Spring 5-17-2017

Subjectivity of Solar Power: Using Q Methodology to Evaluate Perceptions of Solar Energy Projects in the San Luis Valley

Aaron D. Russell

Aaron D. Russell
Candidate

Geography and Environmental Studies
Department

This thesis is approved, and it is acceptable in quality and form for publication:

Approved by the Thesis Committee:

Chris Duvall , Chairperson

Maria Lane

Tema Milstein

SUBJECTIVITY OF SOLAR POWER: USING Q METHODOLOGY TO EVALUATE PERCETPTIONS OF SOLAR ENERGY PROJECTS IN THE SAN LUIS VALLEY

BY

AARON D. RUSSELL

BS ENVIRONMENTAL SCIENCE &
BA POLITICAL SCIENCE, UNIVERSITY OF NEW MEXICO
2014

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Master of Science
Geography

The University of New Mexico
Albuquerque, New Mexico

May, 2017

Acknowledgements

I gratefully acknowledge Dr. Chris Duvall, my advisor and chair, for continuing to encourage and ground me during the IRB process, data analysis, and the writing it took to complete this research. His calm demeanor and professional style will remain with me as I continue my career.

I also thank my committee members, Dr. Maria Lane, and Dr. Tema Milstein, for their valuable recommendations pertaining to this study and assistance in my professional development. Their unique perspectives and encouragement have made a huge improvement in my writing and thinking.

I would also like to extend gratitude to the San Luis Valley, the town of Alamosa, and specifically Milagros Coffee without whom, I wouldn’t have had been able to accomplish this project.

Finally, thank you Richard Sylvestre. A better partner in life and work doesn’t exist.

Subjectivity of Solar Power: Using Q Methodology to Evaluate Perceptions of Solar Energy Projects in the San Luis Valley

By

Aaron D. Russell

BS Environmental Science & BA Political Science, University of New Mexico 2014

MS Geography, University of New Mexico 2017

Abstract

Renewable energy is on the verge of becoming a significant source of power generation and for many Americans, that will mean thinking and talking about energy technologies in new ways. Land intensive energies such as solar and green will compete more and more with aspects of our social world. This project focuses on the perception, acceptance, and discourse of renewable energy projects by examining the solar energy conversation in the San Luis Valley of Southern Colorado. This vast high-desert valley holds the excellent geographic conditions needed for the siting of large solar energy installations, but such projects continue to run into local resistance despite wide support for the idea both locally and nationally. This project uses Q methodology to study residents' perceptions of solar energy projects. There are few studies using this technique to approach perception of energy projects. The results of this study reveal important perspectives about consensus for solar energy grounded in drastically different discourses. The results of this study contribute to the greater academic literature regarding energy's place in our society and offer tools for planners, energy geographers, and the communities themselves to make decisions regarding energy generation going forward.

List of Contents

List of Figures

List of Tables

Introduction

The geography of energy in western society is a topic of complex multi-variate issues and relationships. As our dominant culture pushes for more renewable or ‘green’ forms of energy, it will also have to come to terms with the sources of that energy integrating more closely with communities. Extractive industries feeding into fossil fuel industries are kept at so-called safe distances due to industrial risks to human health as well as noise pollution and disruption of sense of place. Alternatively, it should be far more acceptable to locate a solar plant in next to a subdivision than it is a nuclear reactor. This fact does not preclude community specific questions regarding public inclusion and benefit. This project is centered on the topic of social acceptance and perception of renewable energy. It looks specifically at the local scale rather than at the national or global, but it also embraces the fact that issues at each level cannot operate independently of one another. This approach originates from a desire to avoid the discounting of complex narratives of communities when dealing with topics that often span larger geographic divisions. This is the scale where the effects of decisions at higher scales are felt and discussed – the place of action. Therefore, attention to how communities develop and change independently of one another is important. “Communities can be transient and dynamic, fracturing as events unfold and relationships evolve” (Walker and Cass 2007). Goedkoop and Devine-Wright (2016) also emphasize that “the ways that the ‘community’ becomes constituted through the process of shared ownership needs to be carefully researched by paying attention to divergent framings held by the different actors involved” (136).

Within rural landscapes and across public lands, it is important to appreciate that the narratives of such developments are created through different practices of communication. The changing relationship between energy systems and the communities that host them, and how these, in turn, interact with national imaginaries is important. That as well as the conception of 'progress' are critical implication to be considered by policy makers, concerned citizens, and academics alike. By grounding the idea of energy in philosophy, socio-technical relations and justice, this work will evaluate and describe this topic and then, through praxis, begin to explore and understand how rural communities respond to changes in the modern energy landscape.

This work focuses on green energy initiatives playing out in the western United States where land is plentiful and ideas of authority and ownership have developed differently than in other places. A project started under the Obama Administration and operated by the Bureau of Land Management (BLM), Department of the Interior (DOI), and Department of Energy (DOE) has produced a Solar Programmatic Environmental Impact Statement (Solar PEIS) meant to help open large quantities of public lands in the west to utility scale solar energy development. Utility scale development characterized by large and centralized energy facilities that feed into the countries existing energy infrastructure. The impact statement is expressed in a series of documents including initial outreach, public commentary, and agency responses to critiques as well as the full permitting report itself ("Solar PEIS Documents" 2017). A main web portal exists to facilitate outreach and to preserve these documents in a publicly available place where laypeople can go to get more information ("About the Solar PEIS" 2016). A preliminary synthesis of the community perceptions of these developments within the San Luis Valley was performed by Farhar et al. (2010).

The purpose of the Solar PEIS has been to carefully plan for the expansion of the U.S. solar industry sector into public lands in the Southwest while avoiding any conflicts with the public or damage to the environment. Such a top-down approach is good for cost-saving efficiency, but puts the community in position of reaction and potentially disengages them altogether. Questions of justice and fairness must not be forgotten in all the aspects of a socio-technical transition that are discussed herein. The impacts of large and visible renewable energy installations, access to renewable energy, and a voice in the making of and implementation of policy are all crucial justice components. This project attempts to engage, at the individual level, the subjectivities within a community and quantify them statistically using a structured interview and analysis technique called Q methodology. Findings indicate that participants hold different perspectives regarding valley's economic strength, best practices for siting projects, the role of ranchers and farmers in the valley, and perception of water scarcity and climate change or pollution in the valley. Perception of the role of government and value of the land further influence these. What's more, widespread support for solar energy projects exists as well as an unexpected lack of concern over transmission line siting. An implication of this for wider conversations is a lack of knowledge of consensus and dissensus about certain aspects of renewable energy. Greater shared knowledge of such things would mean greater potential for the community to advocate for itself.

Literature Review

A theory of ‘energy geography’ seeks to understand all different aspects of energy use from a spatial perspective (Calvert 2015; Lawhon and Murphy 2012; Zimmerer 2011). This spatial context has grown beyond the geomorphological context of where to drill and dig for energy. Questions of where to put renewable energy infrastructure, what the consequences of energy developments are going to be, and what it will mean for energy projects to become more integrated with communities point to a complex conversation about this topic which demands a flexible approach. Specifically, it is necessary to understand how the perception of electricity generation is evolving and how perceptions of climate change, risk, and justice have driven much of this evolution. The materiality of electricity, or how tangible and meaningful it is, remains an important factor in this conversation and, as part of the larger conversation concerning technological modernity, represents an important backdrop for this work.

Although a body of literature has developed to explore the opposition and support for socio-technical transitions involving renewable energy (Holdren 1991; Burke 2013; Dangerman and Schellnhuber 2013; Hadjilambrinos 2000; Molyneaux et al. 2012; Späth and Rohracher 2010; Lawhon and Murphy 2012; Stephens, Wilson, and Peterson 2008; A. Smith and Stirling 2010; Walker and Cass 2007), geographic concepts must keep up with new developments. A dearth of work in geography that explores energy perception through communication may be addressed by analyzing such communication and the social contexts in which it is shaped while holding true to the human/environment focus and the spatiality of humans and technologies.

Perception of electrical energy systems exists within the complex connection between local and individual narratives and energy policy (Peterson, Stephens, and Wilson 2015; Pierce and Paulos 2010; Rieur and Alahmad 2014). Local nuance as well as the power of national imaginaries often spawn hybrid and even contradictory narratives (Marafiote and Plec 2006; Jessup 2010; Hulme 2010). Scholarship on this topic addresses how energy affects perceptions of 'space' and 'place' as well as where and how technologies such as renewable energy fit into these perceptions. Communication on this topic may be analyzed in many ways, but a strong approach should focus on a mixed methodology. Discourse analyses and content analysis of energy projects and land use issues offers a critical window into how the environment is shaped by how we speak about it and vice versa (Carbaugh 2007; Johnstone 2008; Hall 2001).

In what follows, the literature review is broken down into four subsections. A broad basis for approaching the intersections of people, energy, and environment is given first and special attention is given to the topic of justice. Following that, a more in depth guide to understanding socio-technical aspects of renewable energy is presented. An exploration of social acceptance is the third subsection. Lastly, the topic of discourse concerning land-use and renewable energy siting is unboxed.

1. Energy and Culture

This first part of the literature review delineates themes that need to be explained as part of a synthesis concerning technological modernity and renewable energy can be sought. The first theme is a review of some general anthropologies and philosophies of energy. These are important to include when looking at human/energy relationships over time, justice, and to look at how energy and electricity exist in abstract thought. A specific attention to justice concerns is contained within the second theme. The materiality of energy is the third theme and deals specifically with how the relevance and significance of energy fits into an idea of technological modernity addressed by Malpas (Malpas 2008). Electricity usage is only part of an overarching technological modernity informed by the relationship to "things" and "devices" (Brittan Jr 2001). Interaction (or lack thereof) with these artifacts of technological modernity plays a part in how we perceive and discuss them. The aspect of an obscurity and obfuscation arises in how technological modernity conceals within it "a danger that threatens the possibility of a genuinely ethical mode of life" Malpas (2016). In a more specific example, Pierce and Paulos (2010) tell us that "the various material technologies that provide us with energy effectively distance us from the material production of energy and even the consumption of energy in many ways" (Pierce and Paulos 2010, 115).

1.1 Anthropologies and Philosophies of Energy

The ties that bind energy and civilization together have been studied for decades (Pimentel et al. 1994; Smil 2008; Clarke 2015). In taking an anthropological lens to this topic, a dominant stance that emphasizes the direct correlation between the growth of civilizations and the amount of energy they use has been central (Basalla 1979; Mitcham and Rolston 2013). The evidence for such a connection can be represented by national level variables such as GDP, doctors per capita, and even Nobel Prizes per capita, which all tend to increase in correlation with energy harnessed per capita (J. H. Brown et al. 2011). Arising from these works is the question of whether civilization and energy can only grow in direct proportion to one another. As electricity production has grown to dominate the world of energy, modern civilization has developed an ignorance of its effects and what it affects. This byproduct of technological modernity has reduced the discourse of energy production to economics instead of human interaction (Mitcham and Rolston 2013). It becomes a commoditized "black box" in all regards (Brittan Jr 2001, 175; Mulvaney 2013).

A philosophy of energy is an abstract idea. The complexity in developing one derives in some part from cultural definitions of energy and how they develop, disappear, and converge over time. Differing concepts of energy have developed around the world and were coproduced with their respective cultures. Mitcham and Rolston (2013) lay out in their paper the different conceptions of energy from various cultures over time. Concepts such as Aristotle's *energia*, the differences between power, force and energy that arise from western physical sciences, and even the spiritual concept of *qi* are representative samples of the diversity of the subject (316). A full accounting of energy philosophy is beyond the scope of this work; however, the branch of philosophy that deals with ethics is important to note, as the obscurity of electricity generation in technological modernity creates questions of justice and fairness.

In their discussion of this topic, Mitcham and Rolston (2013) focus on two separate energy ethics—ethics being the branch of philosophy dealing with moral principles. The contradictory foundations of the two ethical conclusions they discuss are that energy use and civilization should be coproduced and proportional or that they should not be for reasons of equity and fairness. Per the authors, "the most general ethical issue of energy production and use falls under the rubric of energy equity and justice" (317). For instance, the fact that equity through participation and ownership cannot keep up with the growth in complexity of energy production is shown by the current technocratic government of energy generation and the subsequent disengagement that this has caused. Considerations of who benefits from energy production and who pays "in terms of harm and risks" (317) are important from the perspective of justice.

1.2 Justice and Energy Siting

Justice can be a nebulous concept, especially as it can change depending on its context. An effective definition of justice for the purposes of this project is that "justice increases when the benefits and burdens of social cooperation are born more equally, except when moral considerations or other values justify greater inequality" (Wenz 2007, 58). Concepts of justice can be seen as evolving, but a common conception of justice is shared and can inform across many disciplines. Gross (2007) tells us that the key concepts are specifically "procedural justice, outcome fairness and outcome favorability" and paying attention to conversations about what is more important between the outcome and the process is essential to this. For example, solar energy projects are often considered to be a black box where sunlight flows in and benefits (i.e. clean energy, community development, etc.) flow out (Mulvaney 2013; Brittan Jr 2001). Concerns such as the toxicity of materials, supply-chain fixes that move injustices to marginalized communities globally, and the foot-print of large-scale solar projects are not often the primary concerns of this push for energy system changes.

Due to a clean and environmentally friendly legacy, renewable energy sources such as solar projects are often welcomed into communities around the world. Social justice concerns may be overlooked in these scenarios to the detriment of underrepresented, disenfranchised, and other vulnerable populations. We see examples of this in renewable energy developments in India's Charanaka Solar Park where subnational states in India sometimes go to extremes to stay competitive for international and national investment, which often leads to the foreclosure of normally open, communal agricultural land (Yenneti and Day 2015; Yenneti, Day, and Golubchikov 2016). Renewable energy has obvious benefits, which can become less obvious at different scales. Utilizing 'under-used' or misused land to create progressive green-energy projects has benefits at the national and state level in India, but fails to recognize the effect on those with an already precarious existence.

Injustice in the developing world is not always easily comparable to injustice here in the United States. The similarities are found in the inability for vulnerable, and underrepresented people to feel that they have a voice in what is happening around them. In highlighting that, Yenneti and Day (2015) state, "two-way information exchange, meaningful participation, and adequate representation of all groups including the marginalized, signposts the major elements of procedural justice that need to be addressed" (pg. 672). Other authors that have studied justice in energy siting in the global north include special focuses on engineering (Sakellariou 2013), law (Outka 2012), and economics (Çarkoğlu and Kentmen-Çin 2015). The main take-away here is that most environmental goals can be reached through just means if justice is not forgotten. The importance of this is that it shows how discourses of environmentalism don't need to be mutually exclusive from discourses of justice. They, in fact, complement each other quite well.

