and Del Webb differ from Robson and the remainder of their competitors in one key way; currently, they are the only builders in the Phoenix market that offers the possibility of integrating rooftop photovoltaic solar energy into the initial home construction. Like Robson, they have a strong interest in construction the model home and its learning center as a place where customers are brought into contact with a suite of social values embedded in walls and sockets. However, unlike Robson, they have an explicit interest in generating understanding amongst their constituents. Figure (9) depicts two examples of how Meritage and Del Webb situate one advanced technology–

rooftop photovoltaic solar – as objects customers can both see, touch, and read/hear about.

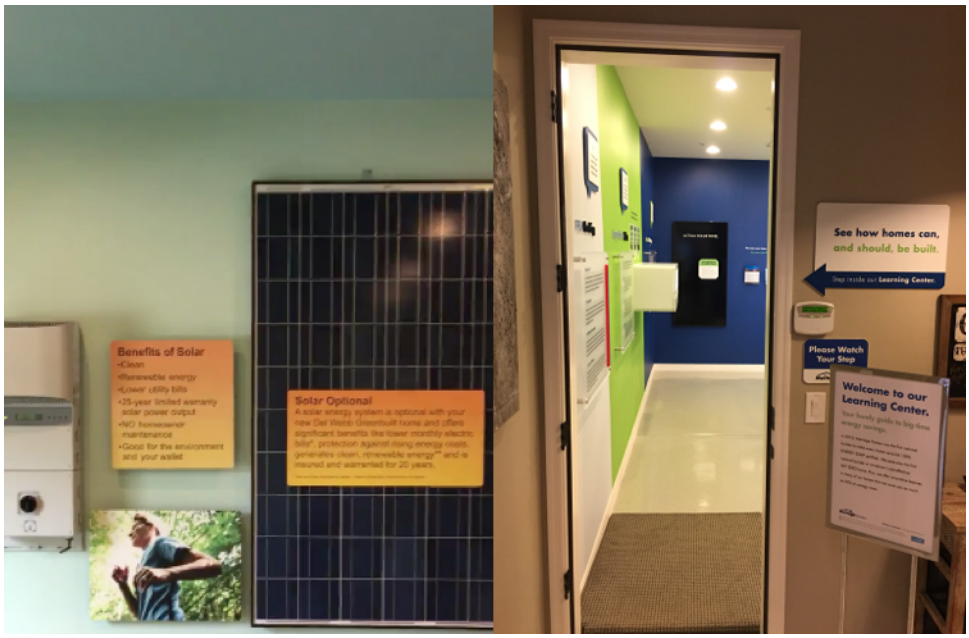


Figure 9: Examples of Photovoltaic Solar Panels in Learning Centers

The model home exists between the family home as a space of public values exercised within the private realm and longstanding food, water, and energy infrastructural systems that flow in and out of spaces defined by government policies, pre-existing corporations, and previous residents. On one hand, the model home as I have suggested above is a space where the values of others – namely those of the company building homes – enter into the lives of new individuals. On the other, model homes are stylized representations of ideal living through a builder's designs – be that in terms of appliance choices or insulation types.

For the majority of builder's surveyed, marketing techniques focused on emphasizing the ability to create comfortable homes that enable a family's preexisting value systems. Meritage, Del Webb, and Robson are by contrast interested in creating

environments where customers either self-identify with new ways of living or can find themselves in a builder's home through seeing the home in new terms. The latter is crucial for Meritage and Del Webb's passive marketing of solar technologies for the home, as their intent is to create the ideal home buyer through experiencing and learning about the advantages novel energy technologies provide. Assuming potential homeowners will simply adapt to a new paradigm of living discounts the tremendous agency owners have in determining what they can or cannot include; however, the important element of these learning campaigns is they take learning about energy technologies and merge them with a passive study in the infrastructural dimensions of home economics.

Take the case of Meritage's photovoltaic power exhibit; in each of the learning center's visited, the solar exhibit was present and generally displayed in a corner with limited prominence vis-à-vis the larger board given up to Meritage's comprehensive model of the ideal home (Figure 10).

Figure 10: Meritage Home Features Schematic

Each solar exhibit includes three major pieces: a "real" solar panel, written text about the advantages of rooftop solar energy, and pamphlet materials from their third-party solar supplier Sunpower. Couched in terms of energy independence through advanced technologies, Meritage plays on the individual home as a private space to situate solar as a natural extension of this access to privacy and self-control of home finances (Figure 11, see text below):

Figure 11: Meritage Solar Energy Exhibit

> If there's ever been a solution for saving money on utility bills, it's building your home with solar energy. After all, the more energy you make at home, the less you have to purchase from the utility company. The value of your savings will also continue to grow as time goes on and utility rates increase. In fact, a national solar provider proclaims that an average homeowner during a span of 30 years can produce twice the money in cost savings than what the average solar-energy system costs to purchase. Also, a U.S. government study showed that homes with solar energy increased the homeowner's resale value significantly.

Displayed on the wall underneath the heading "Advanced Solar Energy", customers in the Meritage Learning Center discover through seeing and learning about solar for the first time how it can provide significant financial control over the value of a home both in the present and over large periods of time. With a national reputation for unstable real estate, situating advanced solar homes in Phoenix as stable in terms of total equity compared to their peers makes adopting photovoltaic energy financially sensible and technologically progressive. It is appropriate, then, Meritage mirrors Robson's use of the sticky note social values – energy technologies exchange from Figure (8) with 'fact' bubbles directing customers to see as in Figure (12) below the truth of energy management.

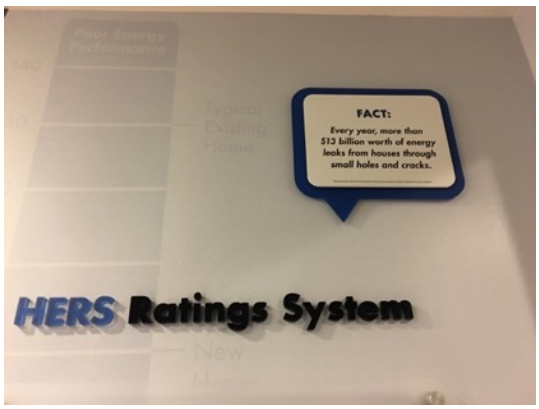


Figure 12: Meritage Energy Facts

Throughout the Meritage Learning Centers observed in Phoenix the builder consistently linked learning about energy use – carbon emissions, utility bills, insulation, and home energy management – in terms of the responsible management of home resources. Figure (13) represents a common diagram found in home kitchens depicting the advantages of a Meritage home. Investing in a Meritage home implies committing to a series of coded intelligent or "smart" in the company's own language choices about energy and its larger environmental and economic impacts both at home and throughout the world. A Meritage home is as depicted below as smart as cutting carbon emissions at power plants, reducing transportation emissions (a critical issue in Phoenix), or re-planting forests.

Figure 13: Meritage Environmental Marketing

Del Webb follows a similar pattern for linking customers to specific home design advantages in terms of financial wellbeing. However, they also emphasize the role of the homeowner as a community member responsible for the long-term sustainability of the world. This differs slightly from Meritage's vision of energy efficiency and environmental protection education in learning centers: where Meritage states buying a home from them generates these values, Del Webb actively situates the homeowner's environmental values within the community borders. On the exterior of the learning center model, Del Webb (Figure 14) openly displays the company's official logo for its 'green'/environmentally friendly programs, putting energy and the environment literally on the walls of its 'model' community.

Figure 14: DelWebb Green Built Model Home

Stepping into the main entryway, Del Webb carries the open themes of conservation and resource management along the floors and into the entryway where a large hole in the ceiling prominently displays the advantages of properly sealed and insulated ceilings. Continuing on through the public spaces of the home and into the learning center the images of advanced technologies and energy management systems are put against a canvas of tranquil images of greenery and adults of the appropriate age group enjoying the outdoors (Figure 15).

Figure 15: Greenbuilt Learning Center

Whereas Meritage emphasized the role of advanced energy systems in terms of saving and generating revenue first, Del Webb describes rooftop photovoltaic solar as a tool for creating positive environmental impact while simultaneously levelling mid to long-term home expenses. Some benefits of solar listed in the learning center include "Clean", "Renewable Energy", "Lower utility bills", "25-year limited warranty solar power output", and "NO homeowner maintenance". Energy and financial savings figure prominently within the discourse of going green by retiring through Del Webb, but the emphasis is always on how these technological choices generate positive environmental impacts throughout the life of the homeowner and the home.

The Home that Generates Values

Before turning to the implications of energy technologies at the center of model home narratives, it is worth reflecting on the impact electrification had on the American home. Throughout the nineteenth and early twentieth centuries scholars, theologians, and politicians alike situated the design of American homes at the center of a narrative of the idealized moral and democratic society. How one built a home and who lived in it were by extension a deeply private expression of larger public values. Furthermore, the suburban home in particular was an expression of the need to generate a communion with nature – a call for the vision of Arcadia against the malignant ills of city life. As electrification became more common in households of the suburban middle and upper-middle class, home designs shifted accordingly to more and more open floorplans, allowing for the spread of light throughout spaces (Nye 1992: 255). Accompanying the

"opening" of space was an extension of the pace of industrialized life into the home, with the home, as Cowan noted, ossifying as a site of resource consumption.

Meritage, Del Webb, and Robson communities and model home designs continue to echo these commitments to illumination and space immersed in nature (Figure 16). Contemporary home designs in Phoenix maximize the entry of light into open spaces, paradoxically encouraging increased thermal transmission while simultaneously employing multi-zoned air conditioning. Model homes are clean, orderly spaces, hearkening to mid-century architectural and interior design choices synonymous with the heyday of Phoenix development.

