Tensions in the installation of a smart electric grid: parasitic mediations and short circuiting environmental justice

by

Heather Rosenfeld

A thesis submitted in partial fulfillment of

the requirements for the degree of

Master of Science

(Geography)

at the

UNIVERSITY OF WISCONSIN-MADISON

2014

Table of Contents

Acknowledgements

It's funny that only my name goes on the cover of this when so many people made it possible. I am tremendously grateful for all of the support and encouragement I have received.

In particular, I want to express my thanks to Keith Woodward for putting up with my bouncing into your office with questions that seemed of utmost importance then but were probably only marginally related to what became this thesis. Thank you also to Elizabeth Johnson for encouraging me to read Serres' *The Parasite* and for teaching a course that led my cat, formerly known as Sparkle, to begin going by Sparkletron, and that led smart grids to start sounding interesting (the last two are related). Thank you to my other committee members, Greg Downey and Bernie Lesieutre. I should have been in touch with you more along the way. Insecurity and pressures of graduate school discouraged me from doing so, but our initial conversations were extremely helpful. I am not sure where this work will go next, but I look forward to working more with you all in the future should that make sense. Other faculty and staff in geography and science and technology studies were also supportive, particularly Sarah Moore, Bob Kaiser, Eric Schatzberg, and Joan Fujimura, and I am grateful to you as well.

I also want to express my appreciation of close friends and housemates who both helped me think through the material I was dealing with, and, at least as importantly, emotionally supported me and my work. I would probably have been fetal in one of the cages in Memorial Library, scribbling out angsty comics in non-photo blue pencil without your support (and while this sounds terrible in many respects, it is also a statement of privilege). I am especially grateful to Sarah Bennett, Marc Brakken, Kevin Gibbons, Elsa Noterman, E Ornelas, Simon Goldberg, Tia Tanzer, Jess Krug, Carl Sack, Chris Alfeld, Mrill Ingram, Kelly Kennedy, and everyone in the Cartography Lab.

Several groups outside of the geography department were also terrifically helpful. Many of what are now central themes in this thesis emerged in the comics-inspired writing and drawing group organized by Ebony Flowers, who is developing ways to apply Lynda Barry's methods for making comics to academic work. This group should also be credited for any sentence less than four lines long. Thanks also to the Pilsen Environmental Rights and Reform Organization, Aikido of Madison, the Madison Infoshop Collective, and the Teaching Assistants' Association.

Additional thanks go to the UW School of Engineering Professional Development for allowing me to sit in on two week-long intensive classes on smart grids, to the Trewartha Fund and Holtz Center for Science and Technology Studies for financial support that allowed me to conduct and present this research, and to everyone affiliated with, opposed to, or otherwise associated with the Naperville Smart Grid Initiative who agreed to be interviewed.

And finally, thank you to the squirrels.

INTRODUCTION

1. On smart grid technologies

"If Alexander Graham Bell were somehow transported to the 21st century," a United States Department of Energy (2008, 4-5) report reads, "he would not begin to recognize the components of modern telephony" – technological artifacts such as smart phones and cell phone towers. Yet, the report continues: "Thomas Edison, one of the grid's key early architects, would be totally familiar with the grid." Painting a picture that the electric grid is old, outdated, and prone to breaking, the narrative ends on a baleful note: "we – all of us – have taken this marvelous machine for granted for far too long. As a result, our overburdened grid has begun to fail us more frequently and presents us with substantial risks." Such narratives are common in the electrical industry, governmental organizations, and the media. They suggest the rationale that, much like older forms of telephony that have been displaced by smart phones, the 20th century industrial electric grid, or the 'dumb old grid' (Koerth-Baker 2012, 89), must be replaced by a 21st century 'smart grid.' In this way, these narratives become a call to action: to create a smart grid.

Traditional electric grids function by way of unidirectional electricity flows – from producers to consumers. Utility workers estimate how much power to send using weather forecasts and based on historical usage patterns. Smart grids, by contrast, add digital information and communication technologies (ICTs) to an electrical distribution system. Such technologies include but are not limited to smart meters in an advanced metering infrastructure (AMI), automating switches that mitigate outages, and programs for consumer engagement. These enable bidirectional information flows in addition to electricity flows. Smart meters collect data on electricity consumption several times an hour, sending this

information through the advanced metering infrastructure to the utility. Consumers also receive some of this information and are able to learn how much energy was consumed at their residence, broken down by time of day and compared to similar dwellings.

Because smart grids produce these information flows, several programs engage consumers and consumption practices directly. These include different pricing rates to encourage consumers to purchase electricity at times of day when it is less used (time of day pricing) and to consume less electricity on days when consumption is especially high and puts strain on the system (demand response). Time of day pricing relies on consumers taking action or using their own automating devices, such as programmable thermostats, to reduce electricity consumption. With demand reponse, utility workers in a control center would be able to turn off certain appliances in households remotely. Additionally, an AMI facilitates the integration of local renewable energy into the grid.

Not all smart grid programs are for consumer engagement. For example, automating switches make outages more invisible to consumers but more visible to utility workers. They include "distribution automation" (DA) switches that respond to disturbances in circuits. When an outage occurs, they open, sectioning off outages and isolating lines that are down. This is to a limited degree, but it cuts down on the number of consumers who experience an outage more than momentarily. DA switches are also ICTs, and they provide more information to utility workers in control centers, who can more easily map the region of a circuit affected by an outage.

Because of the socio-technical changes smart grids produce and enable, they confound many of the assumptions associated with the politics of electricity technology. Electrical infrastructure has long been an apparatus of environmental injustice, with

polluting generation facilities and lower-quality service[1] disproportionally located in poorer areas with more people of color (see, for example, Carruthers 2007 and Harrison and Popke 2011). By contrast, academic literature describes smart metering technologies in a largely positive light, highlighting their potential environmental benefits (Hess and Coley 2012) and opportunities for public participation (Furlong 2011). However, green technologies have been found to produce environmental injustice, as in the cases of paper recycling facilities (Lake 1996), technologies for household energy efficiency (Allen 2013), wind turbines (Cowell et al 2011), electric vehicles (Iles 2013), and 'clean coal' (Tyree and Greenleaf 2009; see also Agyeman 2008; Ottinger 2011). As digital technologies, smart grids are also contradictory. On the one hand, digital technologies are often seen as a means of exposing environmental injustice, especially through the use of GIS (see Reed and George 2011 for a review that highlights contemporary environmental justice scholarship on GIS; Maantay 2002) and community information systems (Lloyd-Smith 2009). On the other hand, they they can also lead to increasingly stratified social power through digital divides (Crampton 2003), and they generate e-waste, which is generally dealt with in environmental unjust ways (Iles 2004).

Accordingly, smart grids are also difficult to think of in binary terms of 'just' and 'unjust', whether in contrast to the tropes of dumb-grid versus smart grid, industrial age versus information age, authoritarian versus participatory technology, or centralized versus

---

[1] Or no service, as in the case of Highland Park, a city in the Detroit area. In 2011 DTE Energy (formerly Detroit Edison) repossessed and removed two thirds of the city's street lights because the city had accumulated debt to the utility company. The same has happened, albeit to a lesser degree, in other cities in the United States (Davey 2011).

decentralized technology. They have been compared to the internet, but their industrial components are much more difficult to dislodge or erase from the digital information they produce. This information, and the knowledge-based labor they demand, too, is material – something perhaps most apparent when doing interviews in a room of cubicles near the control center, where hard hats hang on pegs next to computer screens and boxes of field devices. Smart grid technologies modify infrastructure, which is, as a founding member of the Society of People Interested in Boring Things remarked, "singularly unexciting as a research object for social scientists" (Star 2002, 1). Unexciting as they are, smart grids are also a highly contested set of technological objects and social changes. They facilitate decentralized energy production and incentivize changes in household labor, but they still rely on many of the same forms of electricity generation and paid work as traditional electric grids. They are new, but engineers are quick to point out that they are also decades old. They are futuristic, the automated dream houses of Ray Bradbury (1951) and Marge Piercy (1991), but they are being installed and used today.

Finally, while installation is widespread, protest is as well. As Figure 1 shows, smart metering technologies (and supporting communications infrastructure) are present in over two thirds of the states in the US, and in seven states over half of the electric meters are smart. Groups protesting smart meters are also present in more than half of the states. They voice messy and sometimes conflicting demands – some protesters are naturalistic mothers of various political affiliations who believe that the communication signals from the meters cause health problems for them and their children. They are working with and sometimes as Tea Party members who believe that not only the meters, but the entire project should not exist because it involves government funding. They are united in their opposition to the

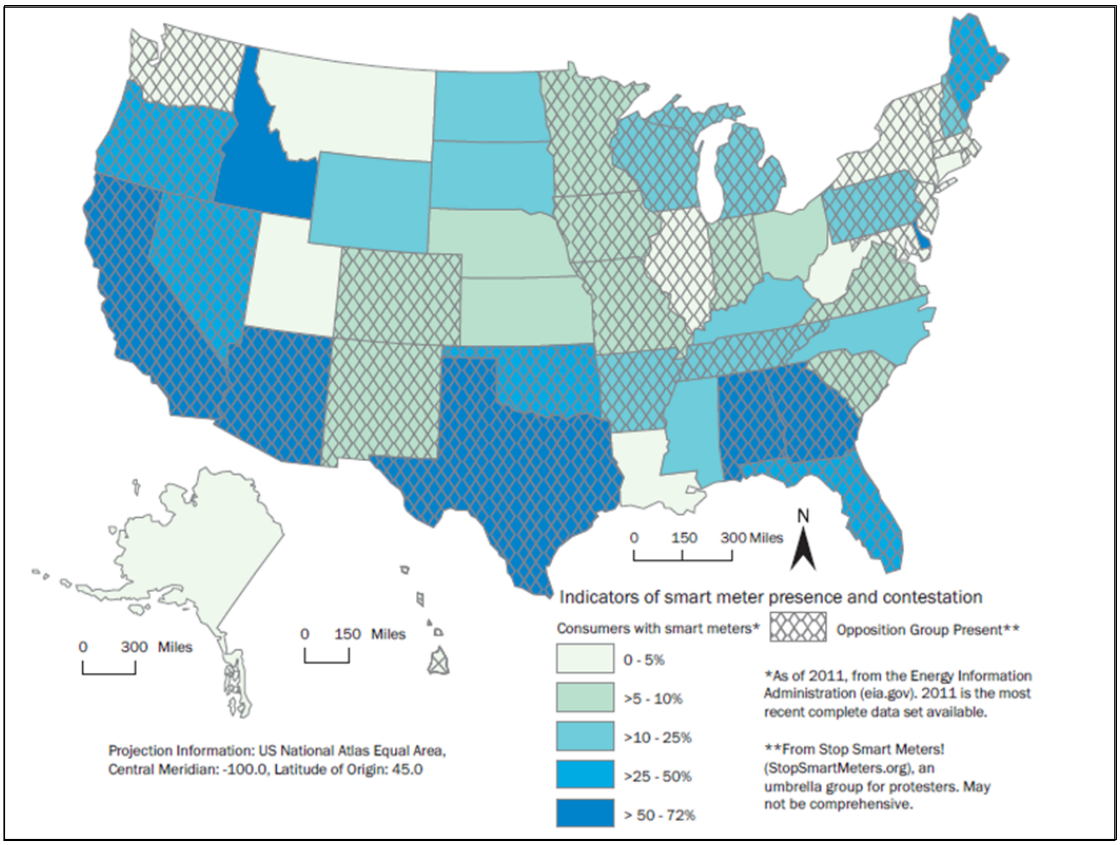

Figure 1: Smart meter installations and protest (map by author).

smart grid. Installations are occurring across several different historical ownership models: municipal, private, and cooperative (Smartgrid.gov 2014, Stop Smart Meters! 2014). Municipally owned utilities comprise a majority – about 60% – of electricity providers in the United States, serving 15% of customers. Six percent of electricity providers are privately owned, serving a majority – 68% – of customers, and beholden to shareholders and customers. Finally, 27% of utilities are cooperatively owned, many of which were established during rural electrification projects of the mid-20th century. These serve 13% of customers (American Public Power Association 2013, 30). Protest, too, takes place in all of these utility

ownership models, although it seems to occur primarily in response to privately-owned and municipally-owned utilities (Stop Smart Meters! 2014; Hess and Coley 2012).

Despite the smart grid/dumb grid binary set up by marketers, the term 'smart grid' remains an ambiguous one. Indeed, it is less an already-existing, coherent entity than a turn away from a past of a traditional electric grid and towards possibilities of an undetermined future. For disagreements about what counts as a smart grid abound among engineers (Brown, Suryanarayanan, and Heydt 2010). Smart grid projects and programs came to prominence with the American Recovery and Reinvestment Act, intended to strengthen national electrical infrastructure against large-scale blackouts and to provide jobs after the 2008 economic recession (Smartgrid.gov 2014, Recovery.gov 2013). Other technologies, though, are much older; sensors that were developed in the late twentieth century are only now being labelled smart grid technologies. Still others, such as programmable thermostats and other household monitoring and energy efficiency devices, can function independently of a smart electricity distribution system but are sometimes considered smart grid technologies (Naperville Smart Grid Initiative 2009). Protesters, too, disagree about what is and what should be considered a smart grid technology (Stop Smart Meters! 2014).

In response to protesters and because of the complex and dynamic sociotechnical context in which smart grids are emerging, some utilities that have plans to install smart grids are changing the technological objects, their configurations, and the programs they use. It is in context of these contingencies and contestations that I turn to my research questions.

2. Research questions and methods

Many geographic questions can be asked of smart grids and the sociotechnical

networks in which they are embedded. This thesis primarily asks two sets of questions: the first chapter examines the limits and contingencies of automation, and the second examines the contradictions of choice, participation, and capacity-building in context of possibilities for environmental justice. Each chapter was written as a stand-alone article. Chapter one is intended for submission to a new interdisciplinary journal, *Big Data and Society*. Chapter two is intended for submission to one of three possible journals: *Science, Technology, and Human Values*, a special issue of *Technology Analysis and Strategic Management* on smart metering technology and society, or a special issue of *Interface* on Theorizing the Web, a conference in late April 2014 at which I have presented some of this material. Both chapters bridge scholarship in human geography and science and technology studies, and are based on a case study of the installation, contestation, and modifications of/to a municipal smart grid project, the Naperville Smart Grid Initiative.

The research for this thesis included over 50 semi-structured interviews, archival research, and participant observation in summer 2012. Research subjects included employees of the municipality involved with the smart grid project, including managers, engineers, Geographic Information Systems specialists, technicians, financial specialists, and a union representative. I also interviewed other municipal employees who were involved with the project – city council members and public relations specialists. Besides official utility and city employees, I interviewed smart grid volunteer advocates, known as 'Ambassadors'. And finally, I interviewed several leaders and members of Naperville Smart Meter Awareness (NSMA), a group that opposed parts of the smart grid project. Archival research included examining documents such as meeting minutes, logo competition records, local and federal reports, and documents created by the NSMA. I also sat in on public meetings associated

with the smart grid, attended open houses such as the one mentioned above, and observed software and equipment demonstrations.

Using this material, Chapter One is about changes in labor practices, inequalities associated with automation, and the challenges of cultivating information-based control. With the increasing presence of information and communication technologies, of which the internet and mobile devices are perhaps the most well-known, scholars have argued that we are in a society increasingly managed by code and information, what Deleuze (1992) terms a "society of control." Describing similar changes to infrastructures, geographer Furlong (2011) introduces the concept of "mediating technologies", information-producing devices that provide diffuse, participatory control.

This chapter argues that such mediations are inherently uneven and limited, using Michel Serres' (1982) understanding of information to understand the changes brought about with such technologies. Serres draws on mid- and late- 20th century developments in information theory (Hayles 1988; Rasch 1992) that equate information not with order or clarity, but rather with disorder, entropy, or equivocation. Information produced by mediating technologies, therefore, is not composed of clear messages but noise, and human labor is necessary to accommodate such noise and enable a working grid. Such an understanding draws attention to the environmental and social labor accompanying mediation. It also transforms the possibilities for control and information-based anticipatory action. Rather than being able to preempt outages before they happen, utility work remains intertwined with technologically-enabled preparedness – in which controllers do "not seek to stop an event from happening or beginning ... but rather to manage the way in which it is responded to as an emergency" (Adey and Anderson 2012, 101; see also Anderson 2010).