1.3 Materiality of Energy

In reviewing how narratives of energy and electricity change and develop as well as the justice implications of these, we move towards another useful lens at looking at human/energy relationships. That is, the way that electrical energy exists in the lives of a layperson. One way to approach this concept is through the idea of materiality. Materiality represents the quality or character of being material or consisting of physicality, but it can also be defined as the quality of being relevant or significant. One of the reasons that electricity as a technology has become obscured as stated above is that it has become essentially immaterial where it can be taken for granted. This is especially true of wealthy countries where electricity has become such an ignorable part of life. One need only think of the discomfort that sets in during a power outage to realize this.

It is this immateriality that helps to bridge the works such as Malpas and Heidegger as they discuss the obscuring effect of technology. Much like the internet, the system of electricity has become so ingrained in the daily experience that it is no longer noticed, but is invisible and intangible (Pierce and Paulos 2010, 115). Conceptions that build into this bring in Heidegger just as Malpas does to facilitate discussion. Albert Borgmann does so as he brings in the concept of *focal engagement* to describe the interaction with technological things (Borgmann 2009, 42). He makes the important distinction between 'things' in the Heideggerian sense, which include human artifacts such as classical windmills and the 'devices' of more recent development including energy producing technologies of all sorts. The development of technology over time has trended from engagement with Heidegger's things (i.e. the understanding of the maintenance of a classical windmill) to being disburdened of cause to care by Borgmann's devices (i.e. the black box of solar energy production) (Brittan Jr 2001). Aesthetics are another source of reasoning behind the apparent invisibility of current electricity infrastructure. Not only do we not interact with it because it is complex to anyone except an expert, but we also hide it and move it to a comfortable distance. In reference again to themes of justice in energy choice and location, energy infrastructure is designed and placed pragmatically and not aesthetically. It is possible that a re-examination of design aesthetic as well as whether a technology can be integrated into an existing landscape will ease energy placement justice concerns as well as stimulate more public interaction and acceptance, which is discussed further below.

2. Socio-Technical Systems

The goal of this section is to assist in drawing down from the complexity of energy geography towards a more focused view of energy system transformation and the political, legal, geographic, and technological components of evolving energy use. The section is divided along themes of socio-technical transitions and socio-technical imaginaries. Socio-technical transitions represent complex social inter and intra-actions that occur between people and technology during times of change. Imaginaries represent the overarching communication structures that develop around the transitions.

It is at this point that the different types of energy systems become more evident. There are so-called *conventional, dirty, or fossil fuel* sources such as coal and oil and there are *clean* sources, which include wind, solar, geothermal, tidal, etc. Terms such as *green, renewable, or alternative* further complicate this. These different names when displayed together help to display the rhetorical fluctuations that are brought about by the two sides. This is because "policy and political developments, proposals and interventions rarely enjoy consensus but either reflect or reproduce underlying social dissensus" (Barry, Ellis, and Robinson 2008).

Such rhetorical devises, which are often interchangeable at the end of the day, are but expressions of underlying causes. People are the *socio* part of socio-technical systems and as such they make location and space important to the conversation. One of the central premises of this work is that energy can be located more closely to communities when it is renewable because it is perceived to be safer. Solar energy sources are even being developed as replacements for shingles to act as a roofing material (Muoio, Feb. 24, and 7 2017). This isn't necessarily the case for industrial or utility-scale projects. These are large projects meant to replace the capacity of conventional fossil-fuel burning operations and include concentrating solar arrays and wind farms. Proximity to them is one aspect of local community resistance as well as issues of justice and fairness (Van der Horst 2007; Carlisle et al. 2016), which are discussed above. They share the need for large transmission infrastructures, which are sometimes of greater concern than energy generation operations themselves (Cotton and Devine-Wright 2011).

One other important aspect of renewable energy at the utility-scale, and especially for large wind and solar, is that it produces more energy by taking up more space. The extractive aspect of conventional power-generation technologies (i.e. mining and drilling) is separate from the production of the energy. For example, the difference in generating capacity between two coal-fired power plants is an obscure issue of technology, while the difference between two solar fields or wind farm has a much more aesthetic basis (Brittan Jr 2001).

2.1 Energy System Transformations

Energy system transformations in the last fifty years can be widely attributed to geopolitical pressures involving the globalization of energy markets. (Smil 2016). Twenty-five years ago, the crux of the energy challenge could be described by the following narrative: the rising population of the planet will strain the accumulation of easy to reach fossil fuels and a wave of efficient, but more expensive energy will crest (Holdren 1991). The transition to renewable energy systems has since been observed thoroughly explored by many disciplines. At the global scale, capability for transforming an energy system is extremely important. Nations historically use available resources until development and economic factors allow for the choice to pursue cleaner energy sources. This has been described as a "national energy ladder" for moving from the cheapest and often dirtiest energy sources to more expensive renewables as economies develop and mature (Burke 2013). Research at this scale involves understanding the interaction of the governments, industrial leadership, and other high priority stakeholders (Burke 2013; Dangerman and Schellnhuber 2013; Hadjilambrinos 2000; Molyneaux et al. 2012), but there are also issues of national identity and methods of decision making that can play a part. Hadjilambrinos (2000) points to two distinct, but interrelated forces that affect energy at the national level. These are the economic and the socio-political (pg. 1111). For example, despite similar economic forces directing change in the French and Danish energy sectors, the countries ended up with very different solutions. France developed a centralized nuclear energy program that emphasized national prestige while the Danes would pursue renewable energy development with quality of life in mind. These movements that play out on national scales are built upon the actions and reactions of communities and even upon those of individuals.

The application of these economic and socio-political forces as criteria for studying energy in the American West requires that these community and individual scales be considered as well.

In the United States, energy transformation literature is plentiful, but it is still highly focused on somewhat elite decision makers and ignorant of processes that include the participation of the public (Lawhon and Murphy 2012). This critique can be applied to the Socio-Political Evaluation of Energy Deployment (SPEED) developed by Stephens, Wilson, and Peterson (2008). Their work represents a well-cited approach to evaluating changing energy landscapes. The authors put emphasis on strategic tactical and operational levels of transition management and prescribe methods of policy review, focus groups, and media analysis to effectively evaluate each. Their paper is a prime example of the methodological approaches that are normally used within socio-technical transition theory. In contrast with it are Lawhon and Murphy (2012) who make an argument for the usefulness of tools from political ecology to address questions of power, exploitation, and discourse at more than just elite levels. The problems as they see them are emphases on technological artifacts, bias toward elites, naivety in scale selection, and ignorance of power relations (Lawhon and Murphy, 2012). This research thus calls for an individual scale focus on people affected by the decisions made by elites. At this scale, forces within the geography of energy transition remain heavily attached to industry and politics. At this level, the resolution does not permit a more thorough attention to human experiences. To explore the interrelatedness of energy transitions to individuals, we must go deeper. A good example of a deeper approach is work done to analyze energy policy responses based on defining contrasting values (Jessup 2010).

2.2 Socio-Technical Imaginaries

This theme represents those state-enacted policies that seek to build upon or motivate new socially constructed interactions with technology or science (Jasanoff and Kim 2013)The importance of this is that it is often the national government that has the resources to facilitate and expand new technological movements if not outright develop them. Examples abound, but the space race, the interstate highway system, and the national energy grid are all results of sociotechnical imaginaries if we keep to the definition outlined here. Malpas (2016) states that, "technology is not identical with just technological apparatuses" and while each example listed above is dependent upon specific apparatuses, the development of new systems that have changed livelihoods are a critical component as well. Since technology and society are coproduced, but equitable understanding and control has not kept pace, it can be misleading to assume that themes such as politics and entertainment are not technological systems in and of themselves.

Socio-technical imaginaries have played a large role in the history of energy development and transition in U.S. history. It is important however to explain that these imaginaries are enacted at the national level and not usually at the community level. "These exercises of power, such as through the selection of policy priorities, fund allocation, and infrastructure investment, draw attention to the performative nature of sociotechnical imaginaries" (J. M. Smith and Tidwell 2016, 330). This does not indicate where these imaginaries originate however as Smith and Tidwell tell us:

> Sociotechnical imaginaries do not simply exist in the collective cultural ether or in powerful political actors and institutions, but circulate much

> more widely as they are criticized, taken up, and reframed by ordinary people (331).

Despite being enacted at the highest levels of states, it is crucial to realize the importance of those other than the experts, academics, policy-makers, and stakeholders. It is also important to be careful of what discourses socio-technical imaginaries arise from. For example, discourses of national energy security often ignore environmental concerns as well as local and regional security needs (Tidwell and Smith 2015, 689).

The dominance of the energy security imaginary represents a challenge for technological modernity as it places energy in a lens where it remains the sole responsibility of the state. The current transitions towards sustainable, and renewable sources of electricity that aren't extractive will require transformations in "social infrastructures, changing established patterns of life and work and allocating benefits and burdens differently from before" (Jasanoff and Kim 2013, 189). Transitioning away from the socio-technical imaginaries of the past towards these new systems will require an understanding that they cannot be "independent of the complex network of systems from which they emerge" (J. M. Smith and Tidwell 2016, 331). These complex systems intersect with those described by Malpas when he states that "technology hides its own encompassing and systematic character" further feeding into the concept of materiality outlined above (Malpas 2016).

3. Approaches to Understanding Acceptance

The complex interplay between literature on the phenomenon of social acceptance unpacks the role of communities in the overall socio-technical system of energy distribution. Even when renewable energy projects are supported from the top down as through socio-technical imaginaries, social acceptance and justice at the community level can become a problematic obstacle (Wüstenhagen, Wolsink, and Bürer 2007). There are many works that attempt to characterize the elements of opposition and support that affect social acceptance of renewable energy. A majority of these concern wind power and transmission lines and are centered in European countries where the subject is receiving ample attention (Fast 2013). In the United Kingdom Patrick Devine-Wright (2009) has specifically sought to address the public's "questions about perceived impacts of technologies, mitigation measures or other types of issues that might act as qualifiers to people's responses" (Batel and Devine-Wright 2015b). He has written quite extensively on this and similarly related works dealing with discourses, place attachment and disruption to it, and social representation of energy systems and changes to them (Batel and Devine-Wright 2015b, [a] 2015; Devine-Wright 2009, 2011; Devine-Wright and Batel 2013; Devine-Wright and Howes 2010). His focus on deconstructing the term NIMBY is particularly important and follows Van der Horst (2007) in deconstructing and understanding the role of this label. This tendency to group together all people who oppose renewable energy developments on the monolithic pretense that distance from an energy development (e.g. windfarm or solar field) is the most important aspect of opposition overlooks much of the complexity and importance of understanding social acceptance of change. Other authors have attempted to move beyond the opponent/supporter dichotomy and have been able to hypothesize about more complex social interactions, but more work in this topic is needed.

The geography of social acceptance is built upon three dimensions: what kind of acceptance is being reported, what form of public is acting, and what geographic concepts are used. (Fast, 2013, 854) The development of these criteria helps to illustrate some of the different approaches to researching social acceptance. For example, Devine-Wright (2009) makes great use of the place attachment concept of geography to help redefine the term 'NIMBY' in relation to social acceptance of the public to wind farms in the United Kingdom. Place attachment is the positive relationship between people and their environment. It is both action and subject and disruption of it can lead to emotional responses at the individual and the collective level. Five different, but interrelated geographic concepts used to explore social acceptance at different renewable energy projects around the world include: immobility, or the inflexibility of renewable energy siting; immutability, or the assumption that landscapes have permanence; solidarity, or the relationship between people and the land; imposition, that the project does not benefit those around it; and space as renewable energy is often seen as imposing both visually and geographically (Pasqualetti 2011b).

Pasqualetti's concepts are beneficial when applied to the local community and individual scales. For example, in researching the development of large solar projects in southern Colorado, we focus on the acceptance of the federal and state policies to bring investment in to this region. The concepts that are particularly appropriate in this research are immobility, immutability, and solidarity. By using Pasqualetti's concepts as crucial lenses for viewing the results of the this project, the implications of the factor viewpoints can be better understood.

4. Discourse of Land Use

Discourse, as it is referred to in academia, has two somewhat interrelated definitions. The first is "meaningful symbolic behavior" and the other, influenced by Foucault and referred to as "discourses" rather, is "linked ways of talking and thinking that constitute ideologies" (Johnstone 2008). Discourse analysis encompasses several approaches to studying language as a social interaction. "Anyone who wants to understand human beings has to understand discourse…" (Johnstone 2008). Each discourse has a social context within which it defines part of the societal structure. A discourse of land use and energy siting may be a promising portal into an aspect of socio-technical systems that political ecology suggests is missing. These are the construction of knowledge, by whom, and for what purpose; the privilege in one viewpoint over another (Lawhon and Murphy, 2012). From these aspects, a storyline can be developed to give form to the values and perceptions that lead to community interaction with policy making and drivers of argument and apathy surrounding renewable energy projects (Jessup 2010).

The social construction of land use carries a large amount of the responsibility for current modes, methods, and laws concerning what and how we use land. This becomes especially important relation to public lands that are open to the enjoyment of all. In observing such nuances, we are instructed to "attend to the ways private, colloquial, or vernacular expressions of human/nature relationships reflect and shape knowledge, attitudes and behavior, for it is these discourses that gird and influence local cultures first" (Marafiote and Plec 2006). Electrical energy production that occurs on public lands ties into this and plays a role in which lands can be used for energy production and why. Literature concerning the cross-section of land use and energy choice is plentiful as are authors that focus on the discursive elements of such cross-sections. (Van der Horst 2007; Adger 2000; Fischhendler, Boymel, and Boykoff 2016; Jessup 2010; Cotton and Devine-Wright 2011; Späth and Rohracher 2010). For example, the "Solar Grand Plan" is representative of the socio-technical imaginary that the lands of the southwestern U.S. are showered with so much energy from the sun, they could be used to power much of the country (Hunold and Leitner 2011). This imaginary relies on discourses concerning how and why to use these lands and exactly what they are. Often, the arid landscapes of the region are described as empty or barren and that the land is unused. "The notion of emptiness is connected to a fundamental uselessness, which is the basis, perhaps, for legitimizing all kinds of destruction of and experimentation on the desert" (2011, 692).