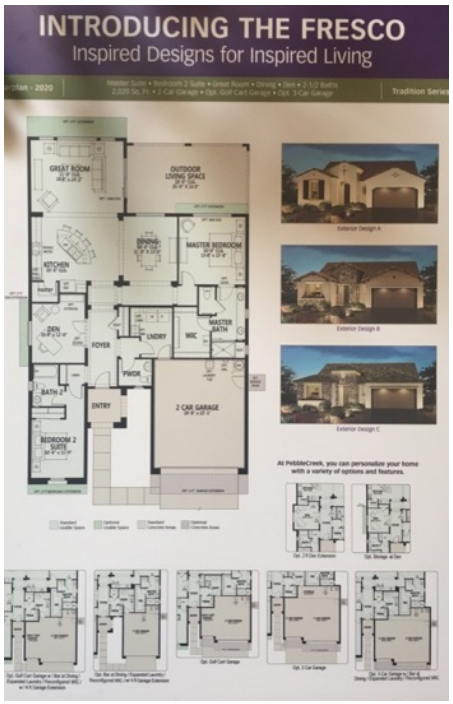


Figure 16: Robson Model Floorplan

Seen through this lens the model homes and learning centers of Meritage, Del Webb, and Robson are a continuation of the suburban home as central to the American vision of individualism and democracy in an idyllic land. Each builder is fundamentally concerned

with the individual family and its role in the social, environmental, and economic fabric of the nation. The single-family homeowner's choices to seek out lives at the periphery of urban landscapes, behind walls and secured gates, are indicative of the larger patterning of securitized suburban spaces. It seems fitting, then, that some of the largest homebuilding in the valley today is taking place underneath the flight paths of Luke Air Force Base's F-22 and F-35 aircraft.

Taken from this perspective, each builder's choice to incorporate advanced energy technologies as part of the marketing of the home extends upon the celebration of electrification technology in the home that accompanied the emergence of electricity as the primary mode of powering homemaking activities. Following plugs from the refrigerator through walls and the circuit breaker back to the inverter and solar panels, we see how learning centers move the frame of reference concerning energy technologies in the home away from individual artifacts towards systemic and infrastructural networks of electrons and information.

Customers learn to think about homes as an assemblage of various materials, technologies, and individual choices for gathering and arraying information. From the perspective of scholars and activists interested in materializing energy practices these centers do a tremendous job making it clear to customers how material choices link abstract values attached to power bills to the individual choices family members make. Like a science museum of the home, visitors to the learning center feel heat, hear the outdoors through insulated walls, and see air blowing through lower grade insulations. The ideal model home, like a properly designed museum is also a hermetically sealed facility situated in nature, but not *within it*, in the sense the outer world can enter.

Adjacent to these exhibits a variety of third-party provided technologies promise to manage water use, keep track of thermostats, and of course provide energy in 'lieu' of the local utility. Wrapped in stucco and faux wood exteriors the home takes on the characteristics of living in a technologically-driven future without the traumatizing experience of modernist design aesthetics. One can live like the *Jetsons*, but one does not have to exchange the comfort of craftsman or hacienda styles for metal and glass.

Through becoming 'learned' customers, individuals are made aware how specific societal values – progress in the case of Meritage, and Del Webb and comfort and individualism for Robson – are made real through their personal choices for the home. It is impossible to exit a Meritage model home without considering the role innovation plays in the home buying process. The idea of being innovative through energy technologies is so central to the company's business model that the company chose to stencil the phrase "Location. Location. Location. Innovation." (Figure 17) on the door their Sedella – Almiera (higher-end homes) sales office.

Figure 17: Meritage Innovation Slogan

Innovation is both a place and a state of mind for Meritage. Like early and mid-century Euroamerican families seeking to 'flee' urban decay and corruption, Meritage places energy efficient home living as part of a flight from the decadence and disorder of traditional suburban homebuilding, to a place where a well-educated population living through technological advances can escape the failures of humankind.

Del Webb takes this narrative of societal material and environmental suburban decadence to a further extreme – it is incumbent upon those who live in an active adult community create a form of living that creates the least impact on future generations possible. Comfort is necessary, but through comfort retired couples can generate other values – health, wellbeing, and independence. At Sun City Festival, the Del Webb community surveyed in this study, the point was made more clear by the fact residents lived in semi-isolation surrounded on all sides by open desert beyond the edge of the Phoenix metropolitan area. Sun City Festival was by no means marketed as a utopia in the sense of the Shakers or the Oneida community, yet it is an inescapable fact that all aspects of the Del Webb model home experience were couched in terms of comfort and social responsibility to others through the responsible – as opposed to early – use of advanced energy technologies.

Between these two models, Robson's PebbleCreek exhibits a commitment to using specific building materials and energy management technologies to create a community of leisure. Robson community members have 'done their duty' in the sense they have served as productive members of society. Retirement, by contrast, is about enjoying the fruits of labor denied throughout middle life. Managerial tasks, such as utility bills and home maintenance, can be brought under the control of Robson

customers via the use of rooftop solar sources or third party energy use assessors. Golf, yoga, and communing with others – in essence socializing – is the role of retirement, a role energy management technologies facilitates.

The Home that Works Itself

Robson homes, like those of Meritage and to a lesser extent Del Webb, 'do work' in the sense the responsibility for managing home resources is ideally pushed off to the home management system. Turning the idea of *reducing or eliminating* the labor of homemakers on its head, builders who emphasized advanced energy technologies as part of their model home marketing strategies spoke a great deal about designing homes that generate economic value. No builder was more clear about this than Meritage, whose marketing directly links the act of purchasing a Meritage home with beginning a virtuous circle between homeowner financial resources and the home's continued habitation (Meritage Homes 2016):

> We believe every family deserves a home built better. And were passionate about engineering an energy-efficient home, that gets better the longer its lived in because of the life it allows your family to lead. A home that keeps the kids just as cozy in the loft, as they are in the living room. And helps your entire family breathe easier. A home that saves up to 50% on utility bills, so you can host bigger barbeques, have more date nights, and do more living. We won't rest until a home that allows you to live better, smarter, and healthier is the new standard, the new American Dream. So, we'll keep working to innovate brilliantly, design thoughtfully, and execute flawlessly.

Positing the home can in fact improve in quality and productivity over its life cycle contradicts the purposeful creation of suburban landscapes as places of mass consumption and waste moving ever outwards from city centers. At a more localized level, the idea of a home that generates value by producing new found financial resources

by optimizing expenses goes well beyond the conceptualization of the home as site of productivity – the home itself *is* productive.

We must take a moment to consider the implications of this vision of home-homeowner co-existence. Throughout much of the twentieth century, reformers of a variety of backgrounds have sought to emulate industrial production within the home setting whilst promising to reduce the ills of laborious and repetitive labor. These visions of home life and homemaking both rejected the house as a site of family-based production of goods and the total mechanization of private spaces. In the late twentieth century environmentalists and government agencies took this further, creating a suite of programs and campaigns, most notably the decades old Energy Star® program from the United States Environmental Protection Agency, to optimize the responsible use of energy and financial resources. To some extent, the marketing campaigns of Meritage, Del Webb, and Robson build on these narratives of efficient resource use against the social, environmental, and economic ills of materialism.

Yet what each builder proposes, and especially Meritage, is deeply unlike the crass optimization of resources. A home that generates values in and of itself implies that the infrastructures of living are capable of being productive sites within society. When these builders pose a home to the customer, they are posing a way of living where the *spaces* of living have agency as newly found members of the family. 'Smarter' homes thus imply more than the integration of information communication technologies; rather the constitution of home spaces, like factories of the nineteenth and early twentieth century, take on the characteristic of being material appendages of a society seeking ways to create new forms of economic generation within the ecological constraints of the

Anthropocene. We (residents of these suburban spaces) have optimized the efficiency of ourselves as agents in the home to the extent we wish to do so – it is now incumbent upon us to create homes that take on the burdens of generating health, welfare, and comfort.

Read one way this is but a mere continuation of the mechanization of the home into the "digital" age—a new venture into finding ways to squeeze out productivity through machines in the search for leisure. Achieving this through a variety of third party provided technologies that manage on the part of the homeowner thus could be seen as a neoliberalization of the home. As noted by Ong (2006: 3): "Neoliberalism can also be conceptualized as a new relationship between government and knowledge through which governing activities are recast as nonpolitical and non-ideological problems that need technical solutions." The home is certainly a site of governance between spaces that are consider private and public, between consumption and production, and between the self and the other. Meritage, Robson, and Del Webb would in this respect be facilitators of a new corporate managed life driven defined by the continue intercession of various managerial techniques masquerading as ambivalent technical innovations. American customers by extension are exchanging agency through financial mechanisms – most notably the ever larger and larger home mortgages common across the county – for the promise of a life defined by what they *can* do with newly found excess capital rather than what they must design for their own needs. They are niche actors proposing a not-so-new vision of home life that, especially based on Meritage's quick ascendance to the top of major domestic home builders, quickly become the norm of how Americans understand the relationship between self, home, and energy management technologies.