Because of this, much of the labor associated with allegedly automating technologies involved responding to outages, monitoring and modifying a system to work in Naperville's environment, and more generally, responding to the 'noise' of multiple messages rather than clear mediations.[2] I argue that this renders the utility an accommodating host to informational parasites.

The questions addressed in the second chapter are inspired by my pre-graduate-school engagement with environmental justice activism in Chicago, Illinois. As part of a community environmental justice group and a citywide coalition, I participated in a decade-long struggle to shut down two grandfathered coal-fired power plants in working class and immigrant neighborhoods, one of which I was a resident. Following over ten years of struggle, we were victorious. At the same time, I was working for the government on environmental remediation, largely of former industrial sites. Alternatives to grandfathered coal power plants thus loomed (and loom) large in my mind, and were a common subject of discussion in the environmental justice group of which I was (and still am, to a lesser degree) a part.

During the power plants' final year of activity, I also was employed by a nonprofit organization that attempted to foster public-private partnerships for technology-based job development. My position focused on smart grid technologies, which were sometimes but not always framed as green technologies. Later, while conducting an interview for my

---

[2] This took place in conjunction with routine maintenance of the distribution system, which was done to prevent major blackouts. Through routine maintenance combined with implementing smart grid technologies, utility work involved intertwined anticipatory logics of preemption and preparedness.

research, without (conscious) prompting, one City Council member described the smart grid project as an matter of producing "eco-justice." He argued that those protesting the project were opposing environmental justice, and referenced the very grandfathered coal power plants I had protested. Smart grids, in his view, were a solution to the seeming necessity of having grandfathered coal plants in neighborhoods such as mine. While juxtaposing smart grids in a rich, white municipality and old coal power plants in a working class neighborhood with a large Mexican immigrant population can clearly be understood as a "false choice" (Lake 1996) the question of whether and how smart grids could cultivate environmental (in)justice drives the second chapter.

A chapter on environmental justice would betray its commitment to recognizing difference if it didn't recognize its author's positionality. Environmental justice scholarship in geography has rightly been critiqued for not placing enough emphasis on race (Pulido 2002). Though this chapter attempts to be mindful of such critiques by calling attention to how smart grids perpetuate erasures of difference, one limitation of the Naperville case study is its focus on a white, wealthy suburb. Moreover, the chapter uses scholarship that developed from environmental justice movements and arose from my experiences as an activist. I raise no critiques of these movements, but rather attempt to learn from them to understand the inequalities and the somewhat smothered possibilities that smart grids perpetuate. Accordingly, this chapter focuses on the utility and community's production of choice and the utility's encouragement of participation and capacity-building, defining characteristics of environmental justice and also of neoliberal governmentality. The kinds of choice, participation, and capacity building of environmental justice are collectivist and devoted to redressing environmental inequalities (Schlosberg 2007), whereas those of neoliberal

governmentality are individualist and market-based (Lemke 2001). I argue that they come increasingly to take a neoliberal form in Naperville, and that this leads to the 'short circuiting' of environmental justice.

Though these chapters were crafted as separate articles, they also have much in common. Both are about digital technologies and politics, but in very different ways. Where the first chapter establishes that any communication involves multiple messages, the second chapter explores how one set of messages came to prominence. As such, they both explore the contradictions of green and/or digital technologies, neoliberalism, and participation. Moreover, writing these chapters raised additional questions concerning smart grids that are largely outside the scope of this thesis. In the conclusion, I raise and develop some of these connections and questions.

Works Cited

U.S. Department of Energy. 2008. *The Smart Grid: An Introduction*. http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/DOE_SG_Book_Single_Pages%281%29.pdf (last accessed 20 April 2014).

Adey, P. and B. Anderson. 2012. Anticipating emergencies: technologies of preparedness and the matter of security. *Security Dialogue* 43(2): 99-117.

Agyeman, J. 2008. Toward a 'just' sustainability? *Continuum: Journal of Media and Cultural Studies* 22(6): 751-756.

Allen, B. 2013. Justice as measure of nongovernmental organization success in postdisaster community assistance. *Science, Technology & Human Values* 38(2): 224-249.

American Public Power Association. 2013. *2013-2014 Annual Directory and Statistical Report*. http://www.publicpower.org/files/PDFs/USElectricUtilityIndustryStatistics.pdf (last accessed 20 April 2014).

Anderson, B. 2010. Preemption, precaution, preparedness: anticipatory action and future geographies. *Progress in Human Geography* 34: 777-798.

Bradbury, R. 1951. "The Veldt." In: *The Illustrated Man*. New York: HarperCollins.

Carruthers, D. 2007. Environmental justice and the politics of energy on the US-Mexico border. *Environmental Politics* 16(3): 394-413.

Cowell, R., G. Bristow, and M. Munday. 2011. Acceptance, acceptability and environmental justice: the role of community benefits in wind energy siting. *Journal of Environmental Planning and Management* 54(4): 539-557

Davey, M. 2011. Darker nights as some cities turn off the lights. *The New York Times*. December 29. http://www.nytimes.com/2011/12/30/us/cities-cost-cuttings-leave-residents-in-the-dark.html?pagewanted=all&_r=0 (last accessed 20 April 2014).

Deleuze, G. 1992. Postscript on the societies of control. *October* 59: 3-7.

Harrison, C. and J. Popke. 2011. 'Because you got to have heat': the networked assemblage of energy poverty in Eastern North Carolina. *Annals of the Association of American Geographers* 101(4): 949-961.

Hess, D. and J. Coley. 2012. Wireless smart meters and public acceptance: the environment, limited choices, and precautionary politics. *Public Understanding of Science* 0(0): 1-15.

Furlong, K. 2011. Small technologies, big change: rethinking infrastructure through STS & geography. *Progress in Human Geography* 35(4): 460-482.

Kinsley, S. 2011. Anticipating ubiquitous computing: logics to forecast technological futures. *Geoforum* 42: 231-240.

Koerth-Baker, M. 2012. *Before the Lights Go Out: Conquering the Energy Crisis Before It Conquers Us*. Hoboken: John Wiley & Sons.

Lake, R. 1996. Volunteers, NIMBYs, and environmental justice: dilemmas of democratic practice. *Antipode* 28(2): 160-174.

Lemke, T. 2001. 'The birth of bio-politics': Michel Foucault's lectures at the Collège de France on neo-liberal governmentality. *Economy and Society* 30(2): 190-207.

Lloyd-Smith, M. 2009. Information, power and environmental justice in Botany: the role of community information systems. *Journal of Environmental Management* 90: 1628-1635.

Maantay, J. 2002. Mapping environmental injustices: pitfalls and potential of geographic information systems in assessing environmental health and equity. *Environmental Health Perspectives* 110(2): 161-171.

Naperville Smart Grid Initiative. 2009. *Smart Grid Investment Grant Application Volume I – NAP Technical and Project Plan.*
http://www.naperville.il.us/emplibrary/Smart_Grid/NSGIgrantapplication.pdf (last accessed 20 April 2014).

Ottinger, G. 2011. Environmentally just technology. *Environmental Justice* 4(1): 81-85.

Piercy, M. 1991. *He, She and It.* New York: Random House.

Pulido, L. 2002. Reflections on a white discipline. *Professional Geographer* 54(1): 42-49.

Reed, M. and C. George. 2011. Where in the world is environmental justice? *Progress in Human Geography* 35(6): 835-842.

Schlosberg, D. 2007. *Defining Environmental Justice: Theories, Movements, and Nature.* Oxford: Oxford University Press.

Serres, M. 1982. *The Parasite*, trans. L. R Schehr. Baltimore: The Johns Hopkins University Press.

Star, S. L. 2002. Infrastructure and ethnographic practice: working on the fringes. *Scandinavian Journal of Information Systems* 14(2):107-122.

Tyree, S. and M. Greenleaf, M. 2009. The environmental injustice of 'clean coal': expanding the national conversation on carbon capture and storage technology to include an analysis of potential environmental justice impacts. *Environmental Justice* 2(4): 167-171.

CHAPTER ONE: Uneven mediations: labor at the interstices of decentralized infrastructure

Preface

> Anticipatory action perplexes us, or at least it should, because it invites us to think about how human geography engages with the taken-for-granted category of 'the future' (Anderson 2010, 777-778).
>
> At twilight objects often start
> to make odd sounds and fall apart.
> (Edward Gorey 1993, 88)

It is a hotter and drier summer than normal in the Chicago suburb of Naperville, but in the control center of the electrical utility there are no windows that say as much. Neither are there leaky doors to the outside through which experiential hints of the out-of-doors might percolate. Instead, there are the computer screens, part of the Naperville electrical system's 'smart grid'. These screens act as different kind of windows; they re-mediate the experience of the outside world, enabling and constraining actions of those in the room. Rather than giving controllers relatively direct sensory experience of their more proximate surroundings, these windows provide visual and quantitative information on the entire suburb. One computer shows the weather report, another has information from sensors about the functionality of the grid, and a mapping program runs on a third. The ceiling is about two stories high, and on one wall is a diagram of the municipality's higher voltage lines. It too is like a screen; nodes light up to signify something amiss or out of the ordinary. To the right above this diagram is a smaller screen that acts in some ways as a daily scoreboard, reporting how many megawatt-hours the city has consumed.

Part of my reason for going to this control center was to study how automation worked – to study the introduction of these mediating screens, sensors, and maps for

anticipating and controlling spaces and human actions. However, I quickly found that what has been referred to as the software-enabled "automatic production of space" was far from automatic (Thrift and French 2002). Rather, in this Midwestern suburb, the installation and use of smart grid technologies was, as Anderson (2010) recognized above, perplexing. The information that the technologies brought was decidedly noisy, prompting tangents in work processes and struggles with local physical and human environments.[3]

On this day, for example, a storm was approaching. Storms are a major cause of outages, and I had hoped to observe how smart grid technologies anticipated and preempted outages or provided information about them. This happened, but it was long before the storm arrived. The phone rang: there was an outage at the country club. The brief call prompted amused banter about the poor folks at the country club in the early morning. It then prompted another phone call, some tinkering with screens, and some scribbling on laminated paper maps with markers. The outage could indeed have been worse, I learn from one of the controllers who learns it from a screen; a distribution automation switch was able to section it off so that fewer people were without power. Even so, people were out of power, and that outage had to be located and repaired. The marked up paper maps get passed along to crews of linemen,[4] who will drive around until they find the outage, which, the controllers tell me, will likely be through finding the corpse of a squirrel. The controllers

---

[3] This question also made my presence as a geographer clear to the engineers I was interviewing. I often introduced myself by saying something like "I'm interested in what will happen with the information these new technologies produce," to which a common response was "so are we."

[4] I use linemen rather than a more gender-neutral term because these field crews were exclusively men, and their position title was technically journeyman-lineman. The latter indicates both their completion of training and the pervasiveness of men in this field.

had worked as linemen for years, and in their experience, from the morning twilight into the early parts of the day, squirrels were a major culprit of outages. By contrast, the evening twilight brought outages and strains on the system mostly due to high consumption rates and summer storms. Smart grid technologies were being implemented to mitigate these outages and strains on the system. While these were partly successful, they also introduced other challenges.

This scene illustrates tensions in infrastructures, their environments, and labor that I examine in this chapter. In the following section, I situate smart grid technologies in contemporary changes to infrastructural networks and information systems, suggesting that smart grids are comprised of mediating technologies (Furlong 2011) that make the grid more participatory and decentralized and that can be said to facilitate anticipatory action (Anderson 2010) and control (Deleuze 1992). However, these understandings of mediating technologies, anticipation, and control neglects the human labor associated with automation. Rather, following Michel Serres' (1982) understanding of noise as parasitic, I find that mediation is far from clear and inherently uneven (Section Three). Such an understanding enables a more nuanced exploration of the human labor necessary for developing and implementing smart grid technologies and programs, including automating switches, advanced metering infrastructure, and programs for consumer engagement (Section Four). The first of these emphasizes the labor associated with automation, the second emphasizes the significance of the 'environment' that systems depend on, and the third explores the contingencies of public engagement. I argue that, because of the noise accompanying mediating technologies, the utility is rendered less *in control* and instead an *accommodating host* to noisy information (or "informational parasites"). Because of this, anticipatory logics of

preemption (Anderson 2010) and practices of control (Deleuze 1992) become intertwined with and sometimes subsumed by an also anticipatory but parasitic logic of preparedness.

Section Two: Growing and re-mediating a smart electric grid

According to the US government's Office of Electricity Delivery and Energy Reliability, smart grid technologies have the following characteristics:

1. Enabling active participation by consumers in demand response
2. Accommodating all generation and storage options
3. Enabling new products, services, and markets
4. Providing power quality for 21st century needs
5. Operating resiliently against physical and cyber attack
6. Optimizing assets and operating efficiently
7. Self-healing from power disturbance events

(U.S. Department of Energy, n.d.)

This description's emphases on participation, an increasingly distributed network, and automation situates smart grid technologies in contemporary changes to infrastructures. As the first two points illustrate, they are now more participatory and decentralized and less authoritarian and centralized (Hughes 1998, 14; Galloway 2006). They are splintered and customized, rather than cohesive (Graham and Marvin 2001), as the third and fourth points show. And where they formerly tended towards stability (Hughes 1987), they now admit perpetual metastability (Rochlin 2001; Furlong 2011), as implied by the fifth through seventh points.

In light of these characteristics, many smart grid technologies can be understood as "mediating technologies" (Furlong 2011). Furlong defines "mediating technologies" as devices that render infrastructures "more transparent and responsive to interactions with a variety of actors … intended to dampen the environmental, economic, and technological

consequences" of infrastructures through making them more visible, dynamic, and participatory (ibid., 461). She gives the example of smart meters and other efficiency devices for water utilities that allow both utility workers and consumers to monitor and repair water leakage. Because smart electric grid technologies, too, are said to provide monitoring capabilities, are more responsive, and enable participation, I consider many of them mediating technologies.

Despite these changes and this participatory turn, power relations are not flattened in smart grids. Rather, given the above definition, smart grids can be understood as part of a transition to what Deleuze (1992) terms a "society of control." As Bogard (2009, 19) summarizes, in such a society:

> [t]here is a shift from mastery over visible space to the integrated management of information, and control operates less through confinement than through the use of tracking systems that follow you, so to speak, out the door and into the open. What matters most in these assemblages is not that your body is visible – that is an already accomplished fact for the most part – but that your information is available and matches a certain pattern or profile.

Rather than enclosing individuals to monitor them, control occurs through information in an open space (see also Mackenzie 2005 on Wi-Fi). Accordingly, "computer code becomes crucial as a way of knowing what large numbers of things are doing" (Mackenzie and Vurdubakis 2011, 11; see also Dodge and Kitchin 2011 on coded infrastructures). In smart grids, digital technologies produce data about electricity circulation and electricity consumption at individual residences.

Such information networks have been said to enable anticipatory action, in which possible futures can be acted on in the present (Anderson 2010), predicting contingencies and preventing situations deemed undesirable, such as border security transgressions and

disease pandemics (Anderson 2010; Amoore 2011; Adey and Anderson 2011; Kinsley 2011; Mackenzie and Vurdubakis 2011). Especially as illustrated by the seventh point above – the capacity to self-heal from disturbances – smart grid technologies enable anticipatory action, intertwining two anticipatory logics: preemption and preparedness (Anderson 2010). Preemption is associated with having knowledge of possible emergent situations and acting in the present to prevent them from happening, to ensure that "not anything might happen" (Mackenzie and Vurdubakis 2011, 15). Preparedness, on the other hand, does not attempt to stop an event from occurring, but rather acts after a future event happens, intervening to stop its effects (ibid., 791). Emergency planning, for example "does not seek to stop an event from happening or beginning... but rather to manage the way in which it is responded to." It thus involves different labor practices than preemption, preparing workers for an emergency rather than planning to avoid one (Adey and Anderson 2012, 101).