Another important aspect of how we communicate about land is that we often carry on more than a single discourse concerning the land at any one time (Marafiote and Plec 2006). Marafiote and Plec (2006) describe hybridity in discourse about the natural world and note that there is an "internal dialogism of discourse". In some instances, one environmental discourse might contradict itself in what has been called "ecocultural schizophrenia" (Dickinson 2014). One specific example, studied by Dickinson, is that park rangers often anthropomorphize aspects of nature so that they are easier to teach about and that such an approach creates a "double-bind" image that can hurt environmental ethics in the long run. In addition to narratives of the desert regarding solar energy siting, hybrid and conflictual narratives within the discourses of renewable energy sighting are explored in more detail in the account of wind energy development across different Rocky Mountain communities (Olson-Hazboun, Krannich, and Robertson 2016). The authors specifically discuss the combination of landscape aesthetic, economic benefit, and climate change concerns, which inform the different communities in different ways.

5. Literature Summary

This literature review first draws on the co-construction of the concept of energy with the growth of human civilizations and the current place of dominance that electrical energy holds in technological modernity. A byproduct of this is the obfuscation of energy and the opacity of its components. The systems that make it and that it is a part of are also hidden in a way that disburdens us of them, but also leaves the potential for issues relating to justice and equity. Next, it looks at renewable energy transition from a socio-technical standpoint. This is important in pointing out how the structures within western governments facilitate changing social and technological systems and that these are often informed by national imaginaries, which arise and change based on discourse. The review then grounds this information on the specific energy siting and land-use discourses, which utilize, adapt/change, or disagree with such national imaginaries. The transition to renewable energy resources should be taken as a positive and complex change with potential justice pitfalls and the literature reinforces this, but that doesn’t mean that laypeople agree and the importance of that fact for the future of renewable energy transitions and human/energy engagement is difficult to ignore. As a way of approaching this, a case study of the solar energy projects that have been established and planned within the San Luis Valley of Southern Colorado has been made herein.

Research Questions

There are many ways that renewable energy project siting concerns can be disambiguated. A gap exists concerning community discourses and renewable energy development in the southwestern United States. A large-scale analysis of the community response to the Programmatic Solar EIS was performed by Farhar et al (2010) and in light of that, this project seeks to uncover narratives and discourses in addition to their work. This is done using different means and takes a more general approach to solar energy perception within the community. Such a post-positivist approach where previous work need not confine future work is useful in shifting the conversations away from numerous survey studies towards a focus on changing narratives and discourse (Barry, Ellis, and Robinson 2008). That said, the following questions are asked:

1. What perspectives of solar energy projects are held by laypeople?
2. Do these perspectives indicate individual beliefs/attitudes regarding environmental justice and/or the materiality of energy in everyday life?

Site Description

The San Luis Valley is a large and open space between the San Juan and Sangre de Cristo mountain ranges in central southern Colorado. The valley, which exists in the far northern extent of the Rio Grande Rift spans about 150 miles from north to south and about 50 miles from east to west. The six counties that comprise the San Luis Valley vary by land ownership statistics, but the breakdown for the whole valley is 57percent federal land, 39percent private land, and 4percent State government land (Farhar et al. 2010). The principal economic driver of the valley has been and remains agricultural crops such as barley, alfalfa, and potatoes and due to limited opportunities in other economic sectors, much of the valley's population has a lower income than the Colorado median income ("Regional Profile: San Luis Valley Region" 2017, "About the San Luis Valley" 2017). The valley's high altitude, flat landscape, and cool temperatures make it a prime location for siting solar energy projects such as those planned in the Solar PEIS.

The Solar PEIS is the result of the Obama Administration's Roadmap for Utility-Scale Solar Energy Development on Public Lands ("Obama Administration Approves Roadmap for Utility-Scale Solar Energy Development on Public Lands" 2012). 17 solar energy zones were established within six western states in a planning process that began in 2008. Four of these zones are within the San Luis Valley (figure 1). An important aspect of this has been that, within the zones, solar energy developers would be granted expedited permits by federal agencies involved in managing the lands (Warburg 2015, 95). This same process has been described in literature as a principal reason for public resistance to the project (Carlisle et al. 2015). Per Farhar et al (2010), the primary technology planned for the valley would be utility-scale concentrating solar arrays, where fields of mirrors would concentrate sunlight on a central tower where the heat produced could be used to spin a turbine. Perceived advantages included "local economic and social-psychological/identity values" within the valley and "broad environmental and technological advantages" outside the valley (Farhar et al. 2010, 17). Perceived disadvantages were mostly environmental and most respondents to this inquiry came from within the valley itself (26). Transmission line controversies appear to have been the largest reason for failure of the initial project design and subsequent lack of development at the initially planned scale (Carlisle et al. 2015).

A full accounting of the Solar PEIS process and transmission line controversies from 2008 through 2010 is provided by Farhar et al. (2010) and includes references specifically to transmission lines being blocked from crossing the Sangre de Cristo Mountain Range by billionaire Louis Bacon (Farhar et al. 2010, 107). The New York Times even picked up on this controversy stating that Excel Energy, a principal investor, stated that "delays in the project – blamed on Mr. Bacon and his lawyers – had undermined potential development of solar power" (Johnson 2010). Further transmission complications developed from the establishment of the Rio Grande del Norte National Monument at the southern end of the San Luis Valley in New Mexico (Logan 2017). This essentially barred the valley from economically exporting any electricity and greatly reduced the prospects of truly utility-scale projects. There are currently smaller scale, but still relatively large solar fields in the San Luis Valley with plans for expansion of more distributed roof-top systems. As these projects keep energy generated for local use, the transmission line controversies are not a factor ("San Luis Valley Ecosystem Council - Renewable Energy" 2017).

The principal research location is the town of Alamosa, which is the economic hub and one of the largest population centers within the valley ("Alamosa County |" 2017). Despite this, the population of Alamosa is around 16,000 and the valley has around 46,000 residents in total ("Regional Profile: San Luis Valley Region" 2017). Alamosa was chosen as the principal research site due to a desire to reach the greatest variety and amount of possible research participants. The town is centrally located in the San Luis Valley and contains much of the valley's retail, medical, and higher education centers. This means that valley residents regularly move through Alamosa making it the best location for sampling the population. As described in the methods section, the research methodology chosen for this work is time intensive, making a centralized location where a variety of participants can be recruited very important. Consideration of the time needed meant finding locations where potential recruits would gather and remain for a period. Area coffee shops tended to provide the most convenient mixture of criteria to support the chosen methodology.

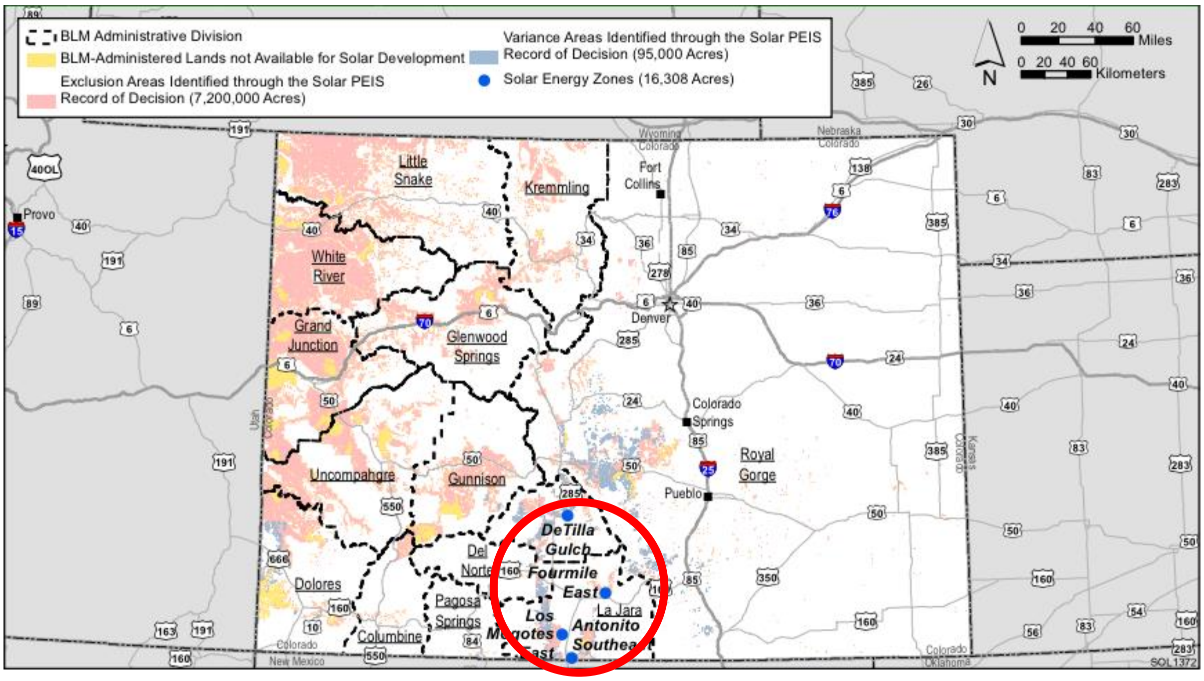

Figure 1: Map of Colorado with Solar Energy Zones denoted by blue dots in the south. Source: cleantechnica.com

Methods

Q-methodology attempts to “analyze subjectivity, in all its forms, in a structured and statistically interpretable form” (Addams and Proops 2000). Watts and Stenner (2012) describe subjectivity in operant terms as “the sum of behavioural activity that constitutes a person’s current viewpoint or point of view” (44) and that Q methodology “allows the main or majority viewpoints to be identified relative to a particular subject matter and for these knowledge structures to be rendered empirically observable” (46). Some exemplary works involving Q methodology and energy or environmental issues can be found in Ellis et al. (2007), Forrester et al. (2015), and Parkins et al. (2015). The process of conducting Q-methodology research involves having research subjects sort statements or materials into a grid of numbered columns running between positive and negative integers. The grid represents a quasi-normal distribution and allows for the production of “a set of shared views about the topic” (414). The semi-normal or bell curve shape is important in allowing participants to have more room to place statements that they don’t feel strongly about or know much about. An example of the sorting process can be seen in figure 2.

The advantage of choosing to utilize Q methodology is two-fold in this work. First and most important to the project’s goals: this methodology provides an understanding of laypeople’s viewpoints that is helpful to experts implementing policies, programs, or services. Barry and Proops (1999) apply this rationale in their own work using Q methodology to gauge which types of environmental policies might be socially acceptable. The second rationale is particularly unique to Q methodology in that it provides holistic data. There aren’t many methodologies that can make such a claim (Watts and Stenner 2012a). Instead of a fragmentary approach focused on a dissection of different factors, Q methodology pursues a focus on the whole story and the relationships between factors.

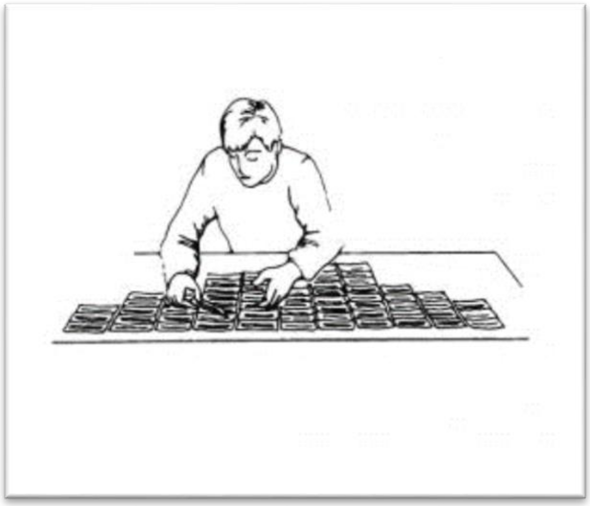

Figure 2 Example of Q sorting process. Note the bell curve shape allowing for more statements towards the center and therefore the undecided area. Source: http://www.betterevaluation.org/en/evaluation-options/qmethodology

The principle step in Q methodology, after asking a question, is to develop a ‘concourse’. This is the set of statements that will be sorted and represents “the sum of discourse on the research topic”(Eden, Donaldson, and Walker 2005). Relevant statements about the topic need to be sought from any possible sources, but public commentary, news articles, and extant academic works are a good way to start.

Some energy researchers have already applied Q-methodology to study the social acceptance of wind projects and the various perceptions involved. Ellis et al. (2007) propose that their application of the method in the UK allows for a bridge between the positivist and post-positivist approaches to understanding the policy debate (2007). This represents what might be called a standard application of Q-methodology to the topic. The researchers pre-prepared a collection of statements summarizing the given topic from possible standpoints. Participants then manually sorted the collection of statements into a given distribution. This is normally in the shape of a bell curve. The different patterns of sorting are subsequently compared using factor analysis to produce information about the modes of engagement, orientation, or forms of understanding that are shared about the given topic. The topic in this example was public acceptance of wind farms.

Another more general application was accomplished by Parkins et al. (2015) concerning environmental issues in Canada. By slightly changing the methodology, it is possible to incorporate even more public input and focus more on the visual landscape. Using pictures instead of statements is one possible application to make this possible (Hawthorne, Krygier, and Kwan 2008). This work considered the aesthetic response of community members to 'rails to trails' conversions in Ohio. The authors' use of images instead of statements could be easily translated to a project about renewable energy citing. Another interesting application of Q-methodology within geography was its incorporation into a project using participatory mapping (Forrester et al. 2015). The authors claim that by doing this they could "overcome a significant problem in social engagement: representing the unclear connection between what people say or do and their underlying attitudes, values or beliefs" (199). In addition to the engagement with the Q-sorts, community members could apply their newly organized sense of the topic at hand, flood plain management in this case, directly to a map of the area. Not only were they able to critically evaluate theirs and other's perceptions, but they were able to experience the spatial application of these perceptions in a novel way.

Research Design

Q-methodology involves the collecting and summarizing of a concourse, which is a representative collection of all possible statements about a situation or context. The statements used for this research project have been gathered using public commentary, meeting notes collected for the Solar PEIS as well as newspaper articles concerning solar energy in the San Luis Valley. There were 35 public comments on file with the information website regarding solar siting for southern Colorado. Newspaper articles were found in Lexus Nexus using the search terms “solar”, “Colorado”, “San Luis Valley”, and “Alamosa”. Stories covering transmission controversies even circulated at the national level. For example, in 2010 the New York Times produced an article covering the development of renewable energy in the San Luis Valley within a wider story concerning U.S. energy development during the age of the BP oil spill disaster. Two specific adaptable statements from this article were:

> 1. Some residents say that scuttling or reducing in scale a giant power transmission line could ultimately be a good thing, if it encourages smaller-scale development.
>
> 2. Others . . . believe that the electricity line is crucial to the valley’s future, and that powerful interests have once again gotten their way. (Johnson 2010)

In addition to these, extant academic works focusing on environmental, justice, and renewable energy perception were sampled topically.