I would posit, however, that this definition is limited in terms of its relationship to how key visions of social life and order such as the single-family home play out against the backdrop of impending environmental change. First, to speak of the retreat of the state in home life implies the question of what is private and what is public has not remained in flux throughout the existence of the United States. We quote de Tocqueville when speaking of the home today as much as then for the sheer purpose that the same questions continue to circulate about defining familial agency and space. Meritage, to continue the example, does not direct our attention as all builders do to the idea of an "American Dream" because it is a convenience of marketing. They are fully committed to the idea that an alternative vision of the home is necessary for family thriving in the twenty-first century. Robson and Del Webb may not be concerned with family in the same sense, but both design for visions of the "good life." Del Webb takes this one step further, seeking to create communities of responsibility where intergenerational questions of environmental justice play out in their design centers.

From the perspective of addressing the design of future ways of living, we cannot escape the power model homes and their associated mass produced neighborhoods have on the American social, material, and political landscape. Andrew Needham reminds us that Phoenix became a city of banking and defense industry interests through the creation of suburban political spaces – the question we must now ask is what other kinds of daily associations can we create through alternative visions of suburban life. These will play out as much in neighborhood board meetings assessing solar installations as they will in the model home and sales offices across the street. Engaging at both points, and in the design committees of master-planned neighborhood developers like Robson and Del

Webb are crucial for determining where energy systems and home design imaginaries fit into the American future.

CHAPTER 6

CONCLUSION: A MODERN BUSYTOWN

In this dissertation, I have sought to explicate the role collective imagination plays in shaping how social and political values become articulated within the context of specific transformations of energy systems. By doing so my intent is to demonstrate the importance of looking at the interstitial spaces between the rules that govern how individuals and communities understand their role(s) in the operation and maintenance of modern technological life and order. Somewhere between the larger cultural milieu through which innovations emerge and the individual policies, daily practices, and material accoutrements of our energized lives exists a constellation of spaces where we exchange ideas about who we are and whose world(s) we live within.

These aspects of the construction of scientific facts and technological artifacts have long been situated within the context of cultural studies of energy science and technology. As a result, scholarship has long regarded these features to be important to understanding how modernity is shaped and expressed in the 'hard stuff' of political power. Yet little attention has been paid within the larger intellectual community concerned with energy innovations as to how societies translate new visions of social life and order into material and political transformations of large sociotechnical systems. Chapter Three tackled this question through answering how post-World War II politicians, businessmen, and bureaucrats saw the role of the United States as a bringer of global order through the reimagining of energy resource management. As those individuals articulated in the 1952 document, *Resources for Freedom,* American *and* global security was a question of seeing disparate energy resource flows long directed by

individual companies, sometimes in the service of particular states, as a comprehensive system.

Through this comprehensive system of energy and resource flows across global space, it was possible to see questions of economic prosperity and strength at home as a question of the American citizenry's collective responsibility to shape their own actions and the actions of others towards maximizing the efficiency of energy resource production and consumption. If the world before World War II was one of multiple powers vying for territory and materials on a planetary scale, then it would seem building a world of collective prosperity would require a heliocentric model of global energy order with the United States as the literal furnace of consumption and economic development. To speak of energy was and is still very much a question of speaking about collectively held value systems, about what things we include and exclude as energy-related, and how we code technologies as innovative or regressive.

Chapter Three set the stage for examining energy systems as questions of political values translated into the re-imagining and operation of large electrification and fuels processes. There was however little attention paid to *how* political values focused at energy system transformations become fixed within the organizational superstructure of how these new systems operate vis-à-vis their predecessors. To address this question, Chapter Four turned away from the transnational scale to focus our attention on a familiar character and setting in the history of energy transitions in the United States: Samuel Insull and the development of Commonwealth Edison in early twentieth century Chicago. Reexamining a territory undertaken by Hughes in *Networks of Power* my analysis turns away from Insull's business practices associated with the physical development of the

power company towards the ways Insull situated Commonwealth Edison as a vision of what energy service providers could and should do for their communities. Advocating for a vision of energy systems regulated by states in service of the 'public interest' Insull situated Commonwealth Edison and its precursors as agents seeking to create balance between various customer classes in the service of providing the maximum financial security for its investors at the lowest cost for its customers. Chicago and later the State of Illinois write large, so Insull argued, was comprised of individual families seeking a morally upright and fiscally responsible partner managed and overseen by a class men who envisioned personal and professional success in terms of stable and reasoned growth. Regulation and the creation of demarcated territories made it possible in Insull's eyes to create a form of natural monopoly that should and could expand to reshape the maximum amount of lives in its territory possible. These individuals would, through electrification in the home and the creation of new forms of work in rural communities, increase their health and wellbeing.

The regulated and territorially demarcated electricity provider was and in many parts of the United States still is the dominant form large sociotechnical system individuals experience electrical energy through, both at home and work. It is a common experience of daily life, one with a shared system of rules for using electricity and norms for how we expect to interface with larger regulated electrification companies. Situated between Nye's vision of Muncie and Hughes understanding of Insull's role in the emergence of electrification my analysis of how Insull sees the role of an electrification company within the larger political and social milieu of Progressive Era Chicago builds on the transnational discussion of energy security in Chapter three to show how through

studying these spaces between cultural narratives and managerial practices we can understand how specific sociotechnical transitions become ensconced in our collective understanding of our energy-consumption focused world.

Few individuals today are not familiar with the monthly electricity bill or the idea of a meter reader – both objects and actions that like Scarry's energized Busytown share a common ancestry with Insull's vision of the electrification of society. Chapter Five followed these understandings and material systems further from the centers of energy systems design and management towards the very spaces Insull imagined electrification shaping: the homes of individual families in suburban and exurban communities. Starting from the perspective of home energy transformations as a key site for the emergence of new energy system understandings and operation in the twenty-first century I shifted away from questions of national policy and systems operation to examine how a critical space, the home, is being shaped through the reimagining where and how energy fits into daily life and order.

Focusing our attention on one key metropolitan landscape of contemporary mass energy consumption – Phoenix, Arizona – and the role of suburban home building in shaping regional energy practices I examined how new home builders in the metropolitan area articulate energy use and management in the context of what the home is and does for a family. Phoenix was built on the creation of spaces for individual energy consumption along an ever-expanding single-family home suburban periphery across the northern Sonoran Desert. By extension the city and its residents have been fundamentally concerned with energy systems operation and maintenance in the home both from the perspective of generating and transmitting enough energy to create comfortable living

spaces but also in terms of how to maximize comfort and wellbeing. As I show certain builders in the 'Valley of the Sun' – Meritage Homes, Del Webb, and Robson Communities – are fundamentally concerned with the situating the new family home within the context of how it manages energy on behalf of the family. Through a variety of marketing techniques and the creation of spaces for learning about energy practices and technologies in the home these builders opened up the walls of daily energy use to show the possibilities alternative home energy system configurations pose for families. The home as a site of financial resource consumption in the name of comfort and health can through the incorporation of new building materials, energy management technologies, and individual energy production via photovoltaic solar become an assemblage of technologies and physical spaces that produce social and economic value for the family. A 'home that produces values' eschews both the role of the family as managers of the home and the home as a site of non-participation in markets as it can actively generate new sources of revenue either through saving existing money or transforming the home into a place of energy production.

A Modern Busytown

Each instantiation of an energy system – be that at the transnational, regional, or local scale – explored in this dissertation is an expression of how individuals engaged in designing energy futures interpret the role of new sociotechnical system configurations in the larger narrative of who Americans are and what makes their forms of living and working ideal and unique. Like Scarry's Busytown these visions of energy systems and daily life begin the process for making alternative technological configurations of daily

life sensible in the eyes of those who invariably experience its material and political effects. Few of us spend much time, if any, considering why utilities invest greatly in their public images, nor do we enter gas stations with questions of American empire and investment in oil producing countries' technological development.

Imagine if we did, though, how would we see our high-energy world? For the residents of the many new home communities studied in Chapter Five across the western Phoenix metropolitan area the bucolic Busytown would be replaced with the master-planned community of Verrado where a multiplicity of builders vies for families to invest in their vision of an energy-efficient home in a re-imagined 'Americana' landscape.

Figure 18: Verrado Community Website (DMB White Tank LLC 2017)

Surrounding this new landscape instead of secondary roads and rail lines would be a series of interlocking interstates prepped to serve an imagined future where indigenous communities' lands are intermingled with retirement communities and an emergent biotechnology industry. Planes fly above, but they are as often commercial jets as they are fighter-interceptor aircraft on a takeoff pattern from Luke Air Force Base to

the east. To the west and throughout the community power is supplied by a variety of sources brought in from across the state – nuclear from Palo Verde Nuclear Generating Station, solar from large plants to the east and south, as well as from the roofs of homes within the community itself; Busytown's coal-fired power plant and associated mine are less than a footnote in this new book, isolated hundreds of miles away situated on another indigenous communities (in this case the Navajo Nation).

I provide this quick summary of a 'modern' Busytown to highlight the challenges that emerge when scholars of technological transitions focus too much attention on the 'rules of the game' of systems, rather than how these link to their larger social and political meanings. None of the elements described above are reflective of how individuals see the implications of the three transition moments examined in this dissertation; yet, it is an inescapable fact that the hybridized sociotechnical systems and landscapes humans inhabit are fundamentally inflected by how individuals, organizations, and communities understand their 'networks of power' in the greater narrative of American social life and order. To this end, one conclusion from this dissertation is that as we begin to shift from studying transitions to actively seeking intercession on their outcomes equal attention should be paid to emergent niche technological artifacts as to how these are situated and propagate existent visions of living, working, and interfacing with other societies. Like in the case of new homes in Chapter Five, our questions should be both about *what* technologies are entering the home as they are about *how* these new configurations of domestic sociotechnical systems become uncanny representation of latent and romanticized visions of American life.