However, control in a digital society is more limited than Deleuze and others perhaps imply (this is echoed by Rose 2000; Lazzarato 2006; Adey and Anderson 2012, and others). Rather, it involves training exercises, engaging individuals and communities, and even so, is subject to failure (Wilson 2011; Albreschund and Ryberg 2011; Anderson 2011; Adey and Anderson 2011; Adey and Anderson 2012). Likewise, Edwards et al (2007, 24) recognize that infrastructures are better understood as modular, connected by gateways, and rife with tensions, especially "[i]n their moments of emergence." That is, infrastructures are *grown* rather than built (ibid., 6-7; see also Star 2002). Suggesting both "nurturing" and "luck" and giving a "sense of an organic unfolding within an existing (and changing) environment" (Edwards et al 2009, 369), growing infrastructures entails adjusting to, reshaping, or internalizing factors from both human and physical environments (ibid.).

Returning to the concept of mediating technologies and mindful of the limits of code-based control, I recognize that the information these technologies produce does not necessarily lead to clear or pervasive control or simple anticipatory action. Furlong (2011, 476) gestures toward this by saying that mediating technologies render "the performance of the system as a whole less predictable." However, unlike Furlong, I challenge the notion that mediating technologies bring efficiency, instead arguing that they are accompanied by considerable additional human labor. Following the vocabulary of "growing" infrastructure, I modify the concept of mediating technologies with Michel Serres' (1982) understanding of mediation as noisy and uneven. Accordingly, I argue that smart grids are largely composed of parasitic mediating technologies. Noise in the network limits control and preemptive action, causing it to be intertwined with preparedness, and the utility acts as a host to accommodate noisy information.

Consequently, this chapter contributes to scholarship that 'rematerializes' information to recognize informational work. Hayles (1999, 205) remarks that "incorporated knowledge retains improvisational elements that make it contextual rather than abstract, that keep it tied to the circumstances of its instantiation" (Hayles 1999, 205; see also Star 1999; Suchman 2007; Bowker et al 2010). By rematerializing the informational work associated with smart grid technologies, the figure of the parasite indeed makes possible a more contextual understanding of the interstitial tensions brought about by mediating technologies. Moreover, such technologies should not be considered simply labor saving devices, as they engender considerable human labor. I elaborate upon this in the following section.

Section Three: The noise of mediating technologies: from *in control* to *accommodating host*

Serres (1982) introduces a novel understanding of the "parasite" through explorations of information theory, social interaction, folktales, and social critique. Beyond the organic incarnations such as ticks or worms, Serres also understands information as parasitic. He foregrounds the informational noise endemic to mediated communication, rendering communication inherently messy and uneven (see especially Lezaun 2011, 737-8, Serres 1982, 70). Recently, the concept has been used to explore, for example, exclusions of information and places in the production of heritage landscapes (Puleo 2013), the politics of beekeeping in context the rise of genetically modified crops (Lezaun 2011), and environmental sinks and the instability of systems (Gabrys 2009). These studies and Serres' own work complicate understandings of smart grids as mediating technologies in three ways, emphasizing the unevenness of mediation.[5]

First, *noise is fundamental, not incidental, to communication.* Communication does not simply occur despite "noise on the line"; for Serres, noise *is* the line. Serres draws on Shannon and Weaver's (1948) developments in information theory in the mid- and late- 20th century (Hayles 1988; Rasch 1992) that equate information not with order or clarity, but rather with disorder, entropy, or equivocation. Accordingly, information is not a single message, but "the total field of choices from which the choice of the correct message is to be made" (Rasch 1992, 65; see also Henaff and Feenberg 1997), and noise, in turn, "does not indicate a lack, but a surplus of information" (Crocker 2007, 5). The noisiness of communication inverts claims that code is exact replication or perfect communication

(Galloway 2006) and weakens the concept of a pervasive, self-deforming society of control (Deleuze 1992). Particularly, mediating technologies should be understood as producing noisy information rather than single instructive messages or codes that enable control. Even in seemingly clear mediations, other messages are present, though they might be suppressed.

Second, *communication is inherently uneven, and positionality matters.* Serres identifies three possible positions in communication channels: sender, receiver, and noise (Crocker 2007). The sender is at the source of an information channel, and from their perspective, there is a 'correct' message (Hayles 1988, 3-4). However, a propos of the first point, the sender can only send the message, or signal, *and* noise (Crocker 2007). This can be destructive for a sender intent on transmitting a particular message (Rasch 1992). It can make communication more interesting for the receiver, though, who might find a different message in the "hesitations, the changes in emphasis, the slips of the tongue" of what the sender says (Brown 2013, 87). Positions of sender, receiver, and noise can vary. Serres gives the example of a telephone ringing at a dinner party. To the host and guests of the party, this is noise, distracting from the party-as-message. When the host picks up the phone, the conversation becomes noise to the guest, but involves a series of messages and noise to the host and the person at the other end of the phone conversation, who take turns being sender and receiver (1982, 66).

These two points have ramifications for power in a digitally-mediated society. Noise – the parasite – is well-suited to the distributed network of contemporary infrastructure and the society of control because its power is not centralized but distributed and dynamic, filling an environment (Serres 1982, 95). Indeed, Serres contrasts earlier communication networks with contemporary ones, presciently remarking that "[t]he old Cartesian chains were slow

and hyperbolically deparasited. Today the chains move at the speed of light and the parasites have them in their grasp" (ibid., 97). A world increasingly full of digital mediating technologies, therefore, is a world less full of 'pure' messages than a world increasingly full of informational parasites. Because sender, receiver, and noise can shift positions, power "depends less on authority than it does upon the technical means to come downstream, to be in the last position in a parasitic chain" (Brown 2013, 93). Accordingly, Serres (1982, 11) remarks that the best hosts (senders or receivers) can also be the best parasites, giving the politics of mediation a sinister edge – one that speaks to possible futures of smart grid technologies.

The third point builds on the first two: *noise is interruptive, productive, and transformative.* Noise demands a response from sender and/or receiver, and here I describe several. The most dramatic, perhaps, is that it can destroy the system, causing a connection between sender and receiver to fail entirely (Serres 1982, Henaff and Feenberg 1997). Alternately, sender and receiver can maintain a connection by, on the one hand, adapting to incorporate the noise into a message. This can strengthen the network, rendering it more adaptable (Serres 1982, 168). On the other hand, sender and receiver can collectively work to exclude noise in favor of a singular message: "[t]o hold a dialogue is to suppose a third man [sic] and seek to exclude him [sic]" (Serres 1982, 67; quoted in Hayles 1990; see also Crocker 2007). In the course of both of these responses, what the sender and/or receiver see as the message can change (Brown 2013, 88). Moreover, producing a message from noise must be considered tenuous and laborious.

Understanding mediating technologies as parasitic in a Serresian sense thus makes it necessary to ask: what counts as noise? What counts as a message? What messages might be

suppressed? Where does mediation occur? What is the geography of senders and receivers of information? What work does each do? For Serres and for smart grid technologies, the answers to these questions are not given in advance, but rather are continuously in flux and produced through messy communication. Consequently, examining mediating technologies contrasts with what Star (1999) refers to as 'infrastructural inversion' – foregrounding the invisible, taken for granted dimensions of infrastructure that become the background for daily life (ibid., 380; Bowker et al 2010; Pinch 2010). Mediating technologies render the foreground/background differences between invisible infrastructures and experienced environments less clear. Instead, they demand attention to the interstices, edges, and environments of infrastructural technologies. I turn to these noisy interstices, edges, and environments in the following section. I find that rather than *in control*, the utility acts as an *accommodating host* to noise (informational parasites) produced by their mediating technologies.

Section Four: The noisy mediations of three smart grid programs

In this section, I introduce three interrupted, delayed, and contested smart grid programs. Understanding them as parasitic mediating technologies enables a recognition that they produce noise rather than clear messages. . This noisiness stifles and constrains relations of control and limits information-based anticipatory actions. Such noise is parasitic in its unevenness; by being an accommodating host to mediating technologies, utility workers are faced with additional labor, as code-based preemptive logics are weakened in favor of or intertwined with logics of preparedness.

Distribution automation and outage response

Distribution automation (DA) switches have been one of the most uncontroversial components of the smart grid in Naperville. As one worker in the control center explains:

> One of the uh, fundamental assets that a smart grid is what we call distribution automation … [points at screen] We can remotely control each breaker, open and close these if we had to … say we're gonna do any work over at Pebble – over at this station here, I can remotely from here, close this and open a breaker, without anybody seeing any type of interruption. ("Vince", July 2012)

As Vince describes, DA switches can be opened and closed remotely from the control center when the utility wants to work on part of a circuit, and they also will open and close automatically in response to perturbations. When an outage occurs, for example:

> Evan: A DA system is able to isolate sections of line and bring more customers back...
>
> Vince: And limiting the scope of the outage
>
> Evan: Exactly, that's basically what it does. It minimizes the customers that are gonna be affected. Before automation there were breakers at the station, and we could lose like 400 customers and the crews would have to run the entire line to find a problem. With the DA, it's kind of like they see the fault occurring, going through, and they can isolate sections of the line and restore other sections. And then that helps us in our diagnostics.
>
> Vince: And the restoration. ("Vince" and "Evan", July 2012)

DA switches therefore make outages less visible to electricity consumers, but more visible to electrical workers. In this way, distribution automation comes closest to typifying the relations of a society of control; they mitigate outages through information management at a distance. And this indeed facilitates preemptive anticipatory action, ensuring that "not anything" will happen – outages are sectioned off. As Vince comments, "it saves a tremendous amount of time" (ibid.).

Even so, "not anything" happening is very different from nothing happening; DA switches re-mediate the relations between utility workers and the grid, but do not eliminate their work altogether. This contrasts with the Department of Energy point that smart grids could be self-healing. The controllers continue:

> Evan: It's not self-healing at all. It's... it's... self-diagnostic might be a more correct one...
>
> Vince: Right, to a degree, and we still have to analy-- there's, it sectionalizes, so instead of running this whole circuit, I only got this portion to run. Half of it – either the back half or the front half, is restored and [customers] just sees it momentary. Evan just used a good term: self-diagnostic. So it's giving you a better understanding of where your problem lies. But in terms of self-healing. No. ("Vince" and "Evan", July 2012)

Automation, as the controllers explained, is distinct from preventing outages. Indeed, this conversation illustrates that outages could not be entirely preempted; the technologies do not stop outages from occurring, but stop their effects from propagating. Utility workers thus do not have to respond to as significant of an emergency, but still have to locate and repair outages. This is also reflected in how performance and improvement are measured: through an index called the System Average Interruption Duration Index (SAIDI). The SAIDI reports not the number of outages, but the number of minutes outages are experienced per meter. This indicates that for the utility, improvement is partly premised on consumers experiencing outages for less time, rather than preempting outages altogether.

Automative and preemptive action is therefore at best only a partial description of how the switches work. When outages actually occur – be they from squirrels, storms, or other causes – the DA switches add noisy information to the system, information that, to use Evan's phrase, is better described as self-diagnostic than self-healing. As self-diagnostic, the grid is able to section off outages, sending a signal to controllers that a switch has

opened. With this, the real message utility workers are interested in is the location of the outage, and the signal that there is an outage is only one message among many. The DA switch, combined with circuit diagrams and maps, provides a region in which the outage could be, but don't identify exactly where it is. All of this is information to control center workers. They go from receivers to senders of this information when they pass these maps and hypotheses to linemen. Linemen, the new receivers of information, must drive around until they locate the outage. Their success thus depends less on clearly coded information than knowledge of local roads, especially vulnerable lines, and local causes of outages, which in this Midwestern suburb happen to be squirrels in the morning and storms in the afternoon.

In this reading, utilities attain some control through mediating technologies, when they want to work on the system and open DA switches remotely. However, when outages occur, utility workers use the noise of the mediating technology to change its message and repair the system. The technology saves time but still relies on considerable labor and knowledge. Control room workers and linemen locate outages not through the distribution automation switch, which only sends the noise of an outage in a certain locational vicinity, but through decades of experience, in which preparedness for parasitic information is at least as valuable for the system to work. In this way, the utility is more of an accommodating host than in control.

This workers-as-host evokes a particular politics: that the parasite (noise) should not kill its host, which draws attention to the necessity of valuing the uncoded, unautomatable work and experiential knowledge (Polanyi 1966; Collins 1982; Vaughn 2004) that nonetheless accompanies automating technologies and a society of control. This is

particularly worth calling attention to in context of rhetorics of 'efficiency' accompanying descriptions of mediating technologies (Furlong 2011). The grid becomes more 'efficient' in a certain way through DA switches, making outages more invisible to consumers, but it does not eliminate the bulk of the work of outage repair. Yet, accompanying these technologies were calls by politicians to run the utility efficiently; one remarked that "[w]e run a pretty lean ship here" ("Louis", July 2012). These were sometimes put into effect by utility managers putting off hiring new field workers ("Oliver", July 2012) and routine maintenance. This is both a major component of utility work (Graham and Thrift 2007) and a common source of complaints by field workers in Naperville, who referenced missing equipment (e.g., cables) that would be useful for maintenance that has historically been crucial for preventing major events ("Robert", July 2012).

Advanced metering infrastructure and airy environments

Another smart grid technology is advanced metering infrastructure (AMI). Smart meters on residences send information by radio frequency that eventually goes to utility offices. Because meters are unable to send signals very far, the AMI also includes 'Tropos' helper units. These are installed on public infrastructures such as streetlights and traffic lights. Together, smart meters and Tropos units form a mesh network, in which signals travel between meters and Tropos units until they reach underground fiberoptic wires that go to computers for utility engineers and billing offices. Eventually, AMI will be able to prevent circuits from being overloaded, reducing the number of outages. As one controller explains:

> The other thing with the smart grid is that the data, it's gonna be coming from the meters, it's gonna give you that ability to see if the transformer's getting close to be overloaded. The individual distribution transformers, we don't have that ability right now. We do for the station transformers, we could see if they're being overloaded. If they're overloaded, what helps us also, I can send a crew to like... for instance yesterday, I could send a crew to do this right here because I have too much load on this circuit. We could send a crew here, we could close this switch, they could open another switch and transfer this load over to another circuit. Load transfer sort of helps us with overloads. ("Vince", July 2012)

Accordingly, the AMI makes possible the "integrated management of information" of a control society (Bogard 2009, 19), usable for the anticipatory practice of preempting outages before they occur.

Even so, in the course of installing the AMI, the utility found that the information they were trying to manage was noisy. Far from a "self-deforming cast" from which control could be exerted (Deleuze 1992, 4), the noisy information of the mesh network forced delays, reconfigurations, and additional installations. Several utility employees were tasked with monitoring signals produced by the AMI, ensuring that data from households could reach the utility. For much longer than planned, though, these employees instead struggled with getting these mediating devices configured so that signals – their desired messages – would reach the utility control center and offices. In other words, the desired messages were destroyed by a parasitic environment, which at first made "so much noise that it erases everything it says" (Serres 1982, 236-7). The medium of these signals is air, and the signals were thus subject to attenuation from seasonal change. One technician summarized this challenge:

> All of the ones that were installed last fall communicated better in the course of the wintertime because there were no leaves on the trees. And then when the leaves started filling out again, we started noticing more problems. Because the leaves are in the way, so we were like okay, we need more units then. So it's keeping it moving

> forward until the system works as well as we can get it to work. ("Tabitha", July 2012)

Technicians had begun researching this, noting that foliated deciduous trees tended to attenuate the signal because of transmission frequency and leaf shapes (they referenced Perras and Bouchard 2002). Also, Tropos units had previously been installed primarily in the Southwest United States, where deciduous trees didn't grow ("Drew", August 2012). Adapting to the local Naperville environment thus produced delays, to the degree that by summer, the utility was struggling to get the system working and had installed hundreds more devices than planned.