Overall 62 statements were collected. The number was reduced to 48 by removing duplicate statements, simplifying similar statements and combining them, and removing statements which were symmetrical opposites from others. The positivity or negativity towards a statement can be captured by moving it towards an end of the q method distribution. The final element of selecting the different statements was an attempt to introduce balance, robustness, and structure to the final list. This was done by using the balanced block approach laid out in Fisher (Fisher et al. 1960) and again used in Brown

(1980). In this article, axes of environmental-economic and justice-independence were used. A full list of the Q statements can be found in Table 1. A helpful fact about the development of these statements for sorting is that the process can be self-policing. It is an assumption that if a statement is missing or inappropriate, the research subjects can let the researcher know and adjust accordingly.

Participants

The widest possible criteria were used during recruitment of participants due to the focus on community perceptions and the attempt to avoid directly interacting with stakeholders and community representatives that had been approached in other studies such as Farhar (2010). Opportunity sampling in this way is not normally condoned as a standard practice of Q methodology due to the danger of the study population not having "well-defined views relative to some of the socially complex subject matter we want to study" (Watts and Stenner 2012a, 70). The response to such a critique that this work makes is two-fold. First, a lack of well-defined views concerning the study subject-material, among other responses, represents a very interesting possibility. Second, Q methodology needs a study population "whose viewpoint *matters*" (Watts and Stenner 2012a, 71). Since this project is focused specifically on the perceptions of laypersons in the community, everyone's viewpoint matters. This project, of course, cannot sample every single viewpoint from across the community but that isn't the goal of a Q methodological approach. Discovering some of the viewpoints and looking at their interrelations is a far more attainable and still important aspect of this study in general.

Recruitment for participants was based on replies to flyers posted in online community forums and in public coffee shops. Due to low initial recruitment, a direct approach method was developed. Potential recruits were approached in a casual setting and asked if they might be interested in participation. Recruits were asked to confirm that they were over 18 years of age and residents of the San Luis Valley. Participants that replied to flyers were asked by email to not participate if they identified as members of the IRB documented vulnerable or special populations. Lists of the vulnerable and special populations were provided in a follow-up email to any recruited individual that responded to flyers. Individuals that failed the screening process were thanked for their interest in participating and given the contact information for the UNM Office of the IRB. All information gained through the recruitment process was de-identified following failure to be recruited or completion of the data collection process.

Table 1. List of Q Statements for Participant Sorting			
1	Solar energy benefits agriculture.	25	Use of private lands adjacent to utility substations has been haphazard.
2	Solar energy benefits public lands and should be put there.	26	The valley is vulnerable to market-driven unregulated industrialization.
3	It is good for energy to be generated close by.	27	Large centralized energy generation and remote transmission are obsolete.
4	Public lands are sacred.	28	Industrial scale solar energy projects may damage or destroy sensitive plant populations.
5	Solar energy needs to be developed at the community and state level.	29	The SLV is one of the most economically depressed areas in the entire country.
6	The federal government needs to step in and develop energy systems.	30	The valley needs an economic base that does not require water.
7	Current electricity infrastructure needs improvement.	31	Switching from agriculture to industry uses more water.
8	Regulation is an important aspect of solar energy development.	32	Protect public lands from development of any kind.
9	The San Luis Valley is isolated.	33	Solar development disrupts the landscape.
10	Open and useful land is plentiful here.	34	Allowing solar development sets a dangerous precedent for public lands in the future.
11	Land here is very valuable.	35	Solar energy development is bad for property values.
12	This community needs its public lands preserved.	36	We need to break our country’s dependence on oil.
13	Underdeveloped transmission lines threaten solar energy in the Valley.	37	The government should help those in small towns to afford solar energy.
14	Renewable energy will pay for itself in a short amount of time.	38	Solar energy belongs in the middle of nowhere.
15	The San Luis Valley sorely needs economic development.	39	Only wealthy people can afford to be environmentally friendly
16	Local farmers and ranchers have always protected the valley’s natural resources.	40	The community can easily get information on solar energy development.
17	The San Luis Valley is experiencing the effects of climate change.	41	It is difficult to follow the progress of renewable energy in the valley.
18	The San Luis Valley is home to different types of renewable energy advocates.	42	Renewable energy is the best way for the United States to fight climate change
19	Distributed (household) solar energy is better than industrial scale (solar fields).	43	The San Luis Valley is polluted.
20	How energy is generated and where this takes place are matters of public debate.	44	Agriculture in the San Luis Valley has damaged the environment.
21	Solar energy must offer a clear return to the community.	45	Ranching in the San Luis Valley has damaged the environment.
22	The SLV contains thousands of acres of degraded agricultural land.	46	Current energy projects in the San Luis Valley are damaging to the environment.
23	Intact lands have enormous public value	47	Transmission lines are damaging and ugly.
24	Intact public lands are being targeted for destruction.	48	The San Luis Valley is running out of water.

Table 1 List of statements developed from concourse for Q methodology participants to sort.

Procedure

The procedure for administering the Q sort follows a simple three step process. First, the 48 Q statements were provided to the participants on numbered slips of paper. They were asked to sort the 48 statements into three piles – agree, neutral, and disagree. The participants were instructed that the sorting distribution runs from “agrees with my personal philosophy,” through “neutral,” and then to “disagrees with my personal philosophy”. This first step is designed to make the next step less intimidating. In step two, the participant is then directed to take their three piles and place them along the given distribution, which has been provided by way of a large sheet of graph paper. An example of the distribution and an example photo can be seen in figure 3. It is important to point out that all the statements must be placed onto the distribution and that there is no ranked difference between each sort in a single column. Following completion of the sorting of statements, participants were asked to inspect the completed Q sort and make any last-minute changes. For the final step, a small follow-up interview was conducted. All participants were asked three open-ended questions, namely:

1. How do you feel about this topic?
2. Do you feel that any of the items in the Q sort were inappropriate or that items were missing altogether and why?
3. What will happen next with solar energy in your community?

Answers were recorded in short-hand and then re-written following the dismissal of the participant. A full accounting of the IRB approval and exemption materials for this research have been included in the appendix.

Participant # 18		39	45	13	32	11	36	40	7	21	29	15
		47	28	38	4	25	43	3	6	42	1	14
			44	33	35	22	18	8	5	16	37	
				26	34	24	31	23	48	10		
					30	46	2	9	17			
						27	19	20				
							41					
							12					

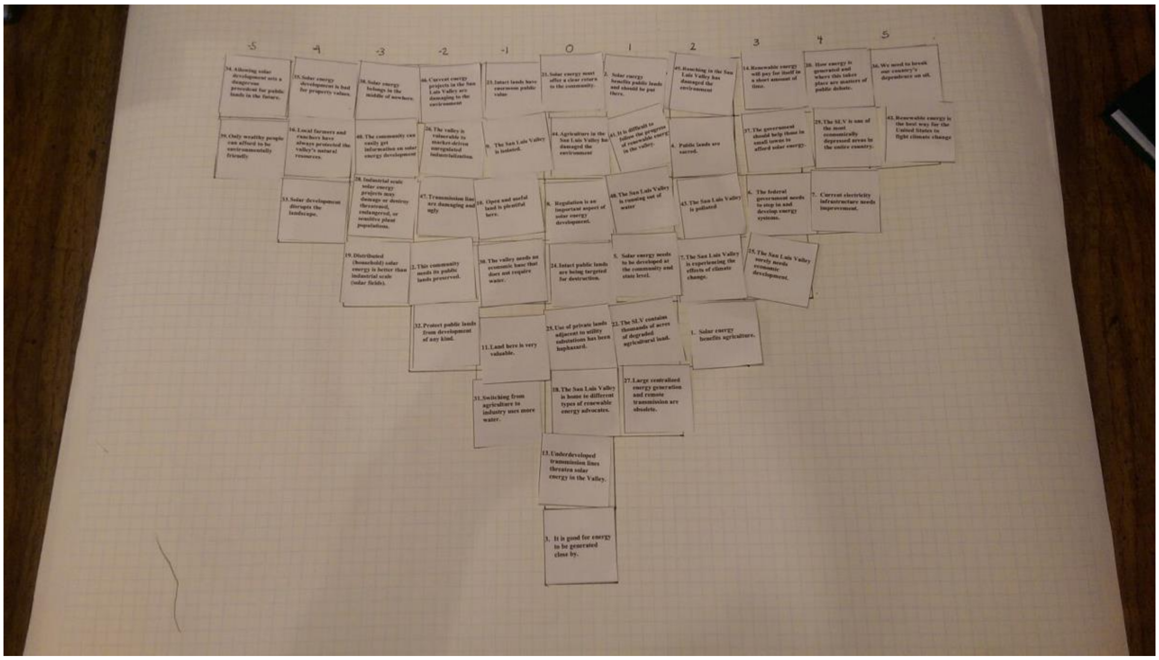

Figure 3 Example Q sort and Example photo of participant Q sort. Note that the shape of the distribution forces participants to place fewer statements at either end that they feel strongly about while allowing for them to inevitably have more neutral or unknown statements in the middle.

Statistical Analyses

Q methodology offers a way to quantify subjectivity or qualitative data. This analysis traverses three methodological transitions that are unique to Q methodology and are described in Watts and Stenner (2012a). These are, in order, the extraction of factors from the Q sorts, the creation of typical factor arrays, and the interpretation of those factor arrays. The resulting interpretations are the largest aspect of the results of the study produced.

As described in the methodology section, this Q methodology study intercorrelated 17 Q sorts and subjected them to a by-person factor analysis. Intercorrelation specifically measures mutual connections between separate items. Factor analysis is a method that reveals patterns based on the connections. Essentially, factors are hidden variables within a spectrum of data that allow data to be generalized and simplified in way that is meaningful. In Q methodology, these patterns reveal groups of research participants with shared perspectives, which are henceforth called factors. All analyses were carried out using the dedicated computer package PQMethod (Schmolck and Atkinson 2002). Three factors were extracted and rotated, which explained 45percent of the study variance or 45percent of the "full range of meaning and variability present in the study" (Watts and Stenner 2012a, 98). The decision to extract 3 factors comes from the suggestion to extract a factor for every 6 sorts provided by Watts and Stenner. This strategy was checked by allowing PQMethod to also run a Horst Centroid Analysis on the data (Horst 1965), which also recommended 3 factors. The relative subjectivity of each Q sort can be measured by a factor loading. The equation for calculating the significant factor loading at the $p < 0.01$ is as follows:

2.58 x [1/(sq. root of # of Q set items)]

For a project with 48 items to be sorted, a significant factor loading is anything above the absolute value of 0.38. In this study, 14 of the 17 sorts loaded significantly on one factor or another meaning that 14 of the Q sorts could be associated with one or other factor's viewpoint in a statistically significant way (i.e. at 99percent confidence). This means that out of all the acceptable sorts, only 14 participants shared enough common ground with a factor to be considered. Table 2 shows the rotated factor matrix with included eigenvalues and variances for each of the three factors. Eigenvalues of the Significant Q sorts are shown in bold. This table shows, for example, that the five sorts with significant loadings for Factor 1 – sorts 3, 7, 8, 9, and 10 – share a distinct understanding of the relationship between solar energy and their community.

Q sort	Factor 1	Factor 2	Factor 3
1	0.26	0.35	**-0.65**
2	0.06	0.15	0.32
3	**0.61**	0.1	0.29
4	0.23	0.29	**0.46**
5	0.29	**0.61**	0.33
6	0.14	**0.72**	0.13
7	**0.55**	0.09	**0.62**
8	**0.78**	0.23	0.17
9	**0.75**	-0.01	-0.02
10	**0.48**	0.2	0.21
11	0.5	0.17	**0.52**
12	0.01	0.09	0.21
13	-0.13	**0.53**	0.04
14	0.3	0.07	-0.03
15	0.32	**0.62**	-0.03
16	0.3	**0.74**	0.14
17	0.5	0.15	**0.61**
EV	3.1031	2.508	2.1138
variance %	18.25	14.75	12.43
total var%	45.44		

Factor 1	3, 8, 9, 10
Factor 2	5, 6, 13, 15, 16
Factor 3	1(-ve), 4, 11, 17
Confounded	7
Non-Significant	2, 12

Table 2 The rotated factor matrix showing the factor loadings for each Q sort along the three factors. Loadings above 0.38 are significant. Also included is a summary table indicating which Q sorts load significantly on each factor, more than one factor (confounded), or on no factors (non-significant). The (-ve) notation simply means that the factor loading was negative.

For the second transition, it is important to remember that a factor is a shared viewpoint about the topic at hand. In this case, the topic at hand is solar energy resources in a rural community. The significantly loading factors (i.e. those that align with that factor's viewpoint) are merged through weighted averaging. Those significant Q sorts with the highest factor loadings are given more weight in the average because they are more closely in line with that factor's viewpoint. The result looks like a completed Q sort and is called a factor array (Figure 3).

The final methodological transition involves a meticulous and holistic exploration of the patterns revealed in the factor arrays to move from factor arrays to factor interpretations. The arrays themselves are the key to understanding each factor. Participants provided additional information to assist in the interpretation of each factor array through follow-up interviews. It is important to remember that the goal of the factor interpretation is to "uncover, understand, and fully explain the viewpoint captured by the factor and shared by the significantly loading participants" (Watts and Stenner 2012a, 181). The interpretations are displayed in the results section as descriptions of the factor arrays with summary details of participants who loaded significantly on those factors.

Results

Rankings of the relevant items are provided in what Watts and Stenner (2012) describe as *commentary* style where the full text of the statement is provided along with the number of the statement and ranking within the factor array. For example, in factor array #1 the statement "Solar energy benefits agriculture**"** (Table 1) is ranked in the +4 column of the array and is referred to in the results section as:

01 Solar energy benefits agriculture. +4

The narrative of the interpretation will be woven around these citations and would say that the representatives agreeing with Factor 1 felt very strongly about the positive connection between solar energy projects and the practice of agriculture.