In this respect, the current study of imaginaries and sociotechnical transitions has privileged an analysis of the 'rules of the game,' and in particular those ensconced in explicit acts of policy, in what otherwise should be a study of the patterning of how individuals and communities make sense of their sociotechnical worlds. Energy security in the post-World War II United States can be seen through various acts of global energy systems management ranging from policies such as the Atomic Energy Act of 1954 to the Central Intelligence Agency's involvement in Egypt and Iran. Similarly, Insull's Commonwealth Edison can, and often is, reduced down to the creation of regulatory bodies – public utility commissions – and the Public Utilities Holding Act of 1934. These laws and acts of state-led aggression stem from a series of conversations amongst actors engaged in defining though action what constitutes the appropriate scope of action to achieve goals.

But how do we define the scope under which goals are constrained? It is here that I have posited, and demonstrated through the three case studies included in this project, that imaginaries serve as a technology of focusing larger cultural norms and values in towards defining the acceptable boundaries of interactions between individuals, large sociotechnical systems, and the people who manage them. Since each case study could and does encompass a wide swath of shifting political, social, and cultural values within American society, I focused on one key place of modulation within the larger milieu of how Americans defined what it meant to live in a verdant body politic. As a whole these case studies cut across a number of fields of study and topics of interest to scholars of imagination and social order – the public/private space divide, globalization and postcolonial order, progressive era politics, and energy policy – to name a few.

Imaginaries are in this respect a highly functional and useful analytical frame for examining the complex and intertwined social and technological issues that individuals and societies confront daily; and it is here that the body of work, to date, has failed to seriously entertain the possibility for imaginaries in the study of sociotechnical change. On the front of imaginaries research, studies represent segmented analyses of isolated or at best semi-linked events, where the essence of analysis is to explicate how actors engaged in the exercises of state power define *why* power should be exercised in certain ways over others. Imaginaries, the complex systems of remembering and forgetting social groups use to create a stable understanding of daily life may be tools of power, but this is not an explicit reason to avoid discussing how systems of power are made rational and nonpolitical.

By focusing my analysis on the subjects through which specific sociotechnical transitions are couched as rational and nonpolitical, I have sought to demonstrate categories as significant or insignificant to the larger dynamics of energy systems change – from security and global resources to what it means to make a 'home'—become windows through which we can observe and document the making of what members of a society consider to be the appropriate management of daily life. Few of us, for example, think in a truly deep and rich way daily about what it means for security to carry a strong moral valence linked to efficiency and control of technoscience. But, it is an inescapable fact that as individuals encounter moments of deviation – from blackouts to the recent Cambridge Analytica misuses of personal data – they strongly identify similar traits as those from the *Resources for Freedom* reports in the management their daily lives and identities.

Transitions are shaped and formed by the collective sensibilities that permeate systems and discourses of origin into ever wider groups. To return to another pertinent example from this study, the spaces and scales of regulated electrification did not emerge from federal-level policy actions, nor from niche actors engaged in providing new services, but from the co-productive effects generated as individuals both saw and understood the possibilities for energy in the home and at work in terms of an electrification system. Transitions research, much like the imaginaries work described above, appears to have lost some of these larger historical and cultural dynamics in the process of translating work from historians of technology into a framework for guiding policy action. The choice makes sense, as the focus of these efforts surrounding transitions management are instrumental in intent. By centering attention on particular cultural dynamics surrounding three energy transitions – security, the public interest, and the home – my hope is like the earliest works in the sociology of technology tradition, SCOT chief amongst them, to bring attention to the idea that sociotechnical transitions are anything but about the arrangement of artifacts alone.

Building a system of rural automobile use, like electrifying Chicago, share many similar cultural resources pertaining to the role of mobility and efficiency in early 20th century American life. Both were not mere cases of manipulating existing artifacts and their use, but complex moments where aspects of daily life and the idea of what it meant to be productive and to play changed for multiple groups in society. Centering my analysis of how transitions are shaped by landscape forces around the imaginings of relevant social groups and within demarcated case studies, serves to both ground the idea of a sociotechnical landscape – something that I have noted still is quite abstract in

reference to a given transition – and recognize the power of imagination beyond the individual works of actors. Imagination is not the purview of the inventor in isolation – the very idea of a single person's creative capacities occurring in lieu of a larger social and cultural milieu is antithetical to the idea of a sociology of technology. Transitions research by extension would and as I have demonstrated does benefit from a careful return to the social and cultural contexts of sociotechnical change, but understood as less a product of larger shifting and amorphous forces and more a product of focused efforts to rethink specific kinds of daily experiences in new terms.

One unanswered question pertaining to the role of imagined technological futures and the propagation of dominant forms of social life and order is that, despite the growing body of literature on what imagination and imaginaries do as techniques of social and political change, we understand little about *how* individuals and communities develop shared understandings of the role of transitions in society. If, as proponents of a sociological perspective on the production of scientific knowledge and technology suggest the co-production of knowledge and social order is a social and political activity then where do individuals develop the cognitive schemata that shape the links between science, technology, and society?

At first pass the easy answer is to say that is a highly complex process through which individuals are normalized to a given culture's daily practices, sense of self and other, and constellation of material objects and associated meanings. Certainly this is in keeping with the vast majority of studies of technology and societies, but it says little about, for example, how a particular type of insulation within a home becomes a question of generating social and economic values through energy management. It does little to

answer critical questions like why do individuals engaged in advanced technology fields like those that inhabit Verrado, seek to live in and amongst new energy-efficient and solar powered homes within a homage to classic Americana? Furthermore, as we look forward to how future generations will see the place of energy and energy transitions within the larger American landscape, current studies of energy transitions do little to intercede in the *processes* through which individuals develop a sense of how understanding and utilizing technology is a complex social process.

Initial work aimed at understanding imaginings of ongoing energy transitions identifies that as we seek to look at the gaps between local commitments to change and national trends the scale at which we examine these questions needs to be reconsidered (J. H. Tidwell and Tidwell 2018). To date scholarship examining imaginaries and transitions provides valuable insights into local, national, and transnational conversations pertaining to bioenergy systems, photovoltaics, and the reorganization of global energy markets. What remains is an effective approach for (1) linking these instantiations of transition together and (2) leveraging larger models of the norms and values surrounding energy transitions to create new spaces for discussing what future energy systems should achieve. The first point requires that we think carefully about the organization of research that can address in meaningful ways sociotechnical transitions at a scale commensurate to the systems at hand.

To the extent new spaces can be created for these conversation, an understudied and enacted space exists at the intersection of sociotechnical transitions, imaginaries, and engagements with primary and secondary education. Roth and Lee (2004) proposed during the late 1990s that STS scholarship should consider the role of constructing

scientific literacy within classroom spaces in the process of developing an informed and engaged citizenry. Speaking of what we now otherwise call 'active learning' their framework included the following tenets (Roth and Lee 2004: 264):

> First, scientific literacy is a property of collective situations and characterizes interactions irreducible to characteristics of individuals. Second, science is not a single normative framework for rationality but merely one of many resources that people can draw on in everyday collective decision-making processes. Third, it makes more sense to organize learning environments that allow students to become knowledgeable by participating in and contributing to the life of their own community, which has the potential to lead to lifelong participation and learning.

Since Roth and others involved in the constructivist movement in educational theory posited these ideas a growing body of literature and engagement in formal and informal science education has continued to push the boundaries of how students understand questions of nanotechnology, sustainability, and other critical topics for twenty-first century life. Yet, even within these various studies little attention has been paid to engaging in creating spaces for discussion and understanding of the co-production of technoscientific knowledge and the ordering of communities. The closest attempts at this are certainly the various works binned under the citizen science movement(s) and by no means am I disparaging their important work; however, it is an inescapable fact that within the context of thinking about future generations and their understanding(s) of the world the formal classroom environment is a dominant space for the structuration of learning how to learn and understand modernity and its place in the larger story of the human built world.

Science, Technology, Engineering, and Mathematics classrooms are in particular critical spaces for intervention on two important fronts. First, for many students who will

eventually go on to play various roles in the shaping of new technological artifacts and systems they will pass through these spaces on their way through the formal education process. In these spaces students develop an understanding of what counts as STEM reasoning and what does not, as well as a personal sense of the cultural norms and values associated with being a participant in the creation of scientific knowledge and technologies. Who is or can assimilate to these spaces is a key challenge noted by scholars of race, gender, and STEM education today, and it leads to my second point: STEM classrooms, especially at the secondary education level, are one of the few examples of a true obligatory passage point for individuals and their ability to be considered valid participants in examining the societal dimensions of science and technology. It is no wonder that scholars addressing questions of race and gender equality in STEM fields have consistently pointed to the cultural dimensions surrounding STEM education practices as a critical limiting factor in the inclusion and exclusion of groups from society. These forms of implicit and explicit exclusion have direct impacts on who interprets the history of American society in the context of scientific and technological change, as well as how these cultural dimensions are inflected on the creation of newly configured forms of living and working.

These factors present an interesting challenge for scholars focused on the role imagination plays in technological transitions. On one hand the consequences of imagination on the shaping of technological systems occurs at scales well beyond the individual and their respective community; transitions are transitions explicitly because of the growing levels of impact they have as older systems are subsumed or transformed to adhere to the new paradigm. Yet individuals, not abstract assemblages of humans and

technologies shape the world(s) we inhabit – to take any other perspective on the role of humans in technological transitions absolves both we the scholar and those we study from taking responsibility for the future of communities and the world writ large. To date the body of work on imagination and imaginaries has been decidedly hush on the material implications of their work despite the fact that much of it speaks at least in abstract to the importance of these visions of idealized social life and order in daily life.