Moreover, as an engineer noted, these challenges of needing to reconfigure the network to accommodate environmental change were expected to continue. The Midwestern United States faced a drought in the summer of 2012; an engineer remarked "it's a dry year, so the leaves aren't quite where they need to be" (ibid.). In wetter summers engineers anticipated needing to continue to reconfigure the system. Even longer term adjustments were expected because of the history of the suburban landscape. Naperville's winding roads, built when it was an agricultural community, made initial installations difficult because the wireless signals travelled in straight paths. These difficulties were exacerbated because about half of Naperville was built in subdivisions in the 1990s. As a result, many trees in those neighborhoods are still new, and engineers expected them to grow for the next 20 years. The

lifespan of the meters is also 20 years, which means that the engineers could be reconfiguring the system for the entire lifespan of the meters (ibid.).[6]

Far from an invisible medium, the air through which signals passed became the focus of environmental work to incorporate noise. This noise included air, trees, seasonal variation, suburban landscape history, and weather, all of which the hosts – the utility – tries to accommodate. They respond to this noise by attempting to incorporate it and strengthen the system. However, this is far from a one-time action, being rather one related to changes in seasons, climate, and suburban development, on timescales felt by the meters. From this, we can understand that communication, in the budding society of control, therefore, is far from location-independent, and the acts of accommodating noise make it even more location-dependent.

Moreover, though the AMI was purported to be a system associated with preemptive action, the utility again became an accommodating host, with technicians and engineers tasked with monitoring and researching possible future sources of signal attenuation. These actions are better characterized not as preemption but by preparedness, which involves different kinds of work. Recalling Serres' statement that the best hosts might make the best parasites, when utility workers begin having more success, the utility might be able to do more preemptive work. This includes implementing programs that in turn parasite on consumers, encouraging them to do more of the work of electricity management and

---

[6] These timelines are only estimates, and this scenario is thus only one of several possible ones. As another utility worker, "Robert" (July 2012), stated, it was common practice to use meters and other parts for longer than they were guaranteed for. He estimated that the meters might actually last thirty years, which would give the engineers who had the responsibility of monitoring and reconfiguring the network more of a respite.

adjusting their environments remotely. The following section explores further challenges that this possibility created.

"Too much information": Programs for consumer engagement and the noise of protest

Enabled by the AMI, the utility planned to introduce several programs for consumer engagement: time-of-use pricing, demand response, and a home energy monitoring website. Time-of-use pricing entailed a two-tiered billing structure, in which those who sign up for it are billed at a discounted price for electricity during off-peak-use hours and a higher rate for electricity consumed during peak hours. For Naperville, peak hours were estimated to be 4pm-11pm. If the price incentives offered worked, the utility could benefit from reducing peak energy consumption (peak shaving), reducing energy waste, and decreasing strain on the system (NSGI 2009). With demand response, utility workers would be able to remotely turn off particular appliances in consumers' households (air conditioning, electric water heaters, and pool pumps were commonly mentioned) for periods of fifteen minutes at a time on days when the utility predicted especially high use. For consumers to engage with both of these future programs, the utility was developing an ePortal home energy management website that would provide filtered information from the smart meters as well as information about energy consumption at similar residences. Of these programs, demand response illustrates perhaps the clearest control society practice, in which the utility could preemptively adjust consumers' environments remotely to generate certain futures. Both time-of-use pricing and the ePortal, though, share other features of the control society, using information to preempt strain on the system.

However, both advocacy and protest added additional noise rather than creating a clear message about what these mediating technologies would do. A group of volunteer advocates known as smart grid Ambassadors would present at events designed for public engagement and education. They had a variety of backgrounds and divergent interests in the program. Some of them were engineers and could speak to various technical aspects of the system. Some of them had been involved in construction, some in sustainability marketing. Some of them were interested in municipal politics, others in municipal service. One was highly involved with solar energy installations and progressive environmental organizations. When another noted that "[o]ne of the biggest challenges we have is that we have too much information" ("Jessica", July 2012), her description could hardly have been more appropriate: Ambassadors indeed construed the smart grid's noisy information into several different messages. In doing so, they produced noise of the sort that, incorporated into the system, could make it more resilient, because it all supported the system.

A group of protesters, the Naperville Smart Meter Awareness group (NSMA) made these dissonant messages into noise and offered their own set of noise and messages. Their concerns as stated were "health, economics, privacy, choice" (Naperville Smart Meter Awareness n.d.), but they cycled between these, to the extent that their main consistency might be their inconsistency.[7] One Ambassador complained:

> At some point, the goal posts are constantly being moved. At first it was the RF concern, and then [we] addressed the RF concern, and then we did our own RF testing on our own meters deployed in Naperville and find out that it's even less than

[7] This messaging was echoed by other smart grid groups around the country, protesting smart grid technologies in municipally-owned, cooperative, and private utilities (Hess and Coley 2012, Stop Smart Meters! 2014).

> the manufacturers claim, and it's not all the horror stories they're talking about. And then the goal post moves to now it's the data security. And we've got an encryption plan, we got a customer bill of rights, it's the same as doing eCommerce online. And then the problem becomes, the money came from the TARP program. And then the problem becomes, wait a minute, these things are right next to my bedroom, or you didn't ask us, or these are our meters we own them... it just continues down the road, multiple conspiracy angles. ("Peter", July 2012)

The effect, unintended by individual protesters, but the product of different members having different priorities, was persistent delay in installation and modifications to the system. In response to demands from protesters, the utility made the time-of-use billing and demand response opt-in instead of opt-out, thereby attempting to accommodate noise – but in doing so abandoning some of the aspects of the program that were most akin to the control society. Likewise, in response to questions about health, economics, and privacy, the utility conducted additional testing, released reports about the economics of the project, and created a Smart Grid Bill of Rights. The last included a "Right to Privacy" (Naperville Smart Grid Initiative 2011).

In the course of these changes, the protesters produced additional noise and the utility again acted the accommodating host. As one city worker involved with consumer engagement remarked:

> [P]art of my expectation is also not to have expectations, because in a project like this, where you're dealing with federal dollars in a technology that is y'know still I'd say rolling out across the country and the world, to have expectations and to let it get to you, is foolhardy. I mean, nothing would get accomplished. So, y'know, we kinda roll with the punches. We follow our plan as best as we can, but, where we have to adjust we adjust … we adjust on the fly our expectations; we have no expectations." ("Anne", June 2012)

Anne's remark shows that the utility was not at this point attempting to control behavior or engage in preemptive action through mediating technologies, so much as responding to and accommodating noise, which was parasitic by engendering additional labor. This was partly

due to the context: Naperville was a municipally-owned utility, and utility workers often stated that their goals were providing a service to residents, though one that involved certain agreements. Even so, noise was transformative in at least two ways here: it catalyzed the system into a new state as the utility attempted to accommodate the noise of social protest, and protesters and utility communications frequently changed what counted as the message and what counted as noise.

Conclusion: From preemption and control to parasitic preparedness

In these attempts to grow a smart electric grid, the utility is less in *control* and instead an *accomodating host* to uneven mediations. Rather than an automatically controlled, locationally independent society of control, information is disorderly, from which fine threads of order can be very carefully and tenuously woven. Mediating technologies can thus be understood as parasitic technologies, producing not clear but noisy information, and this information can stall a system or force it into a new configuration that incorporates or excludes it. All of this occurred in the fraught installation of smart grid technologies, as utility workers struggled to create a system compatible with its environment, to respond to outages, and to accommodate protester demands.

The figure of the parasite *doesn't add* to the material discussed. It doesn't make new actors or new forces appear – the material is already there. What the figure of the parasite adds is a way to recognize and understand the uneven messiness of interstitial work – the challenges and work of adapting to environments – with digital and automating technologies. The parasite challenges assumptions that such work is simply through the "integrated

management of information" (Bogard 2009, 19), instead revealing that information is not inherently clear and manageable, that relations of control are more ambiguous and chains of communication imperfect. Adding information and communication technologies to an electric grid means adding noise, which is parasitic on an accommodating utility.

Here we might recall Serres' question: "Would the best hosts be the best parasites? This logic is unshakable; it is inscribed in language itself" (Serres 1982, 111). If the utility succeeds in being the last in the chain – if it succeeds at installing an automating and controlling smart grid – it, too, can become a parasite, forming "self-deforming casts" (Deleuze 1992) of home environments around data-producing consumers. Their actions can switch from preparing for outages and conflict with consumers to preempting them. Serres was pessimistic in this respect about information and communication technologies, commenting that "[w]e have put into orbit and will continue to put into orbit communications satellites coupled with data banks, so that our informational motors function without a hitch" (1982, 174). Serres was afraid of these "data banks" destroying newness, creating an increasingly inward-looking humanity whose parasitic environment directed and homogenized them (172). And indeed, smart grid technologies share some commonalities with this, with the information provided by distribution automation switches and the control from a distance enabled by smart meters in an AMI system.

In this study, however, precisely because of noise in these systems, and in some respects, precisely because of the adapting and tenuous control of the accommodating utility, a society of control with clear mediations and the capacity for preemptive action never emerged. Information was material and noisy, and producing control was tenuous, involving considerable social and environmental work. Likewise, preemptive action was supplanted by

or intertwined with preparedness. It might be argued that the accommodating utility can be viewed as an odd exception. Utility workers sometimes speculated that a private company would not be as responsive to protest as Naperville, which was a municipal utility. Municipal utilities, though, are far from unique, comprising 60% of electric utilities and serving 15% of consumers (American Public Power Association 2013, 30). Additionally, the utility had to integrate the system into a dynamic local physical and biological environment, composed of deciduous trees, squirrels, suburban developmental history, and a Midwestern climate. Other utilities attempting to negotiate different physical and biological landscapes would face different noise to incorporate or exclude, and it is difficult to believe that Naperville or others would ever be able to incorporate all of it. Recalling that the utility measures improvement by outage time per meter, not the number of outages, it is difficult to believe that they would even attempt to.

Finally, instead of a coherent society of control posing particular challenges or problems, parasites in the network evoke another question: who gets tasked with responding to and blamed for the consequences of the inevitable parasite? In this way, the parasite gestures towards answering Anderson's (2010, 778) question: "[w]hat political and ethical consequences follow from acting in the present on the basis of the future?" Serres' figure of the parasite calls attention to the noisiness of information in mediating technologies but also to the question of whose work it becomes to respond to this noise. Although the parasite is useful for calling attention to nonhumans and objects, the parasite also in this case offers a politics about valuing workers in context of automation, emphasizing not the efficiency of preemption but recognizing the work and inequalities of preparedness.

Works Cited

Adey, P. and B. Anderson. 2011. Event and anticipation: UK Civil Contingencies and the space-times of decision. *Environment and Planning A* 43: 2878-2899.

——. 2012. Anticipating emergencies: technologies of preparedness and the matter of security. *Security Dialogue* 43(2): 99-117.

Albreschund, A. and T. Ryberg. 2011. Participatory surveillance in the intelligent building. *Design issues*. 27(3): 35-46.

American Public Power Association. 2013. *2013-2014 Annual Directory and Statistical Report*. http://www.publicpower.org/files/PDFs/USElectricUtilityIndustryStatistics.pdf (last accessed 20 April 2014).

Amoore, L. 2011. Data derivatives: on the emergence of a security risk calculus for our times. *Theory, Culture & Society* 28(6): 24-43.

Anderson, B. 2010. Preemption, precaution, preparedness: anticipatory action and future geographies. *Progress in Human Geography* 34: 777-798.

Aradau, C. 2010. Security that matters: critical infrastructure and objects of protection. *Security Dialogue* 41(5): 491-514.

Bogard, W. 2009. Deleuze and Machines: A Politics of Technology? In *Deleuze and New Technology*, ed, M. Poster and D. Savat, 15-31. Cambridge, MA: Edinburgh University Press.

Bowker, G. C., K. Baker, F. Millerand, and D. Ribes. 2010. Toward Information Infrastructure Studies: Ways of Knowing in a Networked Environment. In *International Handbook of Internet Research*, eds. J. Huntsinger, L. Klastrup, and M. Allen, 97-118. New York: Springer.

Braun, B. 2008. Environmental issues: inventive life. *Progress in Human Geography*. 32(5): 667-679.

Brown, S. D. (2013) In praise of the parasite: the dark organizational theory of Michel Serres. *Informática na educação: teoria e prática*, 16(1): 83-100.

Crocker, S. 2007. Noises and exceptions: pure mediality and Serres and Agamben. *Ctheory*. 1-13.

Deleuze, G. 1992. Postscript on the societies of control. *October*. 59: 3-7.

Dodge, M. and R. Kitchin. 2011. *Code/space: software and everyday life*. Cambridge, MA: The MIT Press.

Edwards, P. N., G. C. Bowker, S.J. Jackson, and R. Williams, R. 2009. Introduction: An agenda for infrastructure studies. *Journal of the Association for Information Systems.* 10(5): 364-374.

Edwards, P. N., S. J. Jackson, G. C. Bowker, and C. P. Knobel. 2007. *Understanding Infrastructure: Dynamics, Tensions, and Design*. Ann Arbor: Deep Blue.

Furlong, K. 2011. Small technologies, Big change: rethinking infrastructure through STS & geography. *Progress in Human Geography* 35(4): 460-482.

Gabrys, J. 2009. Sink: the dirt of systems. *Environment and Planning D: Society and Space* 27: 666-681.

Galloway, A. 2006. *Protocol: How Control Exists after Decentralization.* Cambridge, MA: The MIT Press.

Goodings, L. and I. Tucker. 2014. Social media and the co-production of bodies online: Bergson, Serres, and Facebook's Timeline. *Media, Culture and Society* 36(1): 37-51.

Gorey, E. 1993. "Verse Advice" *The New Yorker*, 11 Jan: 86-89.

Graham, S., and S. Marvin. 2001. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. New York: Routledge.

Graham, S. and N. Thrift. 2007. Out of order: Understanding repair and maintenance. *Theory, Culture & Society* 24(3): 1–25.

Hayles, N. K. 1988. Two voices, one channel: equivocation in Michel Serres. *SubStance* 17(3:57): 3-12.

——. 1990. *Chaos Bound: orderly disorder in contemporary literature and science.* Ithaca, NY: Cornell University Press.

——. 1999. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics.* Chicago: The University of Chicago Press.

Henaff, M. and A. Feenberg. 1997. Of stones, angels and humans: Michel Serres and the global city. *SubStance* 26(2: 83): 59-80.

Hess, D. and J. Coley. 2012. Wireless smart meters and public acceptance: the environment, limited choices, and precautionary politics. *Public Understanding of Science* 0(0): 1-15.

Hughes, T. P. 1987. The evolution of large technological systems. In *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, ed. W. E. Bijker, T. P. Hughes, and T. Pinch Trevor, 51-82. Cambridge, MA: The MIT Press.

——. 1998. *Rescuing Prometheus*. New York: Pantheon Books.

Kinsley, S. 2011. Anticipating ubiquitous computing: logics to forecast technological futures. *Geoforum* 42: 231-240.

Larner, W. 2007. Neoliberal governmentalities. In *Neoliberal Environments: False Promises and Unnatural Consequences*, eds. N. Heynen, J. McCarthy, S. Prudham, and P. Robbins, 217-220. New York: Routledge.

Lazzarato, M. 2006. The concepts of life and the living in the societies of control. In *Deleuze and the Social*, eds. M. Fuglsand and B. M. Sorensen, 171-190. Edinburgh: Edinburgh University Press.

Lezaun, J. 2011. Bees, beekepers, and bureaucrats: parasitism and the politics of transgenic life. *Environment and Planning D: Society and Space* 29: 738-756.

Mackenzie, A. 2005. Untangling the unwired: wi-fi and the cultural inversion of infrastructure. *Space and culture* 8(3): 269-285

Mackenzie, A. and T. Vurdubakis. 2011. Code and codings in crisis: signification, performativity and excess. *Theory, Culture & Society* 28: 3-23.

Naperville Smart Grid Initiative. 2011. *Naperville Smart Grid Customer Bill of Rights*. http://www.naperville.il.us/emplibrary/Smart_Grid/NSGI-CBoR-web.pdf (last accessed 20 April 2014).

Naperville Smart Meter Awareness. n.d. *Naperville Smart Meter Awareness: Informing the Naperville community about the risks of smart meters*. http://www.napervillesmartmeterawareness.org/ (last accessed 20 April 2014).

Perras, S. and L. Bouchard. 2002. Fading characteristics of RF signals due to foliage in frequency bands from 2 to 60 GHz. In *Proceedings of the 5th International Symposium on Wireless Personal Multimedia Communications*, 267-270.

Pinch, T. 2010. On making infrastructure visible: putting the non-humans to rights. *Cambridge Journal of Economics* 34: 77-89.

Polanyi, M. 1966. *The Tacit Dimension.* New York: Anchor Books.