The results of Q methodological factor analyses are displayed as interpretations. Each extracted factor is given an interpretation in narrative or commentary style and cites statements and their ranking on a factor array. It is crucial to remember that the scores are relative to one another and that the factor interpretations are based off of an intermediate "crib sheet" (Watts and Stenner 2012a, 150). Crib sheets are an organizational technique developed early on for Q methodology. They involve charting the statements for the factors in a way that specifically shows which ones are relatively ranked higher or lower for a given factor. An example crib sheet for factor 1 can be seen in Figure 4. A side-effect of this is that the scores for a given statement might seem neutral or even negative, but may be ranked higher on one factor than on all the others or vice versa.

Factor 1

Factor 1 has an eigenvalue of 3.10 and explains 18percent of the study variance. 4 participants loaded significantly on this factor alone and one loaded significantly on this factor but more so on another.

Factor Interpretation Crib Sheet for Factor 1	
Items Ranked at +5	**Items Ranked at -5**
17. The San Luis Valley is experiencing the effects of clima…	39. Only wealthy people can afford to be environmentally fri. . .
48. The San Luis Valley is running out of water.	31. Switching from agriculture to industry uses more water.
Items Ranked Higher in Factor 1 Array than in Other Factor Arrays	**Items Ranked Lower in Factor 1 Array than in Other Factor Arrays**
1. Solar energy benefits agriculture.	2. Solar energy benefits public lands and should be put ther. . .
9. The San Luis Valley is isolated.	5. Solar energy needs to be developed at the community. . .
10. Open and useful land is plentiful here.	8. Regulation is an important aspect of solar energy develop. . .
12. This community needs its public lands preserved.	14. Renewable energy will pay for itself in a short amount . . .
13. Underdeveloped transmission lines threaten solar energy. . .	21. Solar energy must offer a clear return to the community.
18. The San Luis Valley is home to different types of renewa. . .	24. Intact public lands are being targeted for destruction.
19. Distributed (household) solar energy is better than indu . . .	25. Use of private lands adjacent to utility substations has. . .
23. Intact lands have enormous public value.	26. The valley is vulnerable to market-driven unregulated in. . .
27. Large centralized energy generation and remote transmiss. . .	32. Protect public lands from development of any kind.
28. Industrial scale solar energy projects may damage or des. . .	37. The government should help those in small towns to affor. . .
29. The SLV is one of the most economically depressed areas . . .	42. Renewable energy is the best way for the United States. . .
33. Solar development disrupts the landscape.	43. The San Luis Valley is polluted.
34. Allowing solar development sets a dangerous precedent fo. . .	
41. It is difficult to follow the progress of renewable ener . . .	

Figure 4 Example crib sheet for Factor 1 showing the most important statements for this factor.

Though solar energy is important to the factor 1 viewpoint, it is important to note that protection of the environment and public lands is equal if not more important to it.

25 This community needs its public lands preserved +2
10 Open and useful land is plentiful here +2
23 Intact public lands have enormous value +1

Solar energy production at the distributed level is preferred because of a concern for the effect that large or industrial scale projects have the potential to be damaging to the land.

19 Distributed (household) solar energy is better than industrial scale (solar fields) solar energy 0
28 Industrial scale solar energy projects may damage or destroy threatened, endangered, or sensitive plant populations -1
33 Solar energy disrupts the landscape 0
2 Solar energy benefits public lands and should be put there -1

It is important to also note that the members of factor 1 do not necessarily feel that there is or has been a recent threat to public lands. Specifically, the programmatic Solar EIS planning and the extant solar projects are not seen as negatively impacting the valley. Public lands don't need to be protected from all development.

24 Intact public lands are being targeted for destruction -4
32 Protect public lands from development of any kind -3

However, use of agricultural land would be a better option than using other public lands. Factor 1 viewpoint sharers find that the valley is isolated and economically depressed. One of the most important aspects relating to this is the availability of water both at present and for the future. As water shortages and state policies put pressure on the agricultural sector, the question of what to do with the leftover land provides an opportunity to save water and generate energy industry.

1 Solar energy benefits agriculture +4
9 The San Luis Valley is isolated +3
29 The San Luis Valley is one of the most economically depressed areas in the whole country +4
48 The San Luis Valley is running out of water +5
31 Switching from agriculture to industry uses more water -5

When thinking about the practicality and economics of renewable energy projects, Factor 1 proponents feel that solar energy projects don't need to benefit the community alone. In fact, the importance of transmission line infrastructure development is something they are aware of. In holding with their feelings concerning distributed vs. industrial scale solar projects, the feel more strongly than the other factors that centralized energy generation and remote transmission is becoming obsolete.

13 Underdeveloped transmission lines threaten solar energy in the valley +2

27 Large centralized energy generation and remote transmission are obsolete -1
5 Solar energy needs to be developed at the community and state level +1
21 Solar energy must offer a clear return to the community. 0

They also don't necessarily believe that imposed regulation on the development of solar energy is helpful. Despite this, they do not completely ignore community interests and have caution concerning potential abuses. They certainly don't feel that the valley is particularly vulnerable to issues of abuse.

8 Regulation is an important aspect of solar energy development 0
34 Allowing solar development sets a dangerous precedent for public lands in the future -1
26 The valley is vulnerable to market-driven unregulated industrialization -2

The most important aspects of the viewpoint of members of factor 1 can be explained with the above information as a framework. They feel strongly that the San Luis Valley is experiencing the effects of climate change in one way or another and they feel that renewable energy is an important aspect of dealing with this although not as much as other factors. The also make a distinction between experiencing climate change and feeling like their community is itself polluted. This suggests that they feel, as is common, that the effects of climate change can be found where they live, but the sources cannot.

17 The San Luis Valley is experiencing the effects of climate change +5
42 Renewable energy is the best way for the United States to fight climate change +3
43 The San Luis Valley is polluted -3

Additionally, the factor 1 viewpoint recognizes that there are different types of renewable energy advocates in the valley. This means that specifically that there might be some flexibility in this viewpoint. It also recognizes that it has been difficult to stay informed regarding the progress of solar energy in the valley. This has not translated into a view that some people may need more help with renewable energy participation. The relative inability of some members of society to take environmentally friendly actions due to cost is not something that this viewpoint recognizes. They do recognize that the costs for energy development do not recoup themselves easily. The disparate relationship between these two ideas is not evident to factor 1 either.

18 The San Luis Valley is home to different types of renewable energy advocates +3
41 It is difficult to follow the progress of renewable energy in the valley +1
37 The government should help those in small towns to afford solar energy 0
14 Renewable energy will pay for itself in a short amount of time 0
39 Only wealthy people can afford to be environmentally friendly -5

Factor 2

Factor 2 has an eigenvalue of 2.50 and explains 15percent of the study variance. 5 sorts loaded significantly on this factor alone.

Factor Interpretation Crib Sheet for Factor 2	
Items Ranked at +5	**Items Ranked at -5**
5. Solar energy needs to be developed at the community . . . 36.We need to break our country's dependence on oil.	33.Solar development disrupts the landscape. 34.Allowing solar development sets a dangerous precedent . . .
Items Ranked Higher in Factor 2 Array than in Other Factor Arrays	**Items Ranked Lower in Factor 2 Array than in Other Factor Arrays**
3 It is good for energy to be generated close by.	1. Solar energy benefits agriculture.
4. Public lands are sacred.	2. Solar energy benefits public lands and should be put . . .
7. Current electricity infrastructure needs improvement.	6. The federal government needs to step in and develop . . .
11. Land here is very valuable.	8. Regulation is an important aspect of solar energy deve. . .
20. How energy is generated and where this takes place are . . .	9. The San Luis Valley is isolated.
22. The SLV contains thousands of acres of degraded agricult. . .	10.Open and useful land is plentiful here.
24. Intact public lands are being targeted for destruction.	12.This community needs its public lands preserved.
25. Use of private lands adjacent to utility substations has. . .	13.Underdeveloped transmission lines threaten solar energy. . .
26. The valley is vulnerable to market-driven unregulated in. . .	15.The San Luis Valley sorely needs economic development.
27. Large centralized energy generation and remote transmiss. . .	16.Local farmers and ranchers have always protected the . . .
42. Renewable energy is the best way for the United States . . .	17.The San Luis Valley is experiencing the effects of clima. . .
43. The San Luis Valley is polluted	18.The San Luis Valley is home to different types of renewa . . .
44. Agriculture in the San Luis Valley has damaged the envir. . .	19.Distributed (household) solar energy is better than indu. . .
45. Ranching in the San Luis Valley has damaged the environm. . .	29.The SLV is one of the most economically depressed areas. . .
	35.Solar energy development is bad for property values.
	37.The government should help those in small towns to affor. . .
	38.Solar energy belongs in the middle of nowhere.
	40.The community can easily get information on solar energy. . .
	46.Current energy projects in the San Luis Valley are damag. . .

Figure 5 Example crib sheet for Factor 2 showing the most important statements for this factor

In the viewpoint of the Factor 2 participants, solar energy is an integral step forward in the United States' fight to address climate change. An interesting factor to this perspective is that it isn't seen as disruptive or particularly dangerous depending on the scale or location. This group does not share a common concern that solar energy disrupts the landscape.

5	Solar energy needs to be developed at the community and state level +5
42	Renewable energy is the best way for the United States to fight climate change +4
38	Solar energy belongs in the middle of nowhere -4
33	Solar energy disrupts the landscape -5

More specifically, concerns about the proximity of solar generation, its installation on public land and the size of installations aren't as important as improving energy infrastructure overall and breaking the nation's dependence on outside sources of energy. Regulation concerning development of solar resources isn't a very important aspect of this viewpoint either.

8	Regulation is an important aspect of solar energy development 0
12	This community needs its public lands preserved 0
19	Distributed (household) solar energy is better than industrial scale (solar fields) -1
36	We need to break our country's dependence on oil +5
7	Current electricity infrastructure needs improvement +3

This does not mean that these people don't have feelings of ownership and responsibility towards public lands. On the contrary, they feel strongly that public lands are sacred.

4	Public lands are sacred +4

This point is reinforced by further feelings that other land uses have not been appropriately overseen and have in some cases been damaging to the environment. Agriculture in the form of farming is perceived as more destructive than ranching. The San Luis Valley has already been polluted in their opinion, which means that some damage has been done and that solar energy projects represent a way to fix some of it.

43	The San Luis Valley is polluted +3
44	Agriculture in the San Luis Valley has damaged the environment +3
45	Ranching in the San Luis Valley has damaged the environment 0
24	Intact public lands are being targeted for destruction +1

In contrast, solar energy projects in the valley are not seen as having been destructive. Also of interest is the acknowledgement of pollution but a relatively weaker feeling that the valley experiences the effects of climate change.

46	Current energy projects in the San Luis Valley are damaging the environment -3
17	The San Luis Valley is experiencing the effects of climate change +1

The valley itself is seen as containing large tracts of degraded agricultural land, which is still very valuable. If the land cannot be used for agriculture, solar energy production would certainly be a good stand in.

22	The San Luis Valley contains thousands of acres of degraded agricultural land +1
11	Land here is very valuable +2
35	Solar energy development is bad for property values -4

The benefits of solar energy to public lands and agriculture in their current state are ranked lower in factor 2 than in other factors. They aren’t necessarily in disagreement to this viewpoint, but it seen rather as a practical use of these lands other than what they are used for currently.

1	Solar energy benefits agriculture 0
2	Solar energy benefits public lands and should be put there -1

It is beneficial to generate electricity close by if possible. This is perceived as more efficient than centralized sources of energy transmitting into the valley from elsewhere. One place where the generation of electricity by solar energy would be most beneficial is right next to existing substations. The lack of present use for these lands is seen as a wasted opportunity. Low rankings of these statements show that factor 2 participants are relatively impassionate concerning issues of transmission.

3 It is good for energy to be generated close by +2
25 Use of private lands adjacent to utility substations has been haphazard -1
27 Large centralized energy generation and remote transmission are obsolete -1
13 Underdeveloped transmission lines threaten solar energy in the valley -1

Proponents of this viewpoint anticipate debate concerning solar energy development and feel strongly that the discussion needs to be open and public. They do not strongly recognize other types of allies in the community as being a part of this discussion. The role of the valley's ranching and farming residents isn't seen as necessarily helpful either.

20 How energy is generated and where this takes place are matters of public debate +4
18 The San Luis Valley is home to different types of renewable energy advocates 0
16 Local farmers and ranchers have always protected the valley's natural resources -3

They also feel that the valley is vulnerable to unregulated industry but don't feel that this danger extends to the development of solar energy resources.

26 The valley is vulnerable to market-driven unregulated industrialization +2
34 Allowing solar development sets a dangerous precedent for public lands in the future -5

For those that do want to push for solar energy development, Factor 2 participants acknowledge that following the development of solar energy projects and decisions in the valley is difficult.

40 The community can easily get information on solar energy development -3

This does not mean that they would like just any force to develop their resources. Local government and industry are preferable to the federal government. This is supported by a stronger faith in the local economy than the other factors. The issue of the affordability of taking advantage of resources to be environmentally friendly is not a concern.

6 The federal government needs to step in and develop energy systems -2
15 The San Luis Valley sorely needs economic development +1
29 The San Luis Valley is one of the most economically depressed areas in the entire country +1
37 The government should help those in small towns to afford solar energy 0

Factor 3

Factor 3 has an eigenvalue of 2.11 and explains 12percent of the study variance. Five sorts loaded significantly on this factor and four of them loaded on this factor alone. One of the sorts represents a significant loading, but is negative. This means that the factor is bipolar and a fourth factor could exist that is a mirror of factor 3.

Factor Interpretation Crib Sheet for Factor 3	
Items Ranked at +5	**Items Ranked at -5**
6. The federal government needs to step in and develop energ. . .	44.Agriculture in the San Luis Valley has damaged the envir. . .
15.The San Luis Valley sorely needs economic development.	45.Ranching in the San Luis Valley has damaged the environm . . .
Items Ranked Higher in Factor 3 Array than in Other Factor Arrays	**Items Ranked Lower in Factor 3 Array than in Other Factor Arrays**
2. Solar energy benefits public lands and should be put ther. . .	3. It is good for energy to be generated close by.
8. Regulation is an important aspect of solar energy develop. . .	4. Public lands are sacred.
10.Open and useful land is plentiful here.	7. Current electricity infrastructure needs improvement.
14.Renewable energy will pay for itself in a short amount . . .	11.Land here is very valuable.
16.Local farmers and ranchers have always protected the val. . .	12.This community needs its public lands preserved.
21.Solar energy must offer a clear return to the community.	13.Underdeveloped transmission lines threaten solar energy. . .
31.Switching from agriculture to industry uses more water.	18.The San Luis Valley is home to different types of renewa. . .
32.Protect public lands from development of any kind.	20.How energy is generated and where this takes place are . . .
35.Solar energy development is bad for property values.	22.The SLV contains thousands of acres of degraded agricult. . .
37.The government should help those in small towns to affor. . .	23.Intact lands have enormous public value.
38.Solar energy belongs in the middle of nowhere.	27.Large centralized energy generation and remote transmiss. . .
39.Only wealthy people can afford to be environmentally fri. . .	28.Industrial scale solar energy projects may damage or des. . .
40.The community can easily get information on solar energy. . .	36.We need to break our country's dependence on oil.
46.Current energy projects in the San Luis Valley are damag . . .	41.It is difficult to follow the progress of renewable ener. . .
	42.Renewable energy is the best way for the United States . . .
	43.The San Luis Valley is polluted.
	48.The San Luis Valley is running out of water.