So, let us for the moment consider what it would mean to take the study of the stories we tell about scientific and technological progress made real through policies or material objects into these educational sites of meaning-making? Who would we interface with, and to what extent would we incorporate our ideas into the shaping of STEM pedagogy? I cannot speak for the entire field, but from my perspective this intervention would begin with we scholars making a rather unexpected move – we rather than our ideas must move into these spaces and engage in the difficult grassroots work and scholarship of imagining a different type of STEM experience. Students and we alike must join in the experience of being within the communities – intellectual, social, physical – and begin a dialogue and practice of thinking about how learning about STEM topics can simultaneously facilitate the development of students' ability to reflexively contemplate their own worlds in terms of specific concepts. By opening up the black box of learning and challenging students to understand STEM explicitly in terms of the communities they inhabit imaginaries scholarship may both develop a richer understanding of how larger cultural and social norms are inflected on particular technological and scientific endeavors, but also what possibilities await us in the pursuit of more equitable and just future transitions.

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APPENDIX A

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Morals, Materials, and Technoscience: The Energy Security Imaginary in the United States

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Abstract

This article advances recent scholarship on energy security by arguing that the concept is best understood as a sociotechnical imaginary, a collective vision for a "good society" realized through technoscientific-oriented policies. Focusing on the 1952 *Resources for Freedom* report, the authors trace the genealogy of energy security, elucidating how it establishes a morality of efficiency that orients policy action under the guise of security toward the liberalizing of markets in resource states and a robust program of energy research and development in the United States. This evidence challenges the pervasive historical anchoring of the concept in the 1970s and illustrates the importance of the genealogical approach for the emerging literature on energy and sociotechnical imaginaries. Exploring the genealogy of energy

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security also unpacks key social, political, and economic undercurrents that disrupt the seeming universality of the language of energy, leading the authors to question whether energy security discourse is appropriate for guiding policy action during ongoing global energy transitions.

Keywords
politics, power, governance, markets/economies, environmental practices

Introduction

In 1961, Frank M. Porter, head of the American Petroleum Institute, the largest American oil and gas industry group, was testifying before a House committee on the matter of how growing petroleum imports, specifically from the burgeoning fields of the Middle East, were detrimental to American small business. Discussing the ever-growing problem of new reserve discovery, Porter argued, "[It] is an equally inescapable fact that the foundation of our future *energy security* is based upon the success of continuing exploration, a highly speculative venture" (Small Business Problems Created by Petroleum Imports 1961, 143, emphasis added). Porter's 1961 testimony stands as one of the earliest uses of "energy security" in American policy discourse. His use of the term challenges conventional wisdom on energy policy in the United States—in particular that "energy security" as part of American policy lexicon does not appear until the early 1970s (Smernoff 1973). One can see Porter's appeals to continuing technoscientific advancement in energy production methods echoed today in the energy policy discourse of the Obama administration (Office of the Press Secretary 2013):

> America's scientists are a national treasure. Every day, idea by idea, innovation by innovation, they are developing new technology that will help secure our energy future. If we want to keep moving forward, we need scientists to keep inventing and innovating, to keep unlocking new solutions and pushing new breakthroughs. . . . The Energy Security Trust will invest in research that will make future technologies cheaper and better—it will fund the advances that will allow us to run cars and trucks on electricity or homegrown fuels, and on the technology that will enable us to drive from coast-to-coast without a drop of oil.

Focusing on the Paley Commission's *Resources for Freedom* report from 1952, we explore the fundamental values and assumptions underpinning energy security as they appear in the early 1950s. Although largely overlooked

in later analyses (e.g., Mitchell 2011; Vietor 1984), the Paley Commission's ideas were, in the words of Senator George Malone, "[to be] regarded as an authoritative text and guide to United States mineral policy" (US Senate 1954, 2).

Tracing the genealogy of "energy security," and in particular how it organizes the relationship between the state, natural resources, energy technoscience, and markets, leads us to argue that energy security is best understood as what Jasanoff and Kim (2009) call a "sociotechnical imaginary," a form of social understanding embedded in policy action that elucidates how certain forms of technoscience and political order are coproduced (p. 124). As a sociotechnical imaginary, energy security orients policy action by enrolling a well-ordered "moral" resource-efficient society within the overarching paradigm of unfettered economic growth as supplied through the state-aided advancement of energy technoscience. These moral and material issues are understood to be the underpinnings of US national security and the "freedom" of the world. Concern for the environment and the local and regional scales of energy security do not factor into these discourses; debates between various actors instead focus on federal policies supporting research and development and establishing efficient flows of raw materials from states where they are produced (either internal or external to the state) to where they are needed for efficient consumption.

Approaching energy security as a sociotechnical imaginary advances research in the energy policy, resource economics, and geopolitics literatures that seek to establish "definitional clarity" (Chester 2010, 893) in the process of theorizing what constitutes energy security. Focusing at a multitude of societal scales—community/regional, national, and global, these scholars (e.g., Chester 2010; Hughes 2009; Luft and Korin 2009; Sovacool and Mukherjee 2011; Sovacool et al. 2011; Sovacool 2011) argue that a variety of different factors such as cost of energy, physical security of pipelines and sea faring transport, distribution of ecological burdens from energy production, and overall access to energy can or should determine energy security. This article continues the process of clarification, and through examining the historical context of energy security in the United States, establishes the specific sociotechnical linkages that underlie the relationship between "energy" and "security." Furthermore, this article seeks to emphasize the value of sociotechnical imaginaries as a process of challenging the basis for key concepts in policy discourse. Such an emphasis is doubly important for energy research, as the very ontological uncertainty of energy lends itself to discourses that reify the importance of energy consumption to human civilization (e.g., see Basalla 1980; Hornborg 2013).

Our article begins by outlining current research on energy security, highlighting major themes and recent scholarship focusing on the epistemological nature of energy security. We next briefly outline sociotechnical imaginaries to provide a basis for considering energy security as one, emphasizing the importance of an imaginary's genealogy to understanding and thus challenging the histories that pervade energy security discourse (e.g., Yergin 2011). We then proceed to analyze the Paley Commission's report, emphasizing the importance of efficiency, morality, and security throughout the document and the influence of these concepts on energy policy discourse into the 1970s. Finally, we outline the advantages of considering energy security as a sociotechnical imaginary and propose pathways for further research. Viewing energy security as a sociotechnical imaginary with a particular history illuminates key features of the concept that go largely unspoken in current debates. Energy security is, at its core, a strategy for linking research on energy-producing resources (oil, coal, and uranium) and the basic science underlying each of these productive enterprises to the places of (implicitly domestic) resource consumption and, critically, to a "moral" sensibility of resource economics built on liberal economic principles. Such an underlying sensibility of what policy action is necessary presents serious questions in relation to sustainable development in resource-rich communities and the challenges posed by climate change. In concluding, we strongly question the value of continuing to theorize about energy security as though it is a necessary and attainable material aspect of our world.

Conceptualizing Energy Security

In paradoxical and often contradictory ways, since 2001, the boom in energy social science research has created a large body of work that addresses energy security. Most of this work attends to energy security as a static concept, invoking the term to justify certain policy actions or decision-making tools (e.g., Dhaka 2009; Ferguson 2009; Kumar Singh 2013; Margonelli 2009). Others, most notably Daniel Yergin, criticize the use of the concept itself as embedded in nationalistic resource grabs that attend more to "energy independence" than "security" in a liberal economic sense of global interdependence and mutual growth (Mallaby 2006; Noël 2008; Yergin 2007, 2006a, 2006b). A second set of critiques comes from the geopolitics realm of inquiry and examines the role of state exercises of power, namely, military action, in the securing of natural resources (namely, oil). These authors (e.g., Klare 2007; Toft, Duero, and Bieliauskas 2010) analyze the use of military force by the United States to exercise physical security—that is, the

control of pipelines, refineries, and shipping channels—across the globe. While these scholars also treat energy security as a static concept, they focus on questions of power rather than consumptive economies. Finally, a small group of scholars rejects energy security outright as being too "vague" (Lomborg 2011) to initiate meaningful policy action on climate change in a world of increasing energy consumption.

More recently, scholars have begun to examine the question of energy security from an epistemological perspective, collecting both qualitative and quantitative data to compile, criticize, and refine factors that pertain to energy security and its situatedness in society writ large. These critiques (Ciută 2010; Cherp 2012; Cherp and Jewell 2011; Chester 2010; Littlefield 2013; Toke and Vezirgiannidou 2013; Valentine 2011) note the "polysemic" nature of energy security across policy research and analyze the epistemological methods used to determine what is and is not relevant to being "energy secure." In combination, the authors highlight a number of key factors. First, energy security is not a "security" matter in the sense that it is bounded by an academic "domain of meaning and practice" (Ciută 2010, 124) readily differentiated from other geopolitical issues. The only way in which energy security does fit this space is that it is primarily a nation-state situated discourse (Ciută 2010; Littlefield 2013; Toke and Vezirgiannidou 2013), which draws from security discourse embedded in conceptualizations of hegemony through technoscience (Falkner 2005; Jelly-Schapiro 2013; Masco 2010). Second, energy security research currently focuses on examining the concept via quantitative or qualitative methodologies that start from the initial assumption that energy security is something nation-states (or the world) can and should achieve. Finally, Toke and Vezirgiannidou (2013) note that through inductive analysis scholars can observe that action on climate change is incongruous with current energy security discourse.