Puleo, T. J. 2013. Parasitizing Landscape for UNESCO World Heritage. *Geoforum.* 45: 337-345.

Rasch, W. 1992. Injecting noise into the system: hermeneutics and the necessity of misunderstanding. *SubStance* 21(1): 61-76.

Rochlin, G. 2001. Networks and the Subversion of Choice: An Institutionalist Manifesto. *Journal of Urban Technology* 8(3): 65-96.

Rose, N. 2000. Government and Control. *British Journal of Criminology* 40: 321-339.

Savat, D. 2009. Deleuze's objectile: from discipline to modulation. In *Deleuze and New Technology*, eds. M. Poster, D. Savat, 45-62. Edinburgh: Edinburgh University Press.

Serres, M. 1982. *The Parasite*. Baltimore: The Johns Hopkins University Press.

Star, S. L. 1999. The ethnography of infrastructure. *American Behavioral Scientist* 43(3): 377-391.

Star, S. L. 2002. Infrastructure and ethnographic practice: working on the fringes. *Scandinavian Journal of Information Systems* 14(2):107-122.

Suchman, L. 2007. *Human-Machine Reconfigurations: Plans and Situated Actions*. New York: Cambridge University Press.

Thrift, N. and S. French. 2002. The automatic production of space. *Transactions of the institute of British Geographers* 27(3): 309-335.

U.S. Department of Energy. n.d. *Smart Grid: Aligning Stakeholders.* http://energy.gov/oe/technology-development/smart-grid (last accessed 20 April 2014).

Vaughan, D. 2004. Organizational Rituals of Risk and Error. In *Organizational Encounters with Risk*, ed. B. Hutter and M. Power. New York: Cambridge University Press.

Wilson, M. 2011. 'Training the eye': formation of the geocoding subject. *Social & Cultural Geography* 12(4): 358-376.

CHAPTER TWO: 'Plug into choice'? How neoliberal governmentality short circuits environmental justice in the production of a smart electric grid

Introduction

It was a balmy summer evening in Naperville in the summer of 2012, but the air conditioning inside the sprawling public library made it cool enough to want a sweater. I was in the library's community room, trying to lurk in the background of folks' attention as they buzzed in, out, and through the space. It was maybe the seventh of twelve promotional "smart grid open houses" for the Naperville Smart Grid Initiative. Utility workers had begun hosting these months ago, doing informal presentations and answering questions in different neighborhoods to educate community members about the project, its progress, and how they could participate. Smart meters and other communication devices on tables were supplemented with information fliers and 3-fold poster boards describing smart grid programs, exuding an ambiance somewhat akin to a high school science fair.

Among their ranks were a group of city employees with titles such as manager, engineer, technician, cartographer, communications specialist. In a sense, though, they were all becoming communications specialists. They were accompanied by a group of smart grid 'Ambassadors', members of the public who had volunteered to be, as one paid utility worker appropriately put it, conduits. Ambassadors communicated on behalf of the utility but as community members not employed by the utility. Speaking from different perspectives, they encouraged other community members to, as their slogan read, "plug into choice" and participate in smart grid programs.

Area residents drifted in occasionally. One was clad in the day-glo yellow that marked

the Naperville Smart Meter Awareness group, a coalition of naturalistic mothers and tea party members seeking to stop or modify the project. Almost immediately, a group of Ambassadors descended on her. As a naturalistic mother, she was particularly concerned about how the meters might cause health problems, though she also voiced some of the Tea Party's critiques about meters being an invasion of privacy. She and others had taken turns giving out information on their demands outside of open houses, occasionally going inside and confronting Ambassadors or utility employees directly. She wanted a different choice than that offered by the NSGI: the choice to not have the smart meters altogether in the city, or at least the choice to not have a smart meter on her house.

This conversation between protester and Ambassadors, pivoting in some respects on 'choice', was a common one. However, it was not only about gaining one particular choice, but also involves questions about the meaning of choice, what counts as participation, and the configuration of and technological objects constituting the smart grid. These political-technological debates and conversations are taking place on a national level; both smart meter installations and opposition groups are present in a majority of states. As Figure 1 shows, both installation and protest are widespread. Even though smart meters have replaced more than 50% of electricity meters in some states, the definition of a smart grid and the technologies and programs it includes vary considerably (see for example Brown, Suryanarayanan, and Heydt 2010). Protesters, though they come together in their opposition to the smart grid as is, also disagree on what it should be and whether it should exist altogether. Moreover, because the technologies are still evolving and being protested, some utilities are changing the technological objects or programs associated with smart grids installations.

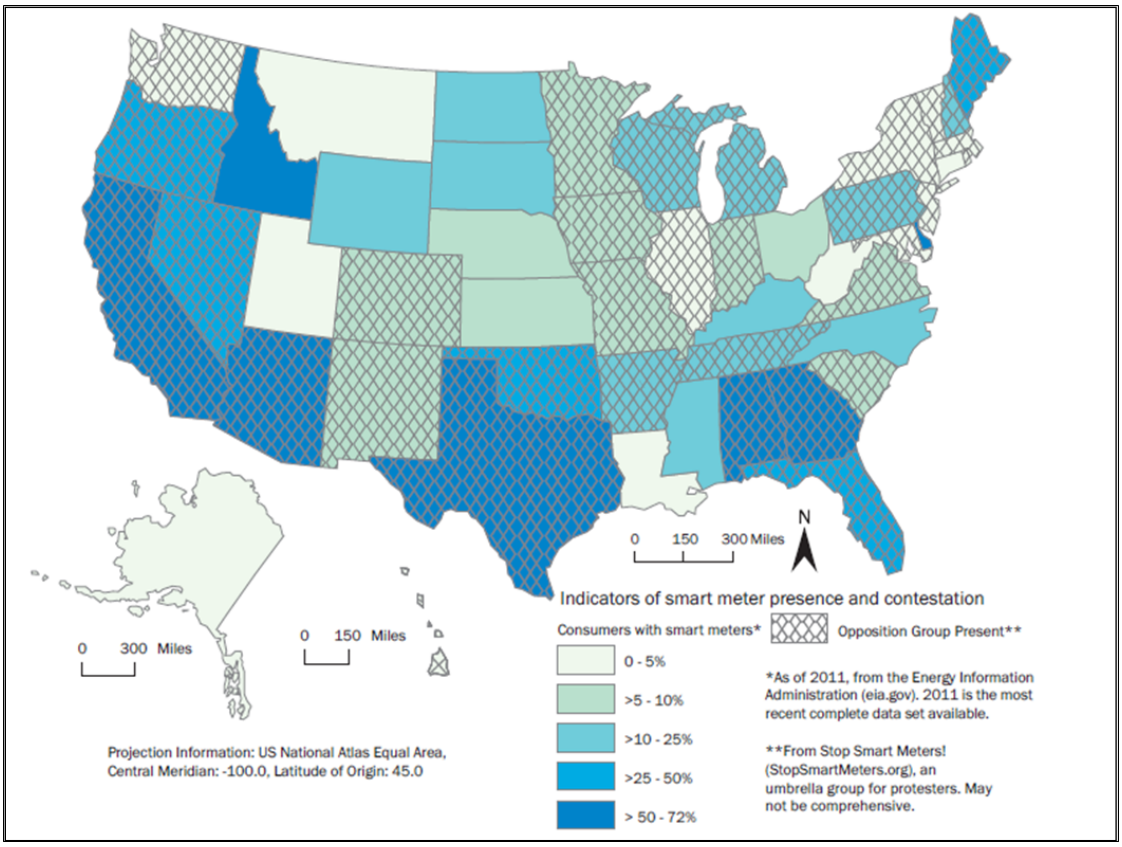

Figure 1: Smart meter installations and protest (map by author).

This chapter examines the complex, contradictory, and dynamic politics associated with the installation, contestation, and modification of one such smart grid project, the Naperville Smart Grid Initiative (NSGI) introduced above. In particular, drawing on scholarship that applies environmental justice principles to understand the politics of green technologies (Lake 1996; Agyeman 2008; Tyree and Greenleaf 2009; Cowell et al 2011; Ottinger 2011; Allen 2013; Iles 2013), and recognizing that "environmentally friendly is not necessarily synonomous with environmentally just" (Ottinger 2011, 83-4), this chapter

inquires into whether and how the NSGI can be understood as environmentally just.[8] For as Edwards (2007, 24) observes, cyberinfrastructures "function as redistribution mechanisms, reorganizing resource flows across scales ranging from the local workplace or research laboratory to the global economy." Smart grid technologies have various redistributive capacities and these are intertwined with facilitating recognition, participation, and capacity building – the four major characteristics of environmental justice.

To use an electrical metaphor, I argue that debates about choice, participation, and capacity-building came to *short circuit* environmental justice in Naperville. Just as short circuiting involves current bypassing much of the circuit and causing an outage, participation and capacity-building on the basis of what became neoliberal, individualistic forms of choice in Naperville excluded many from the network of who gets to choose. Simultaneously, debates about choice delayed and constrained the working of the network and its limited benefits altogether. In the following section, I define environmental justice in more detail, including potential overlap with characteristics of neoliberal governmentality, a contradictory form of governance that broadly entails subsuming social interests to economic ones (Lemke 2001, Peck 2010). Following this, I trace key events in the installation, contestation, and modification of the Naperville Smart Grid Initiative. In these, promoting choice through financially-motivated, individualist participation and capacity-building came to figure as

[8] In this way, this chapter is a departure from en environmental justice as a set of movements. The chapter instead builds on scholarship that uses environmental justice an analytic framework (Carruthers 2007), a "measure of success" for nongovernmental organizations (Allen 2013), a consideration in regulation and policy-making (Holifield 2007), and an inspiration for 'just sustainability', in which questions of "race and class, justice and equity" are key components of promoting environmental sustainability (Agyeman 2008, 751).

central to what the smart grid should do. While this development created openings for cultivating more environmentally just technological infrastructures, it actually led to producing a grid that was more neoliberal and ran counter to the goals of environmental justice. I conclude, therefore, with speculation on how smart grid technologies might be more just.

Implicit in this chapter is neither a technological determinism – in which the implementation of technological objects has definite effects on social relations – nor a social determinism – in which "technology is society made durable" (Latour 1991, 103). Rather, I see technological artifacts and social (human) activities as mutually influencing and co-producing one another, following much scholarship in geography and science and technology studies (see for example Bijker, Hughes, and Pinch 1987). Accordingly, as a case study focused on the particularities of smart grid technologies in Naperville, this analysis is necessarily limited. Even so, it has much in common with sociotechnical transitions around the country. Naperville is a municipal utility and cited this ownership model as a reason for many decisions regarding the smart grid. Moreover, the NSGI was partially funded by the Recovery Act, which funded many other smart grid projects (Smartgrid.gov 2014). Additionally, while protest groups undoubtedly varied, many were in communication and part of national networks (Naperville Smart Meter Awareness n.d., Stop Smart Meters! 2014), and similar concerns have been posed to privately owned utilities (Hess and Coley 2012). Therefore, there is reason to believe that this study has relevance outside of Naperville.

Section Two: Entanglements of participation and capacity-building in environmental justice and neoliberalism

Environmental justice movements emerged in the late twentieth century and early twenty-first century, challenging the disproportionate siting of environmental hazards and lack of green space in poor and working class areas with more people of color, inequalities which can be intentional and structural (Bullard 1996; Pulido 2000; Schlosberg 2007; Boone et al 2009). Drawing on these movements, activists and scholars have developed a concept of environmental justice that includes at least four interrelated characteristics: distribution, recognition, participation, and capacity-building (Taylor 2000; Holifield 2001; Schlosberg 2007). Participation and capacity-building, however, are also characteristics of neoliberalism, albeit in different forms. In this section, I introduce participation and capacity-building put forth by environmental justice scholars, scholar-activists, and activists; emphasize the interrelation of these characteristics with distribution and recognition and collectivist orientation; and then compare these to neoliberal participation and capacity-building.

Participatory justice is characterized by inclusion in the processes of creating environmentally just communities (Schlosberg 2007; Allen 2013). This can range from state, private, or community organizations using inclusive procedures to accept feedback in an otherwise top-down process, to community self-determination (Lake 1996). At the procedural level, Allen (2013, 228) summarizes: "it attempts to link the functions and procedures of institutions and juridical bodies to the just distribution of goods in society. In other words, this reading of justice places the fair and equitable allocation of goods firmly in the hands of the institutional processes of the state." However, participatory justice can also dethrone the state as determinant of a just distribution. According to Lake (1996, 166),

"[s]elf-determination entails an ability not only to select among a set of options but also to determine the options presented for consideration." Participatory justice thus integrates questions of recognition, in terms of who participates and how participation happens, with those of distribution.

Additionally, environmental justice includes cultivating capacities of individuals and communities. Allen (2013, 228-9) describes this facet of justice as "the most speculative, asking us to imagine and engage in practices that enhance human capacity." Even though it is speculative, it emphasizes community functionality, with attention to both individuals and groups. Moreover, capacities justice remains firmly grounded in struggles and consequently, is "not about describing a perfectly just society but instead about making society less unjust … [it is] about what kind of lives people are actually able to lead" (Nussbaum and Sen 2009, quoted in Schlosberg 2007, 33-4). For example, Lloyd-Smith (2009) discusses knowledge development through community information systems, and Allen (2013) explores the challenges of developing community self-sufficiency through green technologies.

While the relative priority of each aspect of environmental justice has been debated, perhaps most important to keep in mind at this point is that they are interrelated and, as Allen (2013, 229) says, synergistic. Participatory justice facilitates an inclusive determination of what counts as a just distribution, and what would be appropriate steps for moving towards one. Justice as capacity-building is intended to encourage community self-sufficiency as well as a more equitable distribution of environmental risks and hazards. Implicit in both of these, therefore, are aspirations towards recognitional and distributive justice.

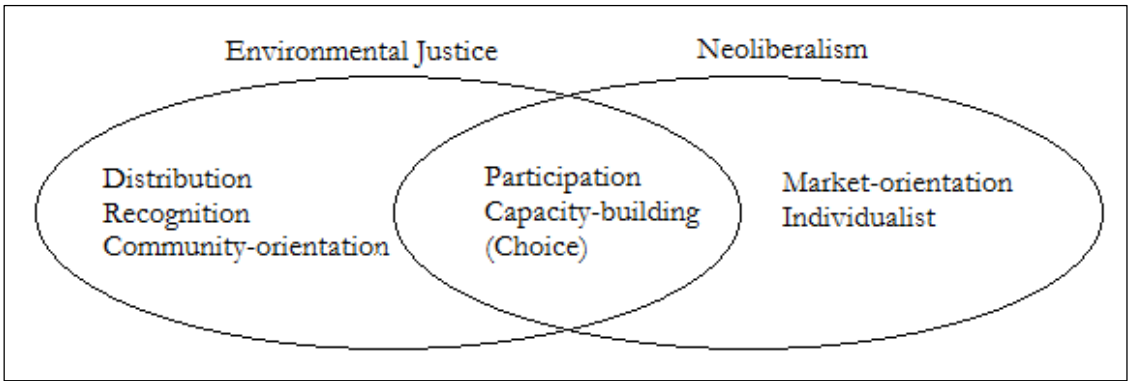

Figure 2: Shared features of environmental justice and neoliberalism.

As Figure 2 shows, neoliberal governmentality, too, seeks to facilitate participation and capacity building. However, this is in context of different priorities and assumptions altogether, as neoliberal governmentality entails:

> shifting the regulatory competence of the state onto 'responsible' and 'rational' individuals. Neo-liberalism encourages individuals to give their lives a specific entrepreneurial form. It responds to stronger 'demand' for individual scope for self-determination and desired autonomy by 'supplying' individuals and collectives with the possibility of actively participating in the solution of specific matters and problems which had hitherto been the domain of state agencies specifically empowered to undertake such tasks. This participation has a 'price-tag': the individuals themselves have to assume responsibility for these activities and the possible failure thereof. (ibid., 202)

Because of this shift from state to individual responsibility and a market emphasis, neoliberal citizens are re-defined as entrepreneurial individuals whose interests are assumed to be economistic. They are not merely encouraged to seek self-actualization and self-fulfillment through making appropriate choices (Rose 1996), but, because of the repositioning of the state, they are obliged to do so (Larner 2000) – thereby necessitating an individualist kind of capacity-building. Neoliberal governmentality also enables participation, as expertise becomes diffused and part of multiple institutions (Thorpe and Gregory 2010). However, in neoliberal form participation "is not conceptualized as an alternative to the market, but

rather as another means for articulating consumer choice", and can therefore co-opt dissent that challenges market-based interactions (ibid., 284). In these ways, the participation and capacity building are both characteristic features of neoliberalism but are also more individualist and more market-based than environmental justice.