Figure 6 Example crib sheet for Factor 3 showing the most important statements for this factor.

Factor 3 participants hold a view of the San Luis Valley that exemplifies the openness and usefulness of the land there. These lands are in no way sacrosanct and thusly, don't need to be specifically preserved. In fact, the monetary value of the land isn't something that they consider very much.

10 Open and useful land is plentiful here +2
4 Public lands are sacred -4
11 Land here is very valuable 0
12 This community needs its public lands preserved 0
23 Intact lands have enormous public value -2

Their viewpoints concerning the valley's residents are very positive as well.

16 Local farmers and ranchers have always protected the valley's natural resources +4

There is not a very strong feeling concerning whether the valley experiencing the effects of climate change, but if it were, it is not the fault of ranchers or farmers. Climate change is also not felt specifically in the San Luis Valley either. Unlike other factors, the importance of water is relatively lower for factor three than for the other factors

43 The San Luis Valley is polluted -3
17 The San Luis Valley is experiencing the effects of climate change +2
44 Agriculture in the San Luis Valley has damaged the environment -5
45 Ranching in the San Luis Valley has damaged the environment -5
48 The San Luis Valley is running out of water +1

There is a definite feeling that the valley needs economic support, and that support should come in part from the federal government. There is an understanding that with government support comes an element of outside regulation and there isn't an issue with that. Renewable energy projects quickly pay for themselves in any case.

6 The federal government needs to step in and develop energy systems +5
15 The San Luis Valley sorely needs economic development +5
8 Regulation is an important aspect of solar energy development +1
14 Renewable energy will pay for itself in a short amount of time +4

As a show of community support, solar energy needs to offer a clear return to the community. This return should extend to those who cannot afford to be environmentally friendly through government assistance. It may or may not be that some people just can't afford it, but it is important to note again that the valley is economically depressed.

21 Solar energy must offer a clear return to the community +3
37 The government should help those in small towns to afford solar energy +4
39 Only wealthy people can afford to be environmentally friendly -1
29 The San Luis Valley is one of the most economically depressed areas in the entire country +3

With these items in mind, industrial scale solar energy is just fine and there isn't an issue with energy being generated at a distance and in a centralized, large-scale fashion. Consideration of disruptions to the local grassland ecosystems are not necessary in these cases.

27 Large centralized energy generation and remote transmission are obsolete -3
28 Industrial scale solar energy projects may damage or destroy threatened, endangered, or sensitive plant populations -4

Factor 3 also feels that engagement with renewable energy projects is not difficult to achieve and that information is accessible. They place identifying other renewable energy advocates lower than the other factors. Also, topics of greater concern in other factors such as infrastructure, location of energy sources, and public discussion of such factors are matters of relative indifference.

41 It is difficult to follow the progress of renewable energy in the valley -3
40 The community can easily get information on solar energy development +2
18 The San Luis Valley is home to different types of renewable energy advocates 0
7 Current electricity infrastructure needs improvement. 0
13 Underdeveloped transmission lines threaten solar energy in the valley -1
38. Solar energy belongs in the middle of nowhere. -1
3 It is good for energy to be generated close by +1

20 How energy is generated and where this takes place are matters of public debate +1

Discussion

The principle goal of this work has been to explore some of the intersections regarding small community engagement with renewable energy projects and solar energy especially. Two research questions were attempted in the performance of this project. The first concerns what perspectives are found by using Q methodology in this research area. The second question looks specifically at the results through a lens of the materiality and justice within human/energy interactions. In answering these questions, three primary implications are derived. These are the comparison of the San Luis Valley to other locations where renewable energy projects are being attempted, the comparison of the San Luis Valley to other Solar PEIS sites, and what the results of this study tell us about the probability that utility-scale solar energy will someday be a reality within the valley.

It is critical to remember that Q methodology, as it is used in this project, produces data about feelings instead of hard facts. The fact is that these feelings have been shown to exist in the San Luis Valley and in relation to solar projects there. Q method studies must reconcile the facts presented in the literature with the feelings discovered using the data. In doing so, the different revealed factors are compared to produce meaningful insights about the extant literatures.

Valley Perspectives on Solar Energy

Each of the factors from the results supports solar energy projects in the valley. The results also reveal that the factors have very different viewpoints along several topics. The most prominent of these are differences concerning the valley's economic strength, best practices for siting projects, the role of ranchers and farmers in the valley, and perception of water scarcity and climate change or pollution in the valley. These are further influenced by perception of the role of government and value of the land. Hunold and Leitner (2011), in their study of discourses of the desert as wasted space, provide an analogous example in the placement of transmission lines and huge solar energy projects. Another oft-cited article commenting on this, Van der Horst (2007), states that those living on "stigmatized lands" often welcome renewable energy projects, while the opposite is often expressed by residents that value their surroundings more.

A closer interpretation of the factors exposes some hybrid or contradictory elements in the ways that the different factors view the subject matter (Marafiote and Plec 2006; Dickinson 2014). For example, factor 1 is not able to state the solar energy can pay for itself. It also does not display a strong feeling that the government should help people pay for access to renewable energy. Contradictorily, these participants disagree that only the wealthy can pay to be environmentally friendly. It is important to recognize the limit of the methodology here to account for all meanings especially when one statement refers to renewable energy and another to the action of being environmentally friendly; however, hybridity in discourse is important to recognize in looking at social barriers to energy projects. A further study could uncover more about cultural discourses concerning solar energy projects.

Reducing the multiple literatures used to frame and ground this work to focused and useful themes represents a challenge due to their complexity. This work has drawn from an interdisciplinary amalgamation to approach its subject matter. Cultural themes and socio-technical studies are used to frame concepts of social acceptance, perception, and justice. The geographic concepts of renewable energy acceptance used by Pasqualetti

(2011) stand out particularly as tools to organize themes presented throughout the literature. The concepts that are particularly appropriate in this research are immobility, immutability, and solidarity. By using Pasqualetti's concepts as crucial lenses for viewing the results of the Q methodology, the implications of the factor viewpoints can be better understood.

Immobility

The first concept, immobility, is used to discuss the specific location needed to accomplish the renewable energy project in question and asks if it can be moved elsewhere. A balance needs to exist between how far away a big renewable energy project can be and how productive and efficient it can remain (Pasqualetti 2011). The locations available for solar energy projects in the San Luis Valley that were planned in accordance with the Solar PEIS were heavily negotiated and have possibly become impossible to use due to transmission issues (Carlisle et al. 2014; Farhar et al. 2010). The reason such projects can be so complex is that planning involves finding the right location for installation of large scale solar energy based on environmental, economic, and socio-cultural factors. The feelings of locals still reflect different aspects of this even though progress on solar energy expansion has been minimal.

A very important finding of this project is that solar energy was seen favorably across all the extracted factors. The different ways that this favorability is expressed can be striking. For example, the factor 1 viewpoint places importance in protecting public lands in from all development. Factor 2 agrees that protecting land is important, but does not see large solar projects as a potential threat to public land in the way that factor 1 does. The factor 3 viewpoint, on the other hand, does not see the protection of public land as an important part of the discussion. Carlisle et al. (2016) find in their work in Southern California that proximity to large projects is not the ultimate deciding factor, but is important. More important is the interplay between proximity of a project and the complex social structures within individual communities. The immobility of such heavily negotiated projects would only be acceptable to two of the three factors that have been found in the San Luis Valley. Despite not representing the full spectrum of viewpoints, it is important to note the potential conflict and evident lack of utility-scale construction. Environmental and procedural justice cannot be accomplished without the "meaningful participation and adequate representation of all groups" (Yenneti and Day 2015, 672). Immobility is certainly not the only concept that affects issues of justice.

Immutability

Immutability deals with landscape permanence. Pasqualetti (2011) tells us that "it is part of the human condition to believe that landscapes . . . will not change over time" (914). Even when renewable energy has the support of a community, there can be issues when perception of landscape is threatened. Although, the term NIMBY might be easily applied to anyone who falls into this category, there are of course many more facets to understanding social acceptance and change (Devine-Wright 2009). In the San Luis Valley, this conversation might play out in different ways based on the revealed factors. Factor 1, as is the trend, prefers distributed solar energy for preserving land and ranked related statements higher than the other factors. The other factors show less of an attachment to landscape permanence. Perhaps this is because the San Luis Valley is more of a high desert landscape, which is flat and homogenous at first glance. If residents aren't attached to the appearance of the landscape nearest them, they won't mind it changing.

Another aspect of immutability is the concern for climate change. Factor 1 participants felt very strongly that the effects of climate change were and could be felt in the San Luis Valley. Perception and acceptance of renewable energy projects can be related to sense of climate change, whereby changes in landscape caused by solar fields or wind farms are more acceptable than the potential changes associated with a changing climate (Devine-Wright 2007). Other factors felt that climate change wasn't an issue, but that pollution was. Without further study of these different perceptions, it is difficult to say whether the difference is simply semantic or another possible question that should be asked.

It is also important to acknowledge the differences in landscape perceptions that belong to different people. When discussing landscape, the different factors have contrasting viewpoints concerning ranching and agriculture. Factor 2 places the idea that solar energy disrupts the landscape very negatively and holds that the agricultural and ranching practices of the valley have been destructive. This landscape is degraded in their viewpoint. The factor 3 viewpoint would disagree vehemently. Each take on the immutability or importance of immutability of the landscape adds to the difference between the priorities of the factors.

Solidarity

Solidarity describes the relationship between people and the land. This can be somewhat difficult to pin down as this project hasn't focused explicitly on the relationship between the people of the San Luis Valley and the lands that they inhabit, but rather approaches this through energy perception. This can, however, be seen through their viewpoints regarding solar projects. The factor 1 viewpoint recognizes that open and useful land is plentiful in the valley. Factor 2 members feel strongly that public lands are sacred. The difference between these two emphases is interesting especially as both factors value the protection of public lands. As stated above, factor 2 does not feel that the sacredness of the land should prevent solar energy projects, while factor 1 is wary of those same projects damaging the land. Again, factor 3 feels that the current uses of the land for agriculture and ranching are appropriate. They also feel that farmers and ranchers have been the protectors of the valley's resources. These viewpoints represent different approaches to solidarity as Pasqualetti defines it that tend to disagree with one another and create different feelings about the possibilities of solar projects. The idea that each of these viewpoints carries weight and should be part of the conversation is important for justice considerations, but also for how research can observe discursive constructions of land use.

Justice and Materiality

Yenneti and Day (2015) state, "two-way information exchange, meaningful participation, and adequate representation of all groups including the marginalized, signposts the major elements of procedural justice that need to be addressed" (pg. 672). Using these criteria to observe justice in energy siting decisions in the San Luis Valley produces some interesting points. First, during initial planning for the Solar PEIS, public support for distributed solar energy projects (i.e. household and small scale) was not considered as the two primary designs for solar energy were to be either centralized photovoltaic fields or concentrating solar facilities. According to Farhar et al. (2010) the early discussion concluded that while "central-station flat-plate PV deployment will become more commonplace in the future, distributed PV generation has a much higher energy market value than central station PV". This was in reference to the choice between the two possible technologies. Trahan (2010) sheds some light on this decision as federal investment in distributed energy systems runs contrary to the extant trends and infrastructure of the United States. The importance of this from a justice perspective is that it places the responsibility and therefore power for energy siting decisions in the hands of a far smaller group of stakeholders.

During the collection of data and before the analysis, it had already become clear that the community enjoyed support for solar energy projects, but participants didn’t maintain much knowledge regarding the valley’s issues in implementing its plans. It would be pertinent to return and take a fuller accounting of perceptions of the actual project design and subsequent events leading to the transmission line controversies. Such a project should also take a closer look at these events from the perspective of marginalized populations. What we do know is that the community soured to the project, in part, thanks to the speed at which decisions were being made. Future project designs or continuations of the current project should take further community involvement into account. Within this idea rests a connection to the topic of energy materiality.

Materiality within the broader topic of technological modernity is another important aspect for discussion. Perceptions of the technological aspects of energy weren’t a subject of this Q methodology, but in a broader sense, the relationship to energy systems was. Yun and Lee (2015) discuss several socio-technical perspectives that are important in gauging the advancement of societal readiness for renewable energy expansion. These are social trust, social support, perceived system quality, and facilitating technical conditions (Yun and Lee 2015). They are discussing factors that deal with changing the material relation that people have with energy. They point to the issue of technological advancement absent of social engagement, which drives at the core of the issue in this work. Each factor produced by the Q methodology shows positive feelings about solar energy projects. All of them do so with an air of awe at such a complex technology. One respondent described the field of drive-in theater sized panels just north of Alamosa as “very sci-fi”. There is no doubt that a more social approach, which includes engagement with the actual technology of renewable energy is needed and would produce helpful outcomes both for a more just approach to energy decision making and a more socially integrated involvement and appreciation for these technologies.

Comparison to Other Sites

Utility-scale renewable energy is being planned and implemented all around the world in various ways. These include wind, geothermal, solar, etc. and one aspect that ties them together is resistance from communities or environmental organizations. In the case of solar, they tend to object to “permanent destruction of hundreds of thousands of acres of pristine public lands designated for multipurpose use that belong to the people” (Bailey 2008). Pasqualetti (2011a) studies renewable energy social barriers in the United Kingdom, United States, and Mexico where he finds that social barriers have outstripped technical issues and have begun to “inhibit, redirect, discourage, or even halt projects” (219). From a lens of materiality and socio-technical systems, such efforts may be an attempt to slow progress until communities have had enough time to get a grip on what a transition to renewable energy is going to mean for their community specifically. In this regard, the San Luis Valley seems quite similar and especially considering transmission difficulties. Farhar (2010) finds that valley residents did not have the technical knowledge or will to purchase third-party expertise that would have been useful in helping them make informed decisions regarding their opposition or support of solar projects.