This final point is important, for it highlights the possibility that "energy security" is in some way embedded in a dialogue that is incongruous with policy discourses that recognize the "climate" as a site for policy action. Other scholars, notably Cox and Béland (2013), argue that through the framing of "sustainability" energy security can serve to build unlikely coalitions (such as between wind supporters and oil tycoon T. Boone Pickens) and enact policy change in support of alternate systems of energy production and consumption, but they fail to clearly define "energy security" nor explain the underlying political–economic consequences of sustainability to energy security discourse. Like Cox and Béland, Toke and Vezirgiannidou's analysis touches on the question of climate discourse and energy security,

but does not meaningfully ask (1) why "energy security" exists as a subject of debate in policy making and (2) where this interest comes from. Reorienting discussions surrounding energy security away from analyses concerned with definitions based on current research and policy discourse toward the examination of how energy technoscience, the state, and society writ large were discursively organized, such as is possible through treating energy security as a sociotechnical imaginary, provides an opportunity to reexamine the landscape of current energy policy discourse.

Energy Security as Sociotechnical Imaginary

As "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific and/or technological projects" (Jasanoff and Kim 2009, 120), sociotechnical imaginaries provide lenses for understanding, valuing, and attempting to bring about a "good society" through particular technoscientific projects. Sociotechnical imaginaries are less explicit, issue-specific, goal directed, politically accountable, and instrumental than policy agendas, as they "reside in the reservoir of norms and discourses, metaphors and cultural meanings out of which actors build their policy preferences" (ibid., 123). Like narratives and discourses, they guide interpretation and frame the boundaries of the thinkable, but sociotechnical imaginaries are more specifically associated with "active exercises of state power" (ibid.), such as through the selection of policy priorities, fund allocation, and infrastructure investment.

Sociotechnical imaginaries induce the active exercise of state power, which means that they are situated within a particular discursive regime that coproduces perceptions of a good society and the forms of knowledge that organize it. Research demonstrates the influence of sociotechnical imaginaries over energy policy, including the concepts of growth and containment in nuclear energy (Jasanoff and Kim 2009, 2013) and localized bioenergy substitutions of non-mineral energy sources for oil imports (Eaton, Gasteyer, and Busch 2014; Levidow and Papaioannou 2013). Other studies use the framework of sociotechnical imaginaries to investigate the linking of national and regional identity with particular energy sources, most prominently in oil and gas (Bouzarovski and Bassin 2011; Ruijven et al. 2014), with attention to the usefulness of the imaginaries concept for translating between local, regional, and national scales (Eaton, Gasteyer, and Busch 2014; Teschner and Paavola 2013). The scale of these political spaces varies from nongovernmental organizations and scientific advisory boards to corporations and entire states (Program on Science, Technology & Society 2014).

The question of scale draws attention to the possibility of multiple and competing sociotechnical imaginaries being simultaneously at play in any one context, as actors can hold "different visions and goals" (Eaton, Gasteyer, and Busch 2014, 2; see also Jasanoff and Kim 2009, 123; Levidow and Papaioannou 2013).

In addition to spatial situatedness, sociotechnical imaginaries invoke a temporal dimension by providing specific, policy intervention–oriented visions of the future. These imaginaries invoke what the world *is* and what the world *should be*, as they are "imbued with implicit understandings of what is good or desirable in the social world writ large" (Jasanoff and Kim 2009, 122; see also Eaton, Gasteyer, and Busch 2014, 4). Although the forward-looking orientation dominates Jasanoff and Kim's (2009) original conception of sociotechnical imaginaries as well as much of the research it inspired, Eaton, Gasteyer, and Busch (2014) point to significance of the past, as "definitions and contestations are related not only to imagined futures but to different interpretations of environmental histories" (p. 3). Varying interpretations of the past shape the visions for the future encoded in imaginaries.

Sociotechnical imaginaries are profoundly *real* in the sense that they underlie the exercises of power and policy making through which actors produce concrete effects in the world (Eaton, Gasteyer, and Busch 2014, 6; Fairclough 2010, 480; Levidow and Papaioannou 2013, 38; Teschner and Paavola 2013; Tsing 2000). As such, they mediate the "understudied regions between imagination and action, between discourse and decision, and between inchoate public opinion and instrumental state policy" (Jasanoff and Kim 2009, 123). Imaginaries are thus performative in the sense that they enact the world they describe, though this enactment is complicated by the messy sociotechnical discourses and systems with which they articulate (Weszkalnys 2011).

This article builds on the emerging sociotechnical imaginaries literature by highlighting the importance of tracing the genealogies (Foucault 1984, 2008) of said imaginaries. With the exception of Jasanoff and Kim's study of nuclear energy imaginaries in the United States and South Korea, few scholars have traced the genealogy of their imaginary within the greater context of the sociotechnical system they seek to analyze. The transactions between the state, knowledge production systems, and everyday lived experience that produce stable discourses around the characteristics of an "energy secure" state are a fundamental part of understanding what types of societies are possible within this paradigm; ignoring them leaves the fundamental assumptions that underlie the ontological consequences of these

imaginaries in political order unchallenged. Levidow's study of biofuels policy in the European Union (EU) during the 1990s provides an example of this. Focusing on the transnational level as opposed to the histories of individual EU-member states obfuscates how state-level biofuels policies, such as the transition from ethanol to petroleum-based vehicle fuels during the twentieth century in France (Carolan 2009) influence how actors decide to link technoscientific projects and political order. While we acknowledge the necessity of such constraints within publication, we argue that in the case of energy security, a concept we have already shown appears over fifty years ago, questioning the "naturalness" of energy security as an organizing principle for policy making is crucial for mapping out how this sensibility of social order maps people, resources, and states. We argue that the 1952 Paley Commission report serves as a valuable site to begin exploring the three elements brought together within energy security discourse—energy-centric technoscience and resources, "security" for the state as a product of resource extraction, and the "moral" underpinnings of a globalized energy market.[1]

Energy Technoscience and Liberalism as "Foundations for Growth and Security"

> The United States, once criticized as the creator of a crassly materialistic order of things, is today throwing its might into the task of keeping alive the spirit of Man . . . In defeating this barbarian violence, *moral values will count most, but an ample materials base must support them*. (The President's Materials Policy Commission 1952d, 1, emphasis added)
>
> Indeed the strongest and most versatile single resource in the fight against scarcities of materials is technology. (The President's Materials Policy Commission 1952a, 132)

In a 1951 letter to CBS Chairman William Paley, President Truman outlined a presidential committee to "make an objective inquiry into all major aspects of the problems of assuring an adequate supply of production materials for our long-range needs" (Truman 1951). Consisting of five volumes and covering questions of both domestic and foreign resources (bounded within the context of the "free world"), the Paley Commission's *Resources for Freedom* report would "put to rest" (Mitchell 2011, 177n10) domestic concerns over material resources. In this section, we overview the context in which the Paley Commission's ("the Commission" hereon) report emerges

to situate our argument for how energy security functions as a sociotechnical imaginary and what particular technologies of governance were imagined as appropriate to make this vision possible. The 1950s represent a pivotal moment in the history of American policy discourse where both "materiality" as the historicized pattern of mounting American natural resource consumption and "materialism" as a "barbarian" (and implicitly Communistic) political–economic philosophy are opposed to the "security" of the state. American overconsumption is viewed as a failure of cultural values—values which require the scientific rationalization of consumptive behaviors to correct. Rational management of consumption, however, does not explicitly provide any space for the role of the "market" as a site of truth-making within society. Furthermore, a purely scientifically managed society is the exact type of "barbarian" political–economic suite of policy actions the Commission directly opposes. In this light, the key question the Commission must contend with is this: how does the state link new forms of sociality around energy resources, the necessity of "natural" activity within liberal economic society markets, and "national security"?

Expanding on Eli Jelly-Schapiro's (2013) genealogy of "security" in Western society, we contend that the process of creating a notion within policy discourse of "energy security" requires discursively constructing a space for market intervention, asserting the role of state-funded "energy technoscience" within this process of marketization, *and* articulating particular notions of what a good American society must behave like as the social fabric which will maintain this arrangement of disparate elements.[2] Energy, as opposed to particular natural resources such as oil, coal, natural gas, and so on, is this site of intervention. Securitizing particular resources, such as oil, was a technique of governance prior to the 1950s; the management of domestic resources, the production of geographies of oil production in relation to the shoring up of military power (Shulman 2003), and imagined military action stemming from the loss of particular resources ("Past, Present and Future of the Oil War" 1927) assume state intervention at the sites of individual resource production and consumption. Intervening on "energy," however, received only cursory attention prior to the Second World War (Energy Resources Committee 1939). The distinction between a particular resource and "energy" as a site of securitization is important—energy does not exist in the material world insofar as one cannot "bottle up" pure energy. It lacks a clear ontological basis (Mitcham and Rolston 2013) and as a consequence one must produce a site for energy to intervene within a sociotechnical system if the concept is to have any practical meaning.[3] To create a site for the intervention of energy, one first needs to create

a sensibility of a particular kind of technoscience devoted to the study and production of energy. Energy technoscience, as a realm of state intervention, draws on the linkages between science, technology, and society established through the Manhattan Project experience and articulated by Vannevar Bush in *Science: The Endless Frontier*. Energy security, by the very emphasis on the "interdependence of moral and material values" (The President's Materials Policy Commission 1952d, 1), establishes certain expectations for what a good society should look like, the explicit role of energy technoscience in such a society, and the importance of well-directed social policies to bring it into existence.