For these reasons and others, neoliberalism is often associated with exacerbating environmental *injustice* (see for example Gardner and Greer 1996; Heynen et al 2007). In a study of the incorporation of environmental justice concerns into US environmental policy, Holifield (2007, 203) found that the Clinton administration allowed public participation in policy and decision-making as part of attempts to "*empower* and *build trust* in 'environmental justice communities.'" These efforts, however, sidestepped or ignored such communities' attempts to redistribute environmental risk (ibid., 202-204). More recently, community participation was used to legitimate industrial emissions by a refinery in Louisiana's "Cancer Alley", and individualistic capacity building was inverted to allow industry scientists and engineers to maintain their authority as enterprising individuals who had expert knowledge (Ottinger 2013).

However, the participation and capacity-building encouraged by neoliberalism governmentality can also facilitate political action. As Bondi (2005, 499) observes, "aspects of neoliberal subjectivity hold attractions for political activists because activism depends, at least to some extent, on belief in the existence of forms of subjectivity that enable people to make choices about their lives." Cultivating active and enterprising neoliberal citizens can result in protest, demonstrating that there are "inherent tensions in the neoliberal project, how on one hand citizens are expected to actively engage in promoting their well-being but passively accept market forces that may threaten aspects of it" (Drake 2011, 543). In his

study, citizens encouraged to pursue self-empowerment protested mobile phone masts in rural areas, thus putting Bondi's observation into practice.

This chapter does not argue that smart grids are inherently or even primarily neoliberal. Actual changes associated with smart grids and recent transitions in electric grids more broadly reveal more complex and nuanced politics and socioeconomic practices, as this case study reveals, supported by scholars who argue that neoliberalism should not be considered a deterministic totality of contemporary society (Gibson-Graham 1996; Larner 2007; Peck 2010). However, inasmuch as choice, participation, and capacity-building are part of smart grid projects, they do have neoliberal aspects. In the following section, I investigate the changes in social, technological, and economic relations brought about as smart grid technologies in Naperville are installed, contested, and modified. Recognizing that neoliberal relations are among these, I trace the influence they have and do not have, influence that, as I argue, first enables and then subverts possibilities for smart grids promoting environmental justice.

Section Three: The installation, contestation, and modification of the Naperville Smart Grid Initiative

Site background and beginnings of the installation

In 2009, the City of Naperville received funding from the American Recovery and Reinvestment Act (ARRA) for the Naperville Smart Grid Initiative, or NSGI. With this funding, they planned to install approximately 57,000 smart meters and other digital

technologies and to develop programs for consumer engagement. These technological changes and programs are as follows:

- **Advanced metering infrastructure** (AMI), including **smart meters**, would replace existing analog electric meters. They would measure electricity consumption at individual residences every fifteen minutes, transmitting this to the utility through a 'mesh network' involving meters communicating with one another and with additional units along streets using radio frequency.
- **Time-of-use billing** would provide residents the option of paying a lower price for electricity than a flat rate during non-peak use hours and a higher price for electricity consumed during peak hours (4pm-11pm).
- **Demand response** would allow the utility to remotely turn off particular appliances in households (e.g., air conditioning, water heaters, and pool pumps) for periods of fifteen minutes at a time.
- **Renewable energy** would be more easily integrated into the grid, and customers who produced renewable energy would be paid for contributing it to the grid.
- **Electric vehicle charging stations** would be made available in public areas to encourage electric vehicle purchase and use.
- **Volt/VAR optimization** would allow the utility to monitor voltage changes along distribution wires. This would allow them to send more precise quantities of electricity to consumers, as opposed to overestimating to compensate for uncertainty. (NSGI 2009)

Some of these can indeed be understood as building neoliberal governmentality into the functioning of the grid. Advanced metering infrastructure, time-of-use billing, renewable energy integration, and electric vehicle charging stations transfer responsibility for energy management from the state (in this case, the municipally-owned utility) to citizens, offering financial incentives for those enterprising individuals (Lemke 2001) who engage with these programs. However, this is far from the only message: demand response relies on individuals ceding control to utilities, trusting that this would result in their own benefit. Likewise, Volt/VAR optimization primarily allows utility workers to have more control of the system. All of these changes were associated with expectations of producing a more just distribution of environmental benefits and harms, and decreasing reliance on coal and more local

renewable energy. Environmental benefits include, for example, reducing peak demand (by 6.31%) by 2023 and reducing carbon emissions by 180,000 tons over 15 years (NSGI 2009; Recovery.gov 2013). Though the NSGI doesn't eliminate Naperville's reliance on coal power by far or accept more of its burdens locally, by encouraging local renewable generation, they shift the geography of electricity generation.

At this point, the utility's aspirations and planned programs can be seen to do three things: they encourage a neoliberal, enterprising subject, they enact changes that are not associated with neoliberal governance but with utility control, and they assume that these together would lead to an improved distribution that would be relatively more just. Moreover, these changes included recognizing certain differences. A communications specialist working for the NSGI anticipated digital divide issues – specifically, that some residents would be less interested in using the ePortal, especially without assistance. She was developing plans to address these so that such consumers would be included, and in doing so offering a degree of recognitional justice ("Anne", June 2012). The NSGI's plan thus integrated aspects of recognition, participation, and capacity-building for Naperville residents and the municipality as a whole. Nonetheless, the NSGI did not assume that 'enterprising individuals' were pre-existing and homogenous. Rather, part of the NSGI's project was cultivating participation in and capacity-building through their programs.

Encouraging choice: an Ambassador program and a logo competition

Having conducted two tests of several hundred meters in spring through autumn 2011, the NSGI planned to install them en masse in 2012. In conjunction with installations, the utility attempted to facilitate acceptance and engagement through many public education

events and activities. They cultivated participation and capacity-building through developing a volunteer smart grid Ambassador program, organizing a series of "smart grid open houses", and hosting a logo competition.

The NSGI Ambassador program was comprised of about two dozen members who had responded to the utility's call for volunteers to communicate with the broader public about the NSGI. A majority of them were retired engineers, but the group also included businessmen and businesswomen, artisans, and self-identified environmentalists. As they often commented at the open houses and other public events, each found an area of expertise with which they engaged the public. As a collective, the Ambassadors presented multiple reasons to be actively involved with the NSGI, from the retiree interested in public service, to the businessman advocating financial benefits, to the engineering professor interested in making the parts of the distribution system more broadly responsive to one another, to the renewable energy advocate concerned about climate change.[9] As with the NSGI's initial planned technologies and programs, the Ambassadors' reasons for engagement were also more than neoliberal: they encouraged consumers to be informed and enterprising. This was partly associated with financial incentives, but was also justified with references to the environment and engineering.

---

[9] Also worth noting is the uniqueness of the Ambassador figure. In historical studies of the development of technological systems, charismatic 'system builders' are key drivers (Hughes 1987). Additional important figures have been technical "wizards", a "maestro" who coordinates various aspects of the system, and a "champion" who promotes the system to generate adoption (McKenney et al. 1995 in Edwards et al. 2007). The Ambassadors were none of these precisely, though they shared characteristics with all of them.

Ambassadors were a cornerstone of "smart grid open houses." As described in the opening scene of this chapter, utility workers – including both paid city staff and unpaid Ambassadors – would present on different aspects of the smart grid, highlighting in particular how it would affect consumer experience. Anne, a communications worker for the City described the Ambassadors as "conduits" of the NSGI. As conduits, members acted "as that first line of interaction" between the project and consumers; City staff would support them but remain in the background as much as possible ("Anne", June 2012). Utility workers, too, acted as conduits when they were also residents. As Anne continued, "I think it's the right thing to do personally and as a resident of this city. And I'll tell people this at the open house: yes I'm a city employee, but I'm also a resident" (ibid.). Ambassadors and (paid) utility workers thus took on multiple identities, as community members and utility representatives. In this way, they blurred the boundary between the governing and the governed in a way that encouraged the self-governing, active and enterprising individual necessary for some of the smart grid programs to succeed. They justified this not simply with financial and individualistic benefits but also with rhetorics of citizenship and collectivist responsibility, pointing out distributive benefits for the utility and the energy generation and transmission systems it relied on.

A similar process is apparent in the development of the NSGI logo. After losing their in-house graphic designer, NSGI leaders decided to create a competition to crowdsource the logo. "We thought that not only is it a great way to get our residents involved, which again is a major priority for us, making new people, you know, feel involved and wanting them to be involved," Anne reflected (June 2012). Competition therefore became a strategy for encouraging participation in framing the project (and avoid hiring a

graphic designer). The City posted over 100 entries online, allowed the public to vote for the top ten, and the City Council chose a winner from these. Figure 3 shows some of these entries, whose messages are both more and less neoliberal and more and less about characteristics of environmental justice. Some of these specifically emphasized individual choice and financial benefits, as in the logo at the top right. Others emphasized 'intelligence' in some way, as in the middle-left logo, with the slogan "power with a brain behind it." Many promoted the environmental benefits with the use of trees, as in the middle-right logo. And still others were more whimsical, as in the bottom row of logos, featuring two heads made and connected by cogs and a smiling sun-clock. The winning entry, at the upper left of Figure 3, combined the illustration from one – a green "N" for Naperville with a leaf on the end – and the slogan "plug into choice" from another. Concerning the winning logo, Anne remarked:

Figure 3: Sample logos from logo competition (winner at top left)

> It's a matter of... trying to find kinda that common denominator to communicate to, and I found that choice seems to be something that everybody understands and everybody wants. Everybody wants choice, and the NSGI is giving them a choice in one area of their life. And we've always said from the beginning, you can choose to do nothing; that is just as much a choice as choosing to do everything. (June 2012)

Participation therefore resulted in the NSGI foregrounding 'choice', thus building on the encouragement of participation and capacity-building modelled by the Ambassador program.

Through the ambassador program and the logo competition, the utility sought and appreciated public participation in certain aspects of the project, as volunteer Ambassadors, open-house attendees, logo designers, or citizens voting on the logo. By attempting to inform and engage citizens in smart grid programs, they also sought to build individual and community capacities of individuals. And again, they attempted to reach out to residents in different ways, recognizing that some would become engaged and informed through open houses and in-person discussions, while also developing a website, email list, and sending paper mailings to inform those with different lifestyles. At this point, and through these participatory activities, the NSGI can be understood as encouraging neoliberal citizens to an extent, and in the same sense encouraging environmental justice.

Contesting choice: the Naperville Smart Meter Awareness group

As the NSGI commenced, so emerged an organization determined to challenge it: the Naperville Smart Meter Awareness Group (NSMA, or, to smart grid advocates, SMAG). In conjunction with dozens of other groups around the country [FIGURE 1], they voiced criticisms about privacy, security, property, government spending, and human health. On the basis of privacy and security, they questioned the accessibility of information produced by smart meters to state parties (legally), hackers (illegally), and commercial interests (not

currently legally, but there was apprehension about this changing). Disagreements about property and government spending pertained to the placement of smart meters on residences and Recovery Act funding, respectively. Finally, concerns about human health were premised on the radio frequency (RF) radiation produced by smart meters and their embedding communications infrastructure (NSMA 2014).

Based on these critiques, the NSMA had many demands, not all of which were consistent with one another. From the least to the most different from the original project, these included:

1. Conducting additional meter testing for safety
2. Having more options to opting-out of programs and technologies, such as demand response and time-of-use billing and not having a smart meter on their residence
3. Terminating the part of the NSGI that involved smart meters, but allowing some sensors, automating switches, and programs for renewable energy and electric vehicles to remain
4. Using smart meters that communicated with fiberoptics instead of radio frequency
5. Terminating the project in its entirety and removing all equipment associated with it.[10]

Many of these demands – the first three especially – were premised on a lack of information and a desire to be informed citizens who made informed choices, demonstrating the potential for neoliberal subjectivity to enable political action (Bondi 2005). Through these

---

[10] The variation in demands can be understood in association with the group's composition, which included Tea Party members and a group called the Holistic Moms. Some Holistic Moms were uncertain about the health effects of the meters and wanted more testing and more opt-out choices. Others were more certain about possible negative health effects and advocated for the third and fourth demands. Tea party members or fiscal conservatives were upset about the project being funded by the Recovery Act generally supported the fifth demand. Moreover, some Tea Party members were also Holistic Moms and vice versa, and they often – though not always – supported the other's demands. This uncanny coalition merits more attention, and I gesture toward one direction I might go with this in the conclusion.

demands, the NSMA challenged precisely some of the more neoliberal programs of the grid, seeking more or different choices in the second and third demands, respectively. They also challenged other programs, such as demand response, asserting that it was an invasion of privacy and excessively controlling, a utility "Big Brother." Furthermore, many of the NSMA's reasons for protest and demands are not simply or not at all about neoliberalism, but are instead, for example, about expectations of the utility as a public service.

For purposes of this chapter, the NSMA are particularly interesting because they publicly argued for many of these changes in terms of desiring more choice than the utility offered – and they were fairly successful in doing so. From 2011 until the present, protesters demonstrated at a central municipal building, marched in parades, gave out literature at and interrupted open houses, and pursued a federal lawsuit (ongoing at time of writing). "I pay the mortgage – I reserve the choice", one sign read. Another read "[s]mart meters ≠ freedom of choice." Photos of these signs being used at 'Take Back Your Power' rallies,[11] as well as the NMSA logo can be seen in Figure 4.

Through public actions, the NSMA challenged the utility's rhetoric. They insisted that the choices of the NSGI were too narrow, and in doing so asserted their own citizenship and rights as community members. Their slogan, 'Naperville asks smart questions about smart meters', is an illustration of this, positioning the NSMA as enterprising citizens in the Naperville community. As one protester remarked, "[i]f they want it, I think that's fine. This is America. But I think the same thing should go for people who don't want it.

---

[11] Take Back Your Power' became associated with the international movement against smart meters as well, at least in a 2013 documentary bearing the same title.

Figure 4: Naperville Smart Meter Awareness Group logo (left) and protest photo (right) (Naperville Smart Meter Awareness 2012).

Real choice," she scoffed. "That's the city's motto, plug into choice" ("Stephanie", July 2012). Especially notable in the demonstrations, logo, and Stephanie's comment is the absence of the (more than neoliberal) reasons for challenging the smart grid alluded to in the previous paragraphs. Rather than espousing these critiques, much of their public face was instead about choice, and by framing their disagreements in terms of choice, the NSMA both embraced and challenged the more neoliberal characteristics of the NSGI.

Moreover, the NSMA did not include all residents who were skeptical about the NSGI. Additional residents at open houses sometimes questioned the purpose of the smart metering programs. In the following conversation, for example, a utility worker attempted to convince a resident that it was in their interest to embrace the demand response program:

> Utility worker: There are benefits if customers do so [lower energy use] simultaneously, because it would lower the overall demand.
>
> Resident: But can't people just do it on their own? I do.
>
> Utility worker: That's great, but you won't get money for it. (July 2012)

The utility worker's response to residents such as this one emphasize the neoliberal aspects of the programs: a resident seeks to maintain individual autonomy and make an informed individual decision. Likewise, the utility worker sought to convince the resident that the informed choice and wise form of participation would be to opt in – and that it was a good choice because of individual financial benefit.

The utility responded to demands by the NMSA and other members of the critical public in several ways. Despite frustrations and disagreements, the NSGI accepted the NSMA as a collective of enterprising individuals. In the next section, I explore the NSGI's responses, which are to incorporate individualistic, market-oriented, and thus neoliberal choices and styles of participation and capacity building into more of the grid's programs.