The transmission line issues in the San Luis Valley also set this situation apart from other utility-scale renewable energy controversies. Despite solar remaining popular at the distributed scale, the will to develop renewable energy at the utility-scale rested with investors such as energy companies and government agencies instead the community itself. Large solar projects would only be feasible if the energy could be exported to where it is needed. With transmission expansion blocked in almost every direction, the focus will need to shift to those barriers before considering the actual development of the solar fields themselves. Other authors have even gone so far as to say that “current regulations, practices, and norms for long distance energy transmission may be doomed because of complications with right-of-way and transmission line easements unless the energy easement itself is reconceptualized” (Ahmad 2014).

Notable developments in other areas within the Solar PEIS include a fight for the creation of new national monuments, expansion of national parks, and other land preservation strategies in response to proposed pressure to put utility-scale solar projects in California (Warburg 2015). It is similar in that proponents followed the discourses of technological modernity conquering the wasted spaces of the desert (Hunold and Leitner 2011) and that economic benefits such as jobs would arise (Carlisle et al. 2014). Opponents cite dangers to the environment and to threatened species (Lovich and Ennen 2011). The California cases and the study produced by Farhar et al (2010) are the two most widely reviewed studies of public resistance to the Solar PEIS, but a full accounting and summary of public concern for all of the major Solar Energy Zones along with the federal responses is included in the documents provided within the Solar PEIS web portal ("Director's Protest Resolution Report" 2012). A full accounting across all six states and their respective Solar Energy Zones is beyond the scope of this project, but would be an excellent temporal study of a regional implementation and subsequent response to a national socio-technical imaginary.

Limitations

As stated above, one of the chief limitation of Q methodology in doing research of this nature is the lack of ability to produce results that are generalizable to a population. An array of research potentially beginning with or including Q methodology is required to be able to generalize. The factors that were produced are not necessarily representative of a large swath of the residents of the San Luis Valley. In fact, they may only be individuals who happened to participate in the study and share nothing with residents outside of the study although this is unlikely. This research does show that there are shared perspectives, but doesn't specify how many there are. A broader survey technique would be needed to uncover their extent.

Beyond the general limitations of the chosen methodology are those associated with the research design. Data sampling was limited due to several factors including the need to travel several by car to the research site during several weekends across three months to reach participants. Distance sampling techniques using online software are available but were outside of the research budget and limit the ability to perform follow up interviews. The size of the San Luis Valley means that there are probably important perspectives that were not sampled due to limiting the recruitment to coffee shops within the town of

Alamosa. A larger research team able to more efficiently make use of time and travel farther within the valley would be a fix for this issue.

Future Work

A discourse analysis framework laid out by Donal Carbaugh (2007), which focuses on providing insights concerning “the cultural shaping of communication practices” as well as the “interactional dynamics” that occur amongst them (167 – 168) is very promising in support of this. The premise under which much of discourse analysis operates is that discourse can be defined as “linked ways of talking and thinking that constitute ideologies” (Johnstone 2008), and that “communication both presumes and constitutes social realities” (Carbaugh 2007). Carbaugh’s methodological framework seeks to address specific questions or combinations of questions. The most pertinent of these, in relation to the overarching research question, is that of structure – “how is this particular communication practice put together?” (169). The phrases and terms of the specific local discourses are an important aspect of determining this.

The economic discourses of the San Luis Valley surround the concept that there is economic fragility due to isolation and lack of homogeneity. Agriculture and ranching make up most of the economic base. Of potential importance is the discursive connection to water that the economy holds. Residents often express concern over water issues when discussing land use. Since large scale solar projects require water to keep the panels or mirrors clean and at stable temperatures, an important connection is uncovered. This is another example of a relatively technical knowledge required to understand and engage with the topic.

Independence discourses surround concepts of self-reliance, heritage, and a lack of trust in outside influence within the valley. Many of these focus on the idea that the valley is isolated and that people don't like the idea of sending energy away. People in the valley like the idea of having private and personal energy generation. The local energy coop also becomes a topic here with one participant stating that "everyone is tired of paying" the local energy cooperative.

Environmental discourses focused specifically on concepts of wider climate change and a general disdain for polluting industries. When prompted to discuss concerns at a more local scale, residents express a concern over access to public land. One participant in the Q-sorting process stated that he "didn't want to deal with a bunch of barbed wire fencing" presumably cordoning off a place he currently has access to. The preference for distributed (i.e. private) solar electricity generation was also common. Lastly, discourses that concern justice focus on the affordability of energy to everyone and the fact that the PEIS planning process wasn't well understood and was largely ignored. The result is that most of the community was not represented in the planning process.

Conclusion

"Today the radical question of how and to what extent energy production and consumption influences opportunities for leading the examined life, the only one that (according to Socrates) is truly human, has been largely suppressed in favor of the pursuits of efficiency or renewable energy" (Mitcham and Rolston 2013).

This projects seeks to explore small community perspectives of renewable energy projects and has focused especially on those that are initiated at the national scale and hold to socio-technical imaginaries of transition. In discussing this, the overarching implications and development of socio-technical imaginaries are introduced. These are at odds to the new immateriality of electricity in peoples' daily lives. Energy generation makes life easier by becoming more invisible over time. By looking at discourses of energy siting on public lands, we see another dimension of the problem in how people want to use land. The conceptualization of available solar energy locations as unused and lifeless or degraded is an example. The issue that this generates is that justice cannot be served when there exists a disconnect between the socio-technical imaginaries of energy systems and the use of public lands and the way that people interact with these during their daily lives. This project has shown that there are varying types of renewable energy supporters in the San Luis Valley of Southern Colorado and that each prioritizes different aspects of economy, aesthetics, and land use in the way that they approach the topic.

Q methodology produces a list of consensus statements, but the importance of these seems to be dubious given the relative low rankings of the consensus items. There is one high ranking positive consensus between the three and that is that renewable energy projects are a very good way for the United States to approach the issue of climate change.

Another important aspect is the recognition by the factors that there are other types of renewable energy advocates in the valley. This would signal a recognition of organizational potential between different peoples and their viewpoints. This realization was not shared in the same way by the three factors, but represents a possible launching point for a more inclusive community approach to developing solar energy. It is not enough to say that there needs to be a bridge across the divide between national discourses and local narratives or that we need to recognize that every community is different from the one before. Attention must also be given to the bridge builders, and there needs to be an acceptance of the fact that bridges must be built from multiple points.

Appendix A.

UNM IRB PROTOCOL

TITLE:	Social Perceptions of Solar Power: Using Q-Methodology to Evaluate Responses to the Solar Programmatic Environmental Impact Statement in Southern Colorado
VERSION DATE:	07/02/2016
PRINCIPAL INVESTIGATOR/ RESPONSIBLE FACULTY:	Chris S. Duvall
STUDENT INVESTIGATOR:	Aaron D. Russell
FUNDING AGENCY:	N/A

BACKGROUND/SCIENTIFIC RATIONALE

A theory of ‘energy geography’ seeks to understand all different aspects of energy use from a spatial perspective (Calvert 2015; Lawhon and Murphy 2012; Zimmerer 2011). This project is centered on the topic of social acceptance and perception of renewable energy and seeks to look specifically at the local scale aspects. The possibility of conflict, the changing relationship between energy systems and the communities that host them, and how these affect policy participation are the inspirations for this research. Using a structured interview method style called Q-methodology, I will collect the discourses of past solar energy subjectivities and then ask research participants to rank them into statistically analyzable patterns. These patterns will help to uncover potential discourse communities and provide insight into who is saying what, why, and how these discourses relate to the real events of solar energy development within the San Luis Valley. The approach to this research is framed by a review of the literatures of socio technical transitions of energy systems, social acceptance of renewable energy, and the application of discourse analysis.

In a socio-technical system, the interplay between societal structures and technical systems (e.g. energy infrastructure) is explored. Research in this area most commonly involves understanding the interaction of the governments, industrial leadership, and other high priority stakeholders (Burke 2013; Dangerman and Schellnhuber 2013; Hadjilambrinos 2000; Molyneaux et al. 2012) however, attention to lower scales is also important. Studies of regional energy transformation in Europe, and the sociopolitical mechanisms of energy deployment in the United States are such examples. The vitality of energy on public lands is a fraught issue for groups that have historically disagreed about the use of public lands such as conservationists and developers. These groups normally disagree about active versus passive use of public land or local versus federal control

(Stevens, Frank, and others 2009). Energy on public lands produces additional conflict and often between members of groups that normally hold consensus on such issues, such as green energy advocates and conservationists. Renewable energy can be seen as environmentally beneficial, but locally damaging (Warren et al. 2005). This factor is especially pertinent in smaller communities where the economy is tied to a few resources related to the use of the land.

Literature on the phenomenon of social acceptance unpacks the role of communities in the overall socio-technical system of energy distribution. Even when renewable energy projects are supported from the top down, social acceptance at the community level can become a problematic obstacle (Wüstenhagen, Wolsink, and Bürer 2007). These obstacles are often attributed to a phenomenon known as NIMBYism (Not In My Back Yard), which has been used to reduce resistance to renewable energy development down to a question of aesthetics. While aesthetics are certainly important, work has been done to problematize and deconstruct the term NIMBY. Related works dealing with discourses, place attachment and disruption, and social representation of energy systems and changes to them have sprung from this premise (Batel and Devine-Wright 2015b, [a] 2015; Devine-Wright 2009, 2011; Devine-Wright and Batel 2013; Devine-Wright and Howes 2010). Five different, but interrelated geographic concepts used to explore social acceptance at different renewable energy projects around the world include: immobility, or the inflexibility of renewable energy siting; immutability, or the assumption that landscapes have permanence; solidarity, or the relationship between people and the land; imposition, that the project does not benefit those around it; and space as renewable energy is often seen as imposing both visually and geographically (Pasqualetti 2011b).

The application of discourse analysis within this project concerns "linked ways of talking and thinking that constitute ideologies" (Johnstone 2008). These ways are the vector by which this project seeks to explore social acceptance of renewable energy within the socio-technical transitions of energy systems. A discourse of the geography of energy may be a promising portal into an aspect of socio-technical systems that political ecology suggests is missing. These are the construction of knowledge, by whom, and for what purpose; the privilege in one viewpoint over another (Lawhon and Murphy, 2012). "Discourse analysis begins with the premise that actors' discursive constructs, imagery, stated and unstated values and assumptions are fundamental to understanding politics" ((Hunold and Leitner 2011). This premise can be expanded to include many different facets of discourse and their effects on the world, language, other discourses, and all different mediums. (Johnstone, 2008).

OBJECTIVES/AIMS

- This project seeks to engage at a deep level with the subjectivities within a community and quantify the statistically.

- This project seeks to provide insights into the interaction of a number of different types of people with energy, policy implementation, and their own communities.
- This project seeks to explore the evolution of renewable energy discourse in a community that is seeking to define its own relationship with energy resources.

STUDY DESIGN

I. *Target Population and Inclusion/Exclusion Criteria*

The target participant population is the adult citizens of the counties contained the San Luis Valley of Southern Colorado. Other than their being adults, this project has no target age range, gender or ethnic background preferences. Due to the research team's inability to efficiently and practically utilize translation, the target population will be limited to English speaking participants. We acknowledge the fact that this potentially hides a segment of the population and will notate this specifically in the findings. There are no plans for the inclusion of any IRB-identified vulnerable populations.

II. *Participant Enrollment*

The maximum number of participants to be enrolled shall be no more than 100 adults fitting the parameters of the target population criteria outlined above.

III. *Recruitment and Screening Procedures*

The plan to identify potential participants will begin with a pilot study whereby the student investigator will recruit individuals through a process of snowball sampling within the research area. This pilot study will help to refine the main research materials. Following the pilot study, recruitment during the main phase will be based on replies to flyers posted in the community and direct approach in public situations. Participants will be asked to confirm that they are over 18 years old and whether or not they are a resident of the San Luis Valley for both direct approach and replies to flyers. Participants that reply to flyers will be asked by email to not participate if they identify as members of the IRB documented vulnerable or special populations (exceptions include . Lists of the vulnerable and special populations will be provided in a follow-up email to any recruited individual that responds to a flyer. Any individual that fails the screening process will be thanked for their interest in participating and given the contact information for the UNM Office of the IRB. All data linked to personally identifiable information, either through email or through signature of the consent form will be destroyed in the event of a screen failure. It is the intention of this research team to de-identify all information gained through the recruitment process as soon as the study is completed and immediately upon screening failure.

IV. *Informed Consent Process*

The research team is requesting a waiver of consent documentation as the subject matter of the research and the methodology are innocuous, straightforward, and meet the definition of minimal risk to participants. The topic of solar energy is now a common theme of discussion and is neither taboo nor uncomfortable. Participants will be engaging in a survey of discourse that has been developed from sampling their own community conversations and publicly available comments. The signed consent form would be the only record linking the participant and the study following the elimination or de-identification of all other personal information or data. Breach of confidentiality would be the principal risk.

If the waiver of consent documentation is denied, the student investigator will amend the attached consent form to collect participant signatures. Consent forms will be given to participants either through email or in person depending on their method of recruitment. The form will be reviewed prior to data collection as well. Participants will be informed of the de-identification of personally identifiable information and the exact amount of time and what, if any, information could link them to the study. All participants will be given contact information for the research team, Department of Geography and Environmental Studies, and the UNM Office of the IRB in the case of any questions or concerns. Applicants that wish to withdraw their consent before information linking them to the research can be de-identified will be directed to contact the research team. Any personally identifiable information will be eliminated at that point in time. Participants will be notified that following de-identification of data, the research team will be unable to identify it to remove it from the project.

V. *Data Collection Procedures*

Data for this project will be collected through a structured interview technique called Q-methodology. Q-methodology involves the collecting and summarizing of a concourse. A concourse is a collection of statements about a situation or context. The statements used for this research project have been gathered using public commentary and meeting notes collected for the Programmatic Solar Environmental Impact Statement. Newspaper articles concerning solar energy in Colorado have also been reviewed for the years during the Solar PEIS. The statements will also be refined during the above mentioned pilot study.