"Lavish" versus "Efficient" Energy Societies

Summarizing the state of materials policy, the Commission notes Americans "think about raw materials last, not first" (The President's Materials Policy Commission 1952a, 2) when considering questions of productivity and economic growth. History, from the Commission's perspective, lends itself to this narrative, with all persons from the first Euro-American settlers to the present day citizenry misinformed that the United States was and is capable of supplying all of its raw material needs. Efficiency and interconnectivity of resource systems were the proposed solutions to this misguided culture of "lavish" waste (ibid., 23):

> As prudent householders our first necessity is to use the remaining resources with the highest efficiency we can achieve, but only as fully as is permitted by the principle of buying materials at the least cost consistent with assuring supplies required by the national security.

Three elements stand out in this statement, each of which we will address in turn: the individual within society (as the atomized "householder"), efficiency as a product of resources and technoscience, and material national security. First, consumption of materials and, as a consequence energy technoscience, is a matter for society as a whole. Morality, as mentioned earlier, is a fundamental part of the fight against the "crassly materialistic order of things"—it is the duty of each individual to overcome the materialisms (consumptive and Communistic) mentioned earlier. Where, however, is this morality rooted? As described by liberal economist Wilhelm Röpke ([1968] 1998, 125), each individual within society must exhibit these morals, lest the market and the state fall prey to materialistic influences:

> Self-discipline, a sense of justice, honesty, fairness, chivalry, moderation, public spirit, respect for human dignity, firm ethical norms—all of these are things which people must possess before they go to market and compete with each other. These are the indispensable supports which preserve both market and competition from degeneration.

Efficiency is, by definition, a form of self-discipline—one that emphasizes the rationalization of material consumptive practices and aims toward a linear relationship between consumption and productivity.[4]

Noting that the rapid growth of productivity in terms of total economic output occurred at over three times the rate of population growth, however, the Commission argues that "the combination of increased energy and improved technology today provides the main promise of further economic growth within the physical limitations of natural resources" (The President's Materials Policy Commission 1952a, 103). Contemporary resources (i.e., fossil fuels) solve immediate needs, but the finite nature of these resources meant that innovation held the keys to "civilization's energy needs" (ibid., 106). This process of innovation has, by and large, occurred outside of the purview of state policy; however, for technology to continue "dwarf[ing] all the previous accomplishments" of the twentieth century (The President's Materials Policy Commission 1952d, 51), especially in relation to the material constraints on energy resources, the state must uptake the morality of energy technoscience innovation through policy action.

To this end, the Commission advocates for a comprehensive energy policy, one that supports "awareness on the part of all those dealing with energy policy of the close relationship of energy to the broader problems of materials, economic growth, and national security" (The President's Materials Policy Commission 1952a, 129). Drawing from Vannevar Bush's emphasis on science as fundamental to "our health, prosperity, and security as a nation" (Bush 1945, 1), the Commission argues that "an intensive program of basic scientific research and technical development be undertaken on techniques and instruments of exploration for minerals" (The President's Materials Policy Commission 1952a, 29) to tame the "headless" (ibid., 144) force of uncoordinated research initiatives across multiple agencies and, to a lesser extent, outside of government. Continuing the theme of linking individual material behaviors, energy technoscience, and state policy to the question of creating a moral and efficient energy technoscience-based economy, the Commission emphasizes the role policy must play in overcoming material deficiencies (ibid., 18):

> Most Americans have been nurtured on the romantic notion that technology will always come to the rescue with a new miracle whenever the need arises . . . But isolated solutions of problems relating to individual materials are no substitute for the broad frontal attack which technology needs to make on the materials problem as a whole.

A moral energy economy, within the context of the United States alone, depends on both overcoming a naive sensibility about the "natural" abundance of resources consumed for energy and enrolling the necessary disparate elements of society via policy action into a visible system of production and consumption. There is, according to the Commission, nothing natural about the United States' material consumption practices—they are a product of a materialistic culture that has so far prospered without consideration of these facts. Energy technoscience and the pursuit of technological innovation, unacknowledged until now, has made this possible. A new economy of energy must depend on both the rational individual consumption of energy producing resources and a necessary (but limited) intervention on the part of the state to support energy technoscientific research. By focusing policy actions on activities related to the development of new knowledge pertaining to the production and consumption of energy, and the physical production of objects of energy technoscience (on a limited scale), the state will facilitate the necessary conditions for new, efficient, "moral," realms of social behavior and market activity.

Energy, Liberalism, and Global Security

A morally efficient, market-based society, however, is not necessarily a secure one. What the Commission has to say explicitly about "national security" pertains to questions of wartime mobilization and reserves capacity. In relation to energy policy, this is the easiest to observe in what the Commission has to say about oil and national security. Following along the lines of "oil security" as conceptualized throughout the early twentieth century (e.g., Sheldon 1948), security pertains directly to questions of supply lines, modes of transportation, and nation-state actors. However, while these issues are ostensibly nationally oriented with an eye toward production during wartime, the Commission notes that "the problem of wartime supply and consumption for which preparation must be made is, therefore, a single comprehensive pattern for the entire free world" (The President's Materials Policy Commission 1952b, 10). National security (or what we can now call security more generally) in this sense is much like the question of

energy efficiency, morally situated and embedded in the rhetoric of the Cold War.

Understanding how the relationship between morality, security, and efficiency works in relation to energy technoscience means stepping back for a moment to take in a larger perspective on the nature of the Cold War as it pertains to economic growth and industry. Sovietologist and economist Peter Wiles (1953, 566), in a piece contemporary to the Commission's report, notes the centrality of economic competition as "the most important thing, for in the end the country that grows most becomes biggest, and every economic advantage belongs to it." It follows that the Commission's analysis should also focus on facilitating the "efficient flow of energy supplies between surplus and deficit areas in order to contribute to general economic growth and to bolster the security of all nations" (The President's Materials Policy Commission 1952a, 122). Emphasizing the centrality of morals and materials to defeating Communism (The President's Materials Policy Commission 1952d, 1), the task of global security as it pertains to materials becomes a question of liberalizing global markets, removing trade barriers, and facilitating an efficient flow of resources from producer to consumer states. This is doubly so for energy materials, where the complexity of global networks for resources, and in particular oil, posed one of the "gravest problems" (The President's Materials Policy Commission 1952b, 10) in terms of wartime security during the Second World War for the United States and its allies in western Europe. Within this network of liberalized trade, the Commission notes, "the United States is in a particularly effective position to lead in the removal of barriers and to stimulate the flow of raw materials" (The President's Materials Policy Commission 1952a, 77).

The case of Venezuela in the report is indicative of the spoke-hub model employed by the Commission in its appreciation of the role of resource producer states. Openly rejecting the desire of producer states to opt for economic diversification, the Commission regards natural (energy) resource production (via American energy technoscientific innovations) as an acceptable modality for development, since "[w]idening the use of modern technology and skills in materials production and processing provides technical training and experience essential to progress in other areas of the economy" (The President's Materials Policy Commission 1952a, 73). In the Commission's assessment, the overarching conclusion that "the security interests of the free world requires expansion of materials output" (ibid., 62) means the primary role of US foreign policy is to improve business opportunities in these states through liberalization of trade policy and the facilitation of capital and technical expertise to develop the economy of the producer state.

Producer states that facilitate the transfer of raw materials to consumers (i.e., the United States) will see the benefits of imported technologies and bolster global security (The President's Materials Policy Commission 1952c, 99, emphasis added):

> By developing her [Venezuela's] rich material resources, mainly with the aid of private investment capital and technical know-how supplied by the United States, Venezuela has achieved in a short span of years an almost unparalleled record of economic and social advancement ... Not only have rising Venezuelan materials exports stimulated world trade, but *the security of all free nations* has been increased by Venezuela's immense and growing capacity to produce oil—an essential for peaceful production and defense.

As such, energy (via oil) production, facilitated by the United States through capital and energy technoscience transfer, increases the overall "security" of the free world by ensuring that the necessary raw materials for peacetime *and* wartime production and defense reach where they are needed in the developed "free" world. This is not simply a question of economics, but of morals, as the "materialistic" threat of Communism demands that both the United States and the rest of the "free world" maintain economic growth and development. Economic growth, via efficient flows of resources and capital, supplemented by American government funded energy technoscience at home and abroad, are the moral and material underpinnings on which global security and "freedom" depend both now and into the future.

After *Resources for Freedom*

The *Resources for Freedom* report functioned as a site of policy discourse in government, academia, and the wider public from its publication in 1952 through the mid-1970s. Resources for the Future (RFF), a think-tank Paley would establish the next year, carried the conversations initiated by the Commission into the Eisenhower Administration (*The Washington Post* 1953), continuing to emphasize the necessity of a system of energy policy making rooted in energy technoscience research, liberalized markets, and a morally "efficient" society (RFF 1954, 251):

> So as we progress, our energy needs increase by leaps and bounds. Everything about our industrial civilization tends to higher and higher consumption of energy. All we can do in the way of conservation is to see that energy is used as efficiently as can be to accomplish the results that we are after.

Although many respected energy scientists and business leaders were present during the inaugural RFF conference in 1953, many of the New Deal era cooperative utilities organizations elected to boycott the proceedings, accusing the organizers of stacking the meeting with anti-public/anti-cooperative private corporations (Graves 1953). This shift away from New Deal politics, in particular centralized planning of infrastructure, suggests one of the essential tensions arising from the Commission's report. With the rise of neoliberal economic theory in the United States and the erosion of planned economies in western Europe over the next twenty years, the extent of the state's role in facilitating what we can now call nascent "energy security" is problematic at best. As an imaginary, the policymaking power of energy security is in the emphasis on adjusting energy consumption through technoscience. Placing the onus on government to facilitate basic research and social policy toward the efficient use of energy today and new technologies tomorrow leaves the government's role in market regulation a matter open to interpretation.