Defining and implementing neoliberal choice, participation, and capacity-building

The NSGI quickly became aware of the NSMA's challenges and demands. They responded in several ways and in doing so, attempted to position themselves as responsible informers. They acknowledged dissent, recognizing the NSMA's expressions of seeking self-empowerment and autonomy. Though the NSMA's demands for choice challenged the more and less neoliberal aspects of the grid, they resulted in changes to programs in favor of the enterprising individuals that are characteristic of neoliberal governmentality, rather than forms of choice, participation, and capacity-building more compatible with environmental justice (see Table 1 for changes made to particular programs).

First, in response to desires for more choice and, especially, comparisons between demand response and 'Big Brother', the utility did make changes to demand response and time-of-use billing. These were originally slated to be programs residents could opt out of,

Program/device	Initial Availability	Modifications
Smart meters (part of an AMI)	Smart meters to be installed for all consumers	A 'non-wireless meter alternative' (NWMA) was made available. It collected data every fifteen minutes but did not communicate by radio frequency, and cost an extra $75 for installation and $25/month.
Tropos and Gateway Units for Communication (part of an AMI)	To be installed on public infrastructure	Installed on public infrastructure, with individual units moved at the behest of individual protester demands
ePortal Home Energy Management website	Available to all consumers.	Delayed for technical and other reasons not described in this chapter.
Two-tiered time-of-use billing rates	Default participation, with opt-out available.	Changed from opt-out to opt-in default.
Demand response	Default participation, with opt-out available.	Changed from opt-out to opt-in default.
Renewable energy integration	Incentives for participation, default nonparticipation.	Delayed, still in development.
Electric vehicle charging	Incentives for participation, default nonparticipation.	Unchanged.
Volt/VAR optimization	Default participation, no option of not participating.	Unchanged.

Table 1: Summary of changes to smart grid programs.

but that consumers would participate in by default. In spring 2012, the utility changed them so that instead, they were strictly opt-in. They still attempted to convince consumers that participating was in their interests, such as in the above conversation between utility worker and resident, but they also emphasized that consumers would not be penalized if they chose to not engage with the programs. Their stated reason for this was that time-of-use billing would not be financially the best choice for everyone given different household work schedules. Concerning demand response, the NSGI also recognized and supported

autonomous individuals. Rather than simply offering the possibility of opting-out, which challenged citizens' autonomy, the utility made nonparticipation the default and offered financial incentives to encourage them to opt in. Through both of these changes, the utility integrated increasingly financially-justified and individualistic choice, participation, and capacity-building further into the grid than it was previously. By emphasizing individual autonomy and self-determination at the expensive of the community and nonfinancial benefits, they render NSGI programs more neoliberal. They also decrease possibilities for the technologies enabling a more just distribution inasmuch as programs for lowering energy consumption were weakened in favor of promoting individual economic interest – a certain kind of choice.

Another set of changes involved questions of safety due to potential health effects of the meters, which were tenuously resolved in practice by offering another choice. To respond to critiques that the RF radiation from smart meters was at unsafe levels, the NSGI conducted research and testing. In three ways, they positioned themselves as informed and responsive to public concerns stemming from a lack of knowledge on *both* the part of the utility and consumers. First, they attempted to normalize the use of RF for communication by identifying other utilities that were implementing similar projects and other devices that emitted RF, identifying 9 utilities conducting large deployments of 1.4 to 5.3 million smart meters which used RF technology for communications. In a similar vein, the NSGI compared emissions from smart meters to those of other common household devices: cell phones, microwave ovens, wi-fi routers, and radio or TV broadcasts (Naperville Smart Grid Initiative 2011a). Both of these actions reflect the utility's attempt to situate the project in

established norms and, again, to position themselves as responsible, responsive, and informed citizens.

Second, the utility purchased equipment for manually testing their smart meters in a sample configuration. One utility employee, "Charles", was sympathetic to consumers' concerns in this respect, remarking:

> They [residents] ask 'well why should I trust you?' Well, I work for the city. And I do tell them that in my personal opinion I don't trust someone who's trying to sell a product to tell me it's safe, whether it's a smart meter or something else, because they have a vested interest. And that's why we did the meter testing ourselves, you know we're not just relying on the meter manufacturer telling us it's safe. We're taking actual measurements of our meters, here in Naperville, to see what the readings are. And if we'd gotten readings that were poor, that would've been a halt to the program (August 2012)

As Charles stated, the results of the emissions testing put the City's smart meters within accepted standards (Naperville Smart Grid Initiative 2011b). Additionally, by counterposing the profit-motives of private companies to the municipal utility, responsible to its citizens, utility workers such as Charles were able to respond to some consumer concerns. They implied that the utility was also composed of enterprising individuals whose interests and desires for information were aligned with those of residents (Naperville Smart Grid Initiative 2011a).[12] However, the utility's politics are also about, as Charles' comment revealed, providing a service to residents as a municipal utility.

Even so, this uncertainty was unresolved. As Charles stated:

---

[12] Charles' comment and the comparisons in the report to established norms also reveal the delicacy around which utility workers and Ambassadors discussed the question of RF radiation from the meters. They tiptoed around the use of the word "safe", favoring comparisons to known and socially accepted devices and standards: the household devices above and Federal Communications Commission limits.

> [O]ften we hear about something that was safe and guess what, now it's not. Cigarettes, asbestos, now it's not. Cell phones. The World Health Organization has classified cell phones as class 2-b carcinogens, along with smart meters, along with a whole mess of other devices. One woman called me who has cancer … and we don't want to be causing any additional problems in their lives, the last thing they want to worry about is an electric meter when they're going through this cancer – thing, so it's a tough one. And we just try to give the information and they can make the best decision they can. And they look at other data, they look at the World Health Organization they look at other studies. Is it inconclusive? Will we know for a fact in ten years that they're still safe? Well, I can't guarantee that. We just go with the information we currently have. … We shouldn't be scaring people, we should just be providing them with a reliable service where they can improve their lives. But I understand what people's points are. (August 2012)

Given this lingering uncertainty, the city offered to install a "Non-Wireless Meter Alternative" instead of a smart meter on individual residencies upon request. These meters were also 'smart' in that they collected and stored data every fifteen minutes, but they did not communicate with radio frequency. Instead, a utility worker would manually download data on site on a monthly basis. Because this was not part of the City's original plan, the utility charged a fee for installation and a monthly fee for the data download. Utility worker Anne commented on this: "I certainly don't want, you know, that's their right, to choose, as an American citizen to choose how they wanna live their life." (June 2012). Through spokespeople such as Anne, the non-wireless meter alternatives were presented as an additional individualistic choice.

This choice was not a satisfactory one for those who believed that the meters were causing health problems, because individual non-wireless meters left the communication network largely unchanged. One NSMA member, "Ruth", said: "it would be so wonderful if an alternative was what I needed, but in a mesh network ... you never know which house is going to be the relay" ("Ruth", July 2012). Ruth's comment reveals a challenge to the neoliberal autonomous individual, in that, for her, the informed choice for her health

necessitated not only that she not have a wireless smart meter, but that there be no wireless activity wherever she went.[13] By offering individuals a non-wireless meter alternative, the utility is able to avoid delays in approval and implementation of smart meters. It offers more individual choices, but it does not recognize the interdependence of even 'enterprising individuals' – that individuals' choices can affect others' well-being.

The non-wireless meter alternative is also a neoliberal response to uncertainty in that it individualizes risk. Premised on the educated and empowered consumer, neoliberal citizens (as opposed to the state) are expected to actively take responsibility for their own health and well-being, by "purchasing private health insurance, being informed citizens, actively investigating health conditions, [and] joining with others in support groups" (Braun 2007, 11; see also Lemke 2001; Drake 2011). By offering an individualized solution in the form of this kind of choice, the utility recognized different responses to the meters and incorporated public participation. Again, however, they did so in a way that reinforces neoliberal governmentality: the decision was pushed onto individuals, giving them the responsibility of becoming informed.

This had ambiguous-to-negative effects in terms of environmental justice. On the one hand, it was an individualized solution, and collective ones were necessary if the NMSA members alleging health problems were to be believed. On the other hand, Ottinger (2011)

---

[13] Ruth also stated that she has been unable to go downtown since the city installed free wireless internet several years ago. She avoids devices that emit RF radiation, including cell phones and microwaves, and wears devices to protect herself from these when she is in public spaces. Other members of the NMSA were not as consistent in their criticism of RF – approaching utility workers at open houses with information about RF displayed on smart phones, for example – but some were apprehensive of the possibility of becoming as sensitive as Ruth.

suggests that for environmentally just technologies, their benefits and burdens should be felt by the same populations – something that is the case for the communication system.[14] For this reason, the smart meters and AMI can be understood as having an environmentally just distribution, one produced through public participation and recognizing different experiences. They subject the public of Naperville to some risk, giving individuals who believed the risk was greater an opportunity to reduce it though not eliminate it entirely. Additionally and at least as significantly, foregrounding choice and responsible individuals, and hinging more of the grid's programs on largely financially-driven individualistic choices, had two other major effects overall. First, it weakened and de-emphasized the possible environmental distributive benefits of the programs that would reduce the energy consumed by coal power plants and integrate renewable energy into the grid. Second, it reinforced the exclusive community focus of the NSGI; though it had effects on other communities, only Naperville residents were included in participation and capacity-building.

Conclusion: Short circuiting environmental justice

Smart grids offer some possibilities for environmental justice, and the NSGI's initial emphasis on choice, participation, and capacity-building enables some of these possibilities and enabled the neoliberal features of the grid to be challenged on their own terms. The utility encouraged participation and capacity building at first on the basis of cultivating empowered individuals and strengthening the community's infrastructure, participation and

[14] A substantial exception to this is the material used for producing the devices in the AMI, which are unaddressed in this chapter.

capacity building that can therefore be understood as only somewhat neoliberal. They welcomed and even relied on participation for the project's technical functioning, through users becoming informed about household energy management and 'choosing' time-of-use or demand response options as they become available. The utility also encouraged participation in creating the public face of the NSGI, through the logo competition and the Ambassador program. They sympathized with desires for other choices that involved different kinds of participation and capacity-building, recognizing, for example, that households with different schedules might not favor the time-of-use option. On the same grounds, prompted by demands for more information, the utility conducted additional research on the meters. Recognitional justice was attained in at least some respects, in the utility recognizing and attempting to work through digital divides that would be presented by metering programs, by offering a wired meter for customers concerned about personal health. Finally, distributive justice was present in risks of using smart meters being faced by the same populations benefitting from them.

Community members, on the basis of perceived burdens, presented themselves as active, informed individuals and challenged the NSGI. For activists, the ways the NSGI was challenged reveal some possibilities for co-opting neoliberalism. Following studies of neoliberalism being potentially politically enabling (Bondi 2005; Drake 2011), the utility's emphasis on choice and empowerment were indeed co-opted to challenge the status quo, to demand "real choice". In that their demands for choice were recognized, protesters succeeded. However, rather than "real choice" heralding a potentially radical questioning of infrastructural change, these challenges and the utility's framing of choice as a "common denominator" made the smart grid more neoliberal and less just: Naperville citizens were

given more individual choices with increasingly economic rationales. Broader questions of redistributing the burdens of producing energy from fossil fuels, except for potential household renewables, are left unasked. Smart metering systems encourage participation in a particular digital network, but those more proximate to the energy-generating infrastructure such systems rely on are not among the possible participants. Ironically, this excludes precisely those in the spaces of more traditional grassroots environmental justice activism from the 'community' the NSGI sought to empower.

Through such changes, neoliberalism short-circuited environmental justice. The NSGI was less neoliberal and offered more potential for environmental justice *before* public participation. Encouraging participation and capacity-building resulted in an emphasis on individual choice and an exclusive community. Though the NSGI had effects on other communities, only Naperville residents and their desires were considered, and they were encouraged to be involved with the project on the basis of individual economic interest. Completing the short circuit, participation and capacity-building in increasingly neoliberal forms weakened, delayed, and de-emphasized the possible environmental distributive benefits of programs that could reduce the need for coal power plants and enable local renewable energy.

Therefore, one change to the implementation of smart grid technologies that might make them more just would be including residents in the spaces of energy generation in decision-making about smart grids. Doing so would also be a challenge to neoliberalism, which relies on exclusionary communities (Stoler 1995; Foucault 2003; Kelly 2004, Staeheli 2008). It is supported, nonetheless, by arguments such as Walker's (2009, 629-30) for the consideration of "multiple spatialities" in environmental justice, including "political and

democratic space; institutional space; spaces of identity; place and community; dynamic spaces of flows; and movement between spaces and across boundaries." For smart grids, this would mean considering those connected by the "spaces of flows" of the technological network to enable the broad redistributive mechanisms that Edwards (2007) referenced. As this paper has shown, smart grid technologies have various redistributive capacities, which could be used to enhance recognition of the different communities connected by electrical networks instead of reinforcing insular notions of community in decision-making.

This might seem like a call for participation of the sort that the NSGI indeed practiced. It also opens up a question: what are the possibilities and limits of participation for environmental justice? As one Ambassador remarked, "we really don't wanna vote on every[thing] – whether this traffic signal is upgraded, whether we change who picks up the garbage. That's why we have a council and they do things" ("Peter" July 2012). Recognition and participation to include those in the spaces of energy generation could lead to a more just distribution, but actually recognizing communities where energy generation takes place might result in *less* choice in the spaces of energy consumption, not more. This inverts, in some ways, Lake's (1996) speculation that calls for environmental justice activists to turn relatively more towards questions of participation and self-determination rather than distribution. Here Lake was discussing historically marginalized spaces of environmental injustice. For the wealthy suburb of Naperville's infrastructure to be part of producing environmental justice, however, the NSGI might rather focus on recognizing communities their infrastructure relies on but excludes, and include these to create a more just distribution. More broadly, this chapter illustrates that when participation and capacity-building are promoted, and even when they are accompanied by degrees of recognition (such

as of digital divides) and redistributive possibilities, it is necessary to inquire into their details and effects to understand whether and how they contribute to environmental justice.

Works Cited

Agyeman, J. 2008. Toward a 'just' sustainability? *Continuum: Journal of Media and Cultural Studies* 22(6): 751-756.

Allen, B. 2013. Justice as measure of nongovernmental organization success in postdisaster community assistance. *Science, Technology & Human Values* 38(2): 224-249.

Bondi, L. 2005. Working the spaces of neoliberal subjectivity: psychotherapeutic technologies, professionalisation and counseling. *Antipode* 37(3): 498-513.

Boone, C. G., G. L. Buckley, J. M. Grove, and C. Sister. 2009. Parks and people: an environmental justice inquiry in Baltimore, Maryland. *Annals of the Association of American Geographers* 99(4): 767-787.

Bowen, W., M. Salling, K. Haynes, and E. Cyran. 2005. Toward environmental justice: spatial equity in Ohio and Cleveland. *Annals of the Association of American Geographers* 85(4): 641-663.

Braun, B. 2007. Biopolitics and the molecularization of life. *Cultural Geographies* 14: 6-28.

Bullard, R., ed. 2005. *The quest for environmental justice: human rights and the politics of pollution.* San Francisco: Sierra Club Books.

Carruthers, D. 2007 Environmental justice and the politics of energy on the US-Mexico border. *Environmental Politics* 16(3): 394-413.

Dobson, A. 1998. *Justice and the Environment.* Oxford: Oxford University Press.

Drake, F. 2011. Protesting Mobile Phone Masts: Risk, Neoliberalism, and Governmentality. *Science, Technology and Human Values* 36(4): 522-548.

Edwards, P. N., S. J. Jackson, G. C. Bowker, and C. P. Knobel. 2007. *Understanding Infrastructure: Dynamics, Tensions, and Design*. Ann Arbor: Deep Blue.

Foucault, M. 2003. *Society Must Be Defended" Lectures at the College de France 1975-1976*. New York: Picador.

Gibson-Graham, J. K. 1996. *The End of Capitalism (As We Knew It): A Feminist Critique of Political Economy*. Minneapolis: University of Minnesota Press.

Gardner, F. and S. Greer. 1996 Crossing the river: how local struggles build a broader movement. *Antipode* 28(2): 175-192.

Hess, D. and J. Coley. 2012. Wireless smart meters and public acceptance: the environment, limited choices, and precautionary politics. *Public Understanding of Science* 0(0): 1-15.