Consequently, while the Commission's report waned in terms of dictating specific energy policies during the late 1950s (Vietor 1984), it did facilitate a space for dialogue concerning the importance of energy technoscience to "contribute to economic progress and national security for the foreseeable future" (United States Congress 1959, 150). Similarly, contemporary coal advocates refer directly to "Energy and National Security" (ibid., 240) writ large (as opposed to particular resources) and the centrality of "energy security" in global economic competition (ibid., 242, emphasis added):

> Now [during this hearing] we're discussing the immediate problem of our energy resources and how they can help America surmount the Soviet challenge. For the basic necessity for *winning* an emonomic [*sic*] race is a greatly expanded output of energy fuels, the very heart of industrial production.

Winning here, much like the Obama Administration's claim of using energy security as a justification to "build a 21st century clean energy economy and *win the future*" (Office of the Press Secretary 2011, emphasis added), puts the emphasis on competition. Porter's 1961 statement concerning energy security mirrors this; energy security is a product of a system of policies that support energy technoscience toward resource production while facilitating a competitive market that supports enterprise (such as through the many small producers Porter represented). Richard Nixon would some ten years later reiterate these points, calling for another study of the United States' energy resources position and policy (Nixon 1971):

> For most of our history, a plentiful supply of energy is something the American people have taken very much for granted. In the past twenty years alone, we have been able to double our consumption of energy without exhausting the supply. But the assumption that sufficient energy will always be readily available has been brought sharply into question within the last year . . .
>
> A sufficient supply of clean energy is essential if we are to sustain healthy economic growth and improve the quality of our national life. I am therefore announcing today a broad range of actions to ensure an adequate supply of clean energy for the years ahead. Private industry, of course, will still play the major role in providing our energy, but government can do a great deal to help in meeting this challenge.

One can observe the same general themes outlined here as were brought up in the Paley Commission report—Americans' consumptive materialism is rooted in a false "history" of plenty. Energy consumption patterns are a product of innovation and economic growth—facilitating a continuation of this pattern of consumption means government must play a part in supporting economic growth by fostering the necessary social policies, especially around energy technoscience research, which will provide the market the tools to continue to meet consumer demand. If morality is missing from Nixon's speech, it is because it has become internalized within the conception of the energy technoscientific research itself—the very rationalization of consumptive behavior through technological means and marketization. The attempted realization of this moral vision through policy making places energy security squarely in the realm of a sociotechnical imaginary.

Conclusion: Implications of Energy Security as a Sociotechnical Imaginary

Based on our analysis of the Paley Commission's report, we argue that the energy security imaginary is, as noted by Maass (1953, 208) "a highly nationalistic drama," whereby energy policy action that facilitates global free markets and energy technoscience performs the doctrine of national security. The energy security imaginary posits economic growth—achieved through the government's facilitation of markets for private industry and sponsorship of research and development—as the primary mode of "security" against Communist, Middle Eastern, and other "non-free world" actors.

Our research fundamentally questions the ontological basis of energy security, as it is conventionally used, by shifting the conversation to attend

to the language and moral visions that underlie policy action. Tracing the genealogy of an imaginary is a crucial but overlooked element in recent scholarship analyzing sociotechnical imaginaries. Genealogies elucidate the complex and conflicting labyrinth by which ways of knowing about the world and human nature become policy action. Although operating at many levels and in a multitude of contexts, sociotechnical imaginaries do not simply drive state exercises of power but produce order in the world. Containment and energy security, both critical imaginaries for understanding the global technoscientific order surrounding energy in the twenty-first century, persist because they are embedded not only in policies but also in how the social body of experts and policy makers enmeshed in these sociotechnical systems construct the world. Thus, analyzing sociotechnical imaginaries should go beyond exposure to consciously recognize the emergence of such ways of knowing and challenge the political order(s) they produce. Genealogical analyses, such as we have provided in the case of energy security, illuminate tenacious formations of state–market–technoscience networks, as Obama's statement on the Energy Security Trust in the introduction makes clear.

Nowhere is this more important than in the case of energy policy discourse, as the ontological "mystery" (Mitcham and Rolston 2013) of energy lends itself to a "moral" economy at the base of neoliberal economic policies. In attending to energy security through the evaluation of various factors relating to the state of being "energy secure," scholars have (whether intending to or not) facilitated the ontological grounding of energy security by ascribing theoretical heft to the concept. Approaching energy security and other energy-related policy terminology (energy justice, energy ethics, sustainable energy, renewable energy, and the like) through an emphasis on the genealogies of these "imaginaries" would emphasize the social, political, and cultural contexts of energy policy discourses. All too often "energy" is taken at face value, as a term that emphasizes the same physical science meanings regardless of context. As such, our emphasis is not on categorization, but disruption of the boundaries between "energy security" policy problems and the larger questions of market construction and state-funded technoscience. Such an approach to the current debates in energy security scholarship challenges efforts to "imagine" consensus on the governance of global environmental problems and problematizes international cooperation on energy resource management.

Tracing the genealogy of energy security also raises implications for grappling with energy security in relation to current questions of social justice. First, if we take two key components of the establishment of climate

and environmental issues within the national consciousness—Rachel Carson's 1962 *Silent Spring* and the 1965 Presidential Science Advisory Committee report on climate change—as markers of the introduction of global environmental issues, we must confront the possibility that "the environment" as an object in energy policy has no bearing on being "energy secure." Despite Nixon's protestations for environment-friendly energy in 1971, the consensus was that energy security is national security through energy market means. Nixon (1973) seems to have had little will to enforce the former point, as after the 1973 Organization of Petroleum Exporting Countries oil embargo it disappears from his "Project Independence" energy policy campaign. Likewise, we can also agree with Toke and Vezirgiannidou's (2013) assessment and say there is little space in the energy security imaginary for sustainability decoupled from liberal economies.

Second, energy security privileges national scales and state-level actors, making it difficult to attend to local dimensions of energy security and regional geographical differences in the energy mix. Contemporaries of *Resources for Freedom* also noted the "Commission's failure to consider problems of materials production and use in their regional setting" (Ackerman 1953, 174). For the Commission, integration of energy and material systems across the country would deal with the problems of energy access. This approach also obscures salient issues pertaining to the equity of community development around and through energy resources and procedural and distributive justice as it applies to knowledge about energy systems.

In our constructive criticism, we hope to facilitate the conversations Valentine (2011) sees as valuable to further articulating energy security. Future research along the path of energy security as a sociotechnical imaginary should take the lead established by Jasanoff and Kim and expand our approach to the nascent energy security conversations in other parts of the world, paying attention to the similarities and differences between American discourse and those in other places that are animated by different visions of a good and "secure" society. Other projects should seek to further explore how these large-scale imaginaries work at the regional/community level, as Eaton, Gasteyer, and Busch (2014) have begun for bioenergy in Michigan. Understanding the interface between sociotechnical imaginaries and lived experience will provide valuable insights into how these imaginaries shape social order.

As a sociotechnical imaginary, energy security has influenced the exercising of vast amounts of state power and capital toward global resource

integration and energy technology development. Furthermore, it is rooted in a particular, Western, sensibility of the moral behaviors of individuals and states—sensibilities that are by no means universal. Stepping back to observe the genealogy of energy security forces us to ask the following question: do we have the right imaginary to "imagine" an energy equitable world?

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Notes

1. In this way, our analysis parallels the work of Mitchell (2011) by focusing on the intersection of national security, "the economy" as a concept in liberal economics, and energy resources. This project goes further, however, in analyzing "energy security" rather than "energy crisis." Although we acknowledge these as intertwined concepts, we argue that understanding the emergence of energy as an object of state intervention as it is coproduced through the techniques of "econom entality" (Mitchell 2014) that are emerging at roughly the same time (1948-1953), requires attending to the object of energy security as used in policy discourse. Energy crisis may create a space for state intervention, but energy security is the imagined form of a suite of policy actions geared toward addressing the linkages between energy and society, both in the present and into the future.
2. We use the term "energy technoscience" here to designate how the Commission constructs a cogent body of research and development focused on the rational and efficient exploitation of natural resources toward the production of energy, in the form of transportation (cars, ships, nonelectric trains), heat, or electricity. Case in point: the structure of the volume *Resources for Freedom* devoted to "energy sources" addresses the energy found in oil, gas, coal, and electricity. Here, resources and technologies alike are subsumed, at least discursively, to the

larger category of "energy" which, as the report notes, is the locus of state intervention.

3. Energy has in many ways always carried a polymorphous set of meanings. As noted by Crosbie Smith (1998) in *The Science of Energy*, early energy technoscience was eminently concerned with the rationalization of all elements of Scottish life. Later political economists of natural resources, such as Stanley Jevons (1866), would acknowledge the "vast store of energy" within various combustible natural resources, but they would continue to focus on particular resources as the site of state and market intervention.
4. These are analogous to "technologies of subjectivity" and "self-government" as opposed to "technologies of subjection" that Aihwa Ong (2006; also see Rolston 2010) discusses in relation to the organization of economies and states in Southeast and East Asia. The comparison between contemporary zones of economic development there and the state of American resource economics at the end of the Second World War is appropriate, given that these forms of managing populations toward the formation of economies are just emerging in the natural resource (soon to be energy) sector.

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