Heynen, N., J. McCarthy, S. Prudham, and P. Robbins. 2007. Introduction: false promises. In *Neoliberal Environments: False Promises and Unnatural Consequences*, eds. N. Heynen, J. McCarthy, S. Prudham, and P. Robbins, 1-21. New York: Routledge.

Holifield, R. 2001. Defining environmental justice and environmental racism. *Urban Geography* 22(1): 78-90.

——. 2007. Neoliberalism and environmental justice policy. In *Neoliberal Environments: False Promises and Unnatural Consequences*, eds. N. Heynen, J. McCarthy, S. Prudham, and P. Robbins, 202-216. New York: Routledge.

Bijker, W. E., T. P. Hughes, and T. Pinch, eds. 1987. *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology.* Cambridge, MA: The MIT Press.

Iles, A. 2013. Choosing our mobile future: the degrees of just sustainability in technological alternatives. *Science as Culture* 22(2): 164-171.

Kelly, M. 2004. Racism, nationalism and biopolitics: Foucault's *Society Must Be Defended*, 2003. *Contretemps* 4: 58-70.

Lake, R. 1996. Volunteers, NIMBYs, and environmental justice: dilemmas of democratic practice. *Antipode* 28(2): 160-174.

Larner, W. 2000. Neo-liberalism: policy, ideology, governmentality. *Studies in Political Economy* 63: 5-25.

——. 2007. Neoliberal governmentalities. In *Neoliberal Environments: False Promises and Unnatural Consequences*, eds. N. Heynen, J. McCarthy, S. Prudham, and P. Robbins, 217-220. New York: Routledge.

Latour, B. 1999. Technology is society made durable. In *A Sociology of Monsters: Essays on Power, Technology, and Domination*, ed. J. Law, 103-131. Routledge: London.

Lemke, T. 2001. 'The birth of bio-politics': Michel Foucault's lectures at the Collège de France on neo-liberal governmentality. *Economy and Society* 30(2): 190-207.

Lloyd-Smith, M. 2009. Information, power and environmental justice in Botany: the role of community information systems. *Journal of Environmental Management* 90: 1628-1635

Naperville Smart Grid Initiative. 2009. *Smart Grid Investment Grant Application Volume I – NAP Technical and Project Plan.*
http://www.naperville.il.us/emplibrary/Smart_Grid/NSGIgrantapplication.pdf (last accessed 20 April 2014).

——. 2011a. *Smart Meters and Radio Frequency Communication*. http://www.naperville.il.us/emplibrary/Smart_Grid/SmartMeterandRFCommunications.pdf (last accessed 20 April 2014).

——. 2011b. *Smart Meters, Household Equipment, and the General Environment*. http://www.naperville.il.us/emplibrary/Smart_Grid/Pilot2-RFEmissionsTesting-SummaryReport.pdf. (last accessed 20 April 2014).

——. 2013. *Frequently FOIAd documents*. http://www.naperville.il.us/nsgifoia.aspx (last accessed 20 April 2014).

Naperville Smart Meter Awareness. n.d. *Naperville Smart Meter Awareness: Informing the Naperville community about the risks of smart meters*. http://www.napervillesmartmeterawareness.org/ (last accessed 20 April 2014).

——. 2012. *Take Back Your Power Rally Successful*. April 18. http://www.napervillesmartmeterawareness.org/2012/04/18/take-back-your-power-rally-successful/ (last accessed 20 April 2014).

Ottinger, G. 2011. Environmentally just technology. *Environmental Justice* 4(1): 81-85.

——. 2013. *Refining expertise: How responsible engineers subvert environmental justice challenges*. New York: New York University Press.

Peck, J. 2010. *Constructions of Neoliberal Reason*. Oxford: Oxford University Press.

Pulido, L. 2000. Rethinking environmental racism: white privilege and urban development in Southern California. *Annals of the Association of American Geographers* 90(1): 12-40.

Reed, M. and C. George. 2011. Where in the world is environmental justice? *Progress in Human Geography* 35(6): 835-842.

Recovery.gov. 2013. *Grants – Award Summary City of Naperville*. http://www.recovery.gov/arra/Transparency/RecipientReportedData/pages/RecipientProjectSummary508.aspx?AwardIdSur=103568 (last accessed 20 April 2014).

Rose, N. 1996. Governing 'advanced' liberal democracies. In *Foucault and Political Reason: Liberalism, Neo-liberalism, and Rationalities of Government*, eds. A. Barry, T. Osborne, N. Rose, 37-64. Chicago: University of Chicago Press.

Schlosberg, D. 2007. *Defining Environmental Justice: Theories, Movements, and Nature*. Oxford: Oxford University Press.

Smartgrid.gov. 2014. *Recovery Act Smart Grid Programs*. https://www.smartgrid.gov/recovery_act (last accessed 12 May 2014).

Staeheli, L. 2008. Citizenship and the problem of community. *Political Geography* 27: 5-21.

Stoler, A. 1995. *Race and the education of desire: Foucault's history of sexuality and the colonial order of things.* Durham: Duke University Press.

Stop Smart Meters! 2014. *Stop Smart Meters! Fighting for Health, Privacy, and Safety.* http://stopsmartmeters.org/ (last accessed 12 May 2014).

Taylor, D. 2000. The rise of the environmental justice paradigm. *American Behavioural Scientist* 43(4): 508-580.

Thorpe, C. and J. Gregory. 2010. Producing the post-fordist public: the political economy of public engagement with science. *Science as Culture.* 19(3): 273-301.

Tyree, S. and M. Greenleaf, M. 2009. The environmental injustice of 'clean coal': expanding the national conversation on carbon capture and storage technology to include an analysis of potential environmental justice impacts. *Environmental Justice* 2(4): 167-171.

Walker, G. 2009. Beyond distribution and proximity: exploring the multiple spatialities of environmental justice. *Antipode* 41(4): 614-636.

CONCLUSION

In many ways, the installation, contestation, and modification of the Naperville Smart Grid Initiative are still ongoing. To conclude, I review additional contingencies and controversies that occurred since completing my research and draw connections between the two chapters. I then introduce avenues for further research, some of which are inspired by the two chapters. These include examining in more detail the politics and research behind the naturalistic mothers' claims about radio frequency radiation, examining the labor associated with smart grid technologies in use in residences, and examining broader questions about participation and technology.

The Naperville Smart Meter Awareness group's lawsuit is still ongoing, and they have also taken more direct action. In late 2012 and early 2013, several NSMA leaders escalated tactics, getting arrested while attempting to stop utility workers from installing wireless smart meters on their houses (NSMA 2013). They were supported in a limited way by one City Councilman who had formerly been supportive of the NSGI, but then became more skeptical. As he critiqued the utility and began asking broad questions about the project, however, he found himself removed from the NSGI steering committee ("Scott", July 2012). This too reveals limits of the possibilities of participation in environmental decision-making in the project, as, in the end, some choices that challenged the project more broadly were forcefully and/or bureaucratically suppressed. This is consistent with Thorpe and Gregory's (2010) observations about neoliberal participation suppressing dissent.

Nonetheless, the City had planned to have a functioning smart grid with all programs running by October 2012 (Naperville Smart Grid Initiative 2009). However, technical issues, described largely in Chapter One, and consumer resistance, a focus of Chapter Two, delayed

the project significantly: at the end of June 2013 the utility was still struggling to install a remaining several dozen meters and had not implemented time-of-use billing, demand response, or other programs – although they were hoping to by the end of the year (Recovery.gov 2013). Their struggles were not only with protesters, but also with smart grid technology companies; in early 2014, the city initiated its own lawsuit against the company designing the ePortal website for consumer engagement because they had failed to deliver a functioning product (personal communication, January 2014).

These lingering struggles to build a functioning system affirm the arguments made in the two chapters. The noise in the system and the difficulties of integrating it into a local cultural and physical environment persists, perpetuating delays and limiting the ability of the NSGI to enact information-based control. These delays and modifications also make the system, in some respects, much less different and 'new' than the contrast between the smart grid and the dumb grid, introduced in the introduction might imply. As was observed of electrical systems a century ago, "the problem of power supply in any district is … completely governed by local conditions" (Merz 1908, 4, cited in Hughes 1987, 68) – something that these chapters indeed demonstrate.

Likewise, choice and participation remain contradictory, as protesters and the utility both agree on consumer choice, and a consumer choice premised on neoliberal logics, but one that is still contested, contradictory, and contingent, as Peck (2010) wrote of neoliberalism. Participation, capacity building, and choice do not necessarily lead to environmental justice, and this becomes interesting in this thesis more not simply because they don't but because of how they produced or maintained injustices. When smart grids technologies are said to have these potentially environmentally just characteristics, and even

when they recognize digital divides, emphasize reducing energy consumption from coal, and facilitate renewable energy generation, it becomes necessary to inquire into the details of those to understand whether and in what ways these are or are not also exclusionary, what differences they recognize, and whether and how they redistribute environmental benefits and pollution or risk. In the Naperville case, participation and capacity-building enabled but ultimately short-circuited environmental justice.

In these ways, both chapters are united by an exploration of contingency and the limits and simplifications of planning and marketing. The first chapter affirms arguments that neoliberalism is only one message among many. The second chapter explains how neoliberalism, among other messages, comes to have more influence than these other messages. The first chapter is largely about utility workers, and the second chapter turns to consumers and the public face of the utility. Even so, both transgress traditionally delineated producer/consumer boundaries, and such changes are endemic to the smart grid. Utility workers become consumers of information produced inadvertently by consumers of metered electricity. Consumers become part of the production of smart grid, through participation at open houses, as Ambassadors, and as protesters.

This leads to a first direction for further research. Where this thesis has explored the work of utility employees and the contestation of smart grid technologies, it has left out the labor of using these technologies in the household. This was because of delays in implementation, to the point that the technologies were not being used in households during my field work. Contemporary scholarship raises the figure of the 'prosumer' to describe how digital technologies often involve consumers doing productive labor (Ritzer and Jurgenson 2010). Dodge and Kitchin (2009) describe this in terms of digital technologies in the home,

observing that such objects change "the spatiality of the home by altering how domestic tasks are undertaken." They remark parenthetically that these changes are "not always more convenient for all", (ibid., 1362-3). Comparing digital technologies to electrifications in the late 19th century, they assert that electrification led to the replacement of manual labor and the ubiquity and near invisibility of electrical systems in the Western world (2009, 1363). This is a particularly noteworthy parallel not simply because it relates to electricity but because, according to Cowan (1983), electrification only reduced manual labor for men and children. At the same time, it catalyzed the introduction of other technologies for home spaces that increased women's reproductive labor (ibid.). Smart grid technologies in the household thus evoke a much longer history than that of the 'prosumer'. It is quite possible that smart grids will catalyze more reproductive labor, but how it will be divided is unclear and complicated by digital divides. This research focus could explore whether and how smart grid technologies in the home reconfigure household divisions of labor, in terms of gender but also in terms of other social/identity categories. Answering this question would require a broader set of sites, to include, for example, the effects of smart grid technologies on household energy poverty (Harrison and Popke 2011).

Another research question on gender would explore the politics of the naturalistic mothers' claims that radio frequency radiation causes health problems. Some of these mothers describe how they or their children have migraines, dizziness, nausea, and other symptoms of what they term electromagnetic hypersensitivity (EHS). They reference personal experiences but also refer to studies by alternative scientific institutions and statements by consultants and engineers. Also worth dwelling on, though, is that the people focused on these health effects are almost all upper-middle class white women (in contrast to

the mostly working class male utility), concerned about the presence of meters on households, their children, and spatial mobility of them and their children inside and outside the household. Because of this, their claims possibly involve gendered, classed, racialized, and household-level spatial politics. I suspect addressing this question would mean drawing on work such as that of Murphy, who has described similar experiences of women experiencing 'sick building syndrome' in the late 20th century (2006), and Nast (2000), who has described ways the interior psyche and exterior landscape influence one another in ways that are gendered and racialized. The group is also oddly reminiscent of the politics of well-educated upper-middle class white women returning to the household in the 1950s, described by Freidan in *The Feminine Mystique* (1963). Like these 1950s women, naturalistic mothers protesting smart meters channeled their education into childcare and anxieties about themselves and their children.

A final question for possible future work involves a further exploration of participation in context of environmental justice and green anarchism, and possibly involves comparing smart grids and other participatory technologies. As this study has demonstrated, participation stands in contrast to centralized and relatively authoritarian governance. It is simultaneously an important part of cultivating environmental justice and necessary for neoliberal governance. Anarchist geographers, too, call for economic practices that are participatory, self-managed, and "empowering and desirable in that they are harnessed through choice, and not economic necessity" (White and Williams 2012, 1636). Again, smart grid technologies meet these qualifications to a certain extent, but precisely through choice and empowerment reiterate neoliberalism. Hayes-Conroy (2008, 30) moves toward redressing this, contrasting anarchist ideas of community with neoliberal ideas of it,

remarking that anarchist communities are premised not on individualist entrepreneurial individuals (Lemke 2001), but on cultivating mutual aid, "public social welfare from the ground up". A further line of inquiry would therefore develop ties between environmental justice and green anarchism – ties which are already strong in environmental justice social movements – to ask how they might add to understandings of participation.

The generation, transmission, distribution, and consumption networks of electric grids are complexly woven into the daily lives of many in Western societies. Though smart grids do not change these as dramatically as planned in the NSGI's grant application (NSGI 2009) or as promoted by smart grid advocates, smart grids nonetheless introduce significant changes and potential changes to electric grids. As the above questions reveal, and as the still-ongoing and far from complete story of the NSGI demonstrates, smart grids are still evolving, to the degree that the changes they might ultimately result in are still not entirely determined. With particular attention to politics in the socio-spatial context of Naperville, this thesis has explored several of these changes.

Works Cited

Cowan, R. S. 1983. *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave*. New York: Basic Books.

Dodge, M. and R. Kitchin. 2009. Software, objects, and home space. *Environment and Planning A* 41: 1344-1365.

Friedan, B. 1963. *The Feminine Mystique*. New York: W. W. Norton and Company.

Harrison, C. and Popke, J. 'Because you got to have heat': the networked assemblage of energy poverty in Eastern North Carolina. *Annals of the Association of American Geographers* 101(4): 949-961.

Hayes-Conroy, J. 2008. Hope for community? Anarchism, exclusion, and the non-human realm. *Political Geography* 27: 29-34.

Hughes, T. P. 1987. The evolution of large technological systems. In *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, ed. W. E. Bijker, T. P. Hughes, and T. Pinch Trevor, 51-82. Cambridge, MA: The MIT Press.

Lemke, T. 2001. 'The birth of bio-politics': Michel Foucault's lectures at the Collège de France on neo-liberal governmentality. *Economy and Society* 30(2): 190-207.

Murphy, M. 2006. *Sick Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers*. Durham, NC: Duke University Press.

Naperville Smart Grid Initiative. 2009. *Smart Grid Investment Grant Application Volume I – NAP Technical and Project Plan.* http://www.naperville.il.us/emplibrary/Smart_Grid/NSGIgrantapplication.pdf (last accessed 20 April 2014).

Naperville Smart Meter Awareness. n.d. *Naperville Smart Meter Awareness: Informing the Naperville community about the risks of smart meters.* http://www.napervillesmartmeterawareness.org/ (last accessed 20 April 2014).

Nast, H. 2000. Mapping the "Unconscious": Racism and the Oedipal Family. *Annals of the Association of American Geographers* 90(2): 215-255.

Peck, J. 2010. *Constructions of Neoliberal Reason*. Oxford: Oxford University Press.

Recovery.gov. 2013. *Grants – Award Summary City of Naperville.* http://www.recovery.gov/arra/Transparency/RecipientReportedData/pages/RecipientProjectSummary508.aspx?AwardIdSur=103568 (last accessed 20 April 2014).

Ritzer, G. and N. Jurgenson. 2010. "Production, Consumption, Prosumption: The Nature of Capitalism in the Age of the Digital "Prosumer". *Journal of Consumer Culture* 10: 13-36.

Thorpe, C. and J. Gregory. 2010. Producing the post-fordist public: the political economy of public engagement with science. *Science as Culture* 19(3): 273-301.

White, R. and C. Williams. 2012. The pervasive nature of heterodox economic spaces at a time of neoliberal crisis: towards a 'postneoliberal' anarchist future. *Antipode* 44(5): 1625-1644.