Once collected, the concourse is reduced to a number of statements that participants will interact with. Participants will organize the statements along a normal distribution curve from most unimportant to most important. Participants will be able to place the statements manually upon the distribution curve. This process only needs to be done once and will take approximately an hour. The statements will be printed upon cards and placed on a large poster of the normal distribution. Different participants will interact with and organize the ‘Q-sorts’ in different ways, which will lead the research team to a deeper understanding of different perspectives that exist and how they relate to each other. Once a participant has completed a Q-sort, they will be given a chance to reflect upon their q-sort and make comments if they would like. The participants will be asked to comment on how their interaction with the q-statements has affected their views on the main research topic.

The participant's q-sorts will be recorded using a Microsoft excel model of the normal distribution.

VI. *Study Timelines*

The study will begin upon approval by the IRB and will conclude by the end of 2017 or when at least 20 q-sorts have been completed, whichever occurs first. Study participants will only participate from the time they are approved during screening until they have completed any follow-up commentary following their Q-sort.

VII. *Study Location(s)*

The data collection portion of the project will take place in Alamosa, Colorado at a small coffee shop that has agreed to host the Q-sorting process. Advertisements will go up in other public places in the valley with the hope that interested participants will be willing to travel the short distance to Alamosa for the project.

There will be no analytical processes taking place outside of the University of New Mexico.

The coffee shop owners have not specified any site-specific regulations or customs. Their letter of support can be found in the supporting documents.

VIII. *Participant Compensation*

There is no plan, at this point, to compensate participants. If funding can be found, it would be nice to compensate participants for their time. An addendum will be submitted if this becomes the case.

IX. *Study Resources*

There are currently no additional resources to draw upon for this project. The project team does not feel that additional resources are necessary.

EXPECTED RISKS/BENEFITS

I. *Potential Risks*

There are no psychological, physical, social, or legal risks anticipated for participants in this project. Participants do risk some boredom as the sorting of the statements can take some time. Though risk of breach of confidentiality and privacy exists, the research team will take all possible steps to minimize this through de-identification following the screening process and following the q-sorts. There is no risk of physical harm, social stigmatization, legal action, or any other negative result of political, social, or economic context. There isn't a risk of any economic burden for participants either as they will be notified ahead of time of the possibility that the q-sorting can take some time.

The plan to minimize all risk involves appropriate screening procedures, which are outlined above along with the immediate elimination of any information associated with a screen failure. All data will de-identified and all personal information of participants will be eliminated as soon as possible during the project.

II. *Benefits*

There is no direct benefit to participating in this survey.

III. *Privacy of Participants*

Participant privacy is an important consideration of the project team. Our goal is to eliminate personally identifiable data and personal information as soon as possible. This process will begin during the recruitment phase. All recruitment emails will be kept secure on the student researcher's private University of New Mexico email account. These emails will be eliminated as soon as a potential recruit has either withdrawn their initiative to be a part of the research or finished their participation in the Q-sorting. All data will be de-identified following this phase and impossible to associate with any specific individual. Participants will be notified that the participatory phase of the project will take place in a public setting. Participants that do not wish to participate in this setting will not be approved during the screening process.

IV. *Unanticipated Problems/Adverse Events*

Any unanticipated problems/ adverse events will be reported to the IRB within 7 calendar days. Any adverse events will also be reported to the business owners of the primary research location as soon as they can be reached.

V. *Participant Complaints*

Any participant complaints or requests for information that cannot be addressed in person will be given the following contact information.

All associated parties will be given a safe, confidential, and reliable channel for contacting the student researcher and primary investigator. In addition to this, participants will also be given contact information for the Department of Geography and Environmental Studies at the University of New Mexico as well as the Office of the IRB.

STUDY DATA

I. *Data Management Procedures and Confidentiality*

The only data that will be produced are pictures of the sorted Q-statements. Individuals will have already been de-identified at this point. Once a participant has passed the screening process and participated in the research, all personally identifiable information about them will be stripped from the data and eliminated. All data will be stored on a password protected computer as well. Consent forms will be locked in a secure location if they are deemed necessary. Both of these measures will keep all research, data, and/ or personally identifiable data confidential. After the research has concluded, all data will be kept by the student investigator or will be part of the final thesis. No other records or data are planned to be kept.

II. *Data Analysis/Statistical Considerations*

The literature suggests that the study population be between 40 and 60 and that "for statistical reasons, it may also be sensible to operate using a number of participants that is less than the number of items in your Q-set" (Watts and Stenner 2012b). Since Q-methodology only aims to establish the existence of particular viewpoints and their relationships to each other, a large number of participants is not necessarily demanded.

Data shall be analyzed by the student investigator using available free software called PQ-method. The study also incorporates a partial qualitative analysis as participants will be given the opportunity to comment on their experience interacting with the methodology afterwards.

Data will be examined using a combination of factor extraction and factor rotation. Factor extraction involves the production of a matrix by intercorrelating each Q-sort with every other sort. From here centroid factor analysis is used to identify and remove distinct portions of common variance from the correlation matrix. These steps will be used to explain a good proportion of the study variance.

In factor rotation, the unrotated factor loading are used to plot the factors extracted in the above step on coordinate planes in order to show relative positions and viewpoints. Used together these analytic techniques will help to answer the study objectives by giving definition to different perspectives on solar energy projects, the different pathways that citizens have taken discursively to reach such views, and the relationships that these represent within the topic.

III. *Participant Withdrawal*

Participants that seek to withdraw during data collection will be thanked for their interest in participation and will be given the contact information for the University of New Mexico IRB, the Geography and Environmental Studies Department and the research team. Incompletely collected data will be purged and all personally identifiable data for that participant will be eliminated.

PRIOR APPROVALS/REVIEWED AT OTHER IRBS

This project is not being approved by another IRB.

References

"About the San Luis Valley." 2017. Accessed March 4. http://www.slvahec.org/index.php/about/52-about-the-san-luis-valley.html.

Addams, Helen, and John LR Proops, eds. Social discourse and environmental policy: an application of Q methodology. Edward Elgar Publishing, 2000.

Adger, W.n. 2000. "Social and Ecological Resilience: Are They Related?" *Progress in Human Geography* 24 (3): 347–64.

Ahmad, Nadia B. "Billionaires, Birds, and Environmental Brawls: Reconceptualizing Energy Easements." Washington and Lee Journal of Energy, Climate, and the Environment 6, no. 1 (2014): 3.

"Alamosa County." 2017. Accessed March 4. https://www.colorado.gov/pacific/alamosacounty.

Bailey, Ronald. 2008. "Fighting Big Solar." *Reason.com*. August 12. http://reason.com/archives/2008/08/12/fighting-big-solar.

Barry, John, Geraint Ellis, and Clive Robinson. 2008. "Cool Rationalities and Hot Air: A Rhetorical Approach to Understanding Debates on Renewable Energy." *Global Environmental Politics* 8 (2): 67–98.

Barry, John, and John Proops. 1999. "Seeking Sustainability Discourses with Q Methodology." *Ecological Economics* 28 (3): 337–45.

Basalla, George. 1979. "Energy and Civilization." *EPRI J.;(United States)* 4 (6). http://www.osti.gov/scitech/biblio/5901808.

Batel, Susana, and Patrick Devine-Wright. 2015a. “Towards a Better Understanding of People’s Responses to Renewable Energy Technologies: Insights from Social Representations Theory.” *Public Understanding of Science* 24 (3): 311–25.

———. 2015b. “A Critical and Empirical Analysis of the National-Local ‘gap’ in Public Responses to Large-Scale Energy Infrastructures.” *Journal of Environmental Planning and Management* 58 (6): 1076–95.

Borgmann, Albert. 2009. *Technology and the Character of Contemporary Life: A Philosophical Inquiry*. University of Chicago Press.

Brittan Jr, Gordon. 2001. “Wind, Energy, Landscape: Reconciling Nature and Technology.” *Philosophy & Geography* 4 (2): 169–84.

Brown, James H., William R. Burnside, Ana D. Davidson, John P. DeLong, William C. Dunn, Marcus J. Hamilton, Norman Mercado-Silva, et al. 2011. “Energetic Limits to Economic Growth.” *BioScience* 61 (1): 19–26.

Brown, Steven R. 1980. *Political Subjectivity: Applications of Q Methodology in Political Science*. Yale University Press.

Burke, Paul J. 2013. “The National-Level Energy Ladder and Its Carbon Implications.” *Environment and Development Economics* 18 (04): 484–503.

Calvert, Kirby. "From ‘energy geography’to ‘energy geographies’ Perspectives on a fertile academic borderland." Progress in Human Geography 40, no. 1 (2016): 105-125.

Carbaugh, Donal. 2007. “Cultural Discourse Analysis: Communication Practices and Intercultural Encounters.” *Journal of Intercultural Communication Research* 36 (3): 167–82.

Çarkoğlu, Ali, and Çiğdem Kentmen-Çin. 2015. "Economic Development, Environmental Justice, and pro-Environmental Behavior." *Environmental Politics* 24 (4): 575–97.

Carlisle, Juliet E., Stephanie L. Kane, David Solan, Madelaine Bowman, and Jeffrey C. Joe. 2015. "Public Attitudes Regarding Large-Scale Solar Energy Development in the US." *Renewable and Sustainable Energy Reviews* 48: 835–47.

Carlisle, Juliet E., Stephanie L. Kane, David Solan, and Jeffrey C. Joe. 2014. "Support for Solar Energy: Examining Sense of Place and Utility-Scale Development in California." *Energy Research & Social Science* 3 (September): 124–30.

Carlisle, Juliet E., David Solan, Stephanie L. Kane, and Jeffrey Joe. 2016. "Utility-Scale Solar and Public Attitudes toward Siting: A Critical Examination of Proximity." *Land Use Policy* 58: 491–501.

Clarke, Mari H. 2015. "Interrogating Power: Engaged Energy Anthropology." *Reviews in Anthropology* 44 (4): 202–24.

Cotton, Matthew, and Patrick Devine-Wright. 2011. "Discourses of Energy Infrastructure Development: A Q-Method Study of Electricity Transmission Line Siting in the UK." *Environment & Planning A* 43 (4): 942–60.

Dangerman, A. T. C. Jérôme, and Hans Joachim Schellnhuber. 2013. "Energy Systems Transformation." *Proceedings of the National Academy of Sciences* 110 (7): E549–58.

Devine-Wright, Patrick. 2007. "Reconsidering Public Attitudes and Public Acceptance of Renewable Energy Technologies: A Critical Review." *Manchester: School of Environment and Development, University of Manchester. Available at:*

Http://www. Sed. Manchester. Ac. Uk/research/beyond_nimbyism. http://geography.exeter.ac.uk/beyond_nimbyism/deliverables/bn_wp1_4.pdf.

———. 2009. “Rethinking NIMBYism: The Role of Place Attachment and Place Identity in Explaining Place-Protective Action.” *Journal of Community & Applied Social Psychology* 19 (6): 426–41.

———. 2011. “Place Attachment and Public Acceptance of Renewable Energy: A Tidal Energy Case Study.” *Journal of Environmental Psychology* 31 (4): 336–43.

Devine-Wright, Patrick, and Susana Batel. 2013. “Explaining Public Preferences for High Voltage Pylon Designs: An Empirical Study of Perceived Fit in a Rural Landscape.” *Land Use Policy* 31 (March): 640–49.

Devine-Wright, Patrick, and Yuko Howes. 2010. “Disruption to Place Attachment and the Protection of Restorative Environments: A Wind Energy Case Study.” *Journal of Environmental Psychology*, Identity, Place, and Environmental Behaviour, 30 (3): 271–80.

Dickinson, Elizabeth. 2014. “Ecocultural Schizophrenia: Dialectical Environmental Discourses and Practices.” *Communication, Culture & Critique* 7 (4): 612–31.

“Director’s Protest Resolution Report.” 2012. http://solareis.anl.gov/documents/docs/Solar_PEIS_BLM_Protest_Resolution_Report.pdf.

Eden, Sally, Andrew Donaldson, and Gordon Walker. 2005. “Structuring Subjectivities? Using Q Methodology in Human Geography.” *Area* 37 (4): 413–22.

Ellis, Geraint, John Barry, and Clive Robinson. 2007. “Many Ways to Say ‘No’, Different Ways to Say ‘Yes’: Applying Q-Methodology to Understand Public

Acceptance of Wind Farm Proposals.” *Journal of Environmental Planning and Management* 50 (4): 517–51.

Farhar, B. C., L. M. Hunter, T. M. Kirkland, and K. J. Tierney. "Community Response to Concentrating Solar Power in the San Luis Valley." Golden, Colorado: National Renewable Energy Laboratory (2010).

Fast, Stewart. 2013. “Social Acceptance of Renewable Energy: Trends, Concepts, and Geographies.” *Geography Compass* 7 (12): 853–66.

Fischhendler, Itay, Dror Boymel, and Maxwell T. Boykoff. 2016. “How Competing Securitized Discourses over Land Appropriation Are Constructed: The Promotion of Solar Energy in the Israeli Desert.” *Environmental Communication* 10 (2): 147–68.

Fisher, Sir Ronald Aylmer, Ronald Aylmer Fisher, Statistiker Genetiker, Ronald Aylmer Fisher, Statistician Genetician, Great Britain, Ronald Aylmer Fisher, and Statisticien Généticien. 1960. “The Design of Experiments.” http://www.etcases.com/media/clnews/1420782013117205015.pdf.

Forrester, John, Brian Cook, Louise Bracken, Steve Cinderby, and Andrew Donaldson. 2015. “Combining Participatory Mapping with Q-Methodology to Map Stakeholder Perceptions of Complex Environmental Problems.” *Applied Geography* 56 (January): 199–208.

Goedkoop, Fleur, and Patrick Devine-Wright. 2016. “Partnership or Placation? The Role of Trust and Justice in the Shared Ownership of Renewable Energy Projects.” *Energy Research & Social Science* 17: 135–46.

Gross, Catherine. 2007. “Community Perspectives of Wind Energy in Australia: The Application of a Justice and Community Fairness Framework to Increase Social Acceptance.” *Energy Policy* 35 (5): 2727–36.

Hadjilambrinos, Constantine. 2000. “Understanding Technology Choice in Electricity Industries: A Comparative Study of France and Denmark.” *Energy Policy* 28 (15): 1111–26.

Hall, Stuart. 2001. “Foucault: Power, Knowledge and Discourse.” *Discourse Theory and Practice: A Reader* 72: 81.

Hawthorne, Timothy, John Krygier, and Mei-Po Kwan. 2008. “Mapping Ambivalence: Exploring the Geographies of Community Change and Rails-to-Trails Development Using Photo-Based Q Method and PPGIS.” *Geoforum*, 39 (2): 1058–78.

Holdren, John P. 1991. “Population and the Energy Problem.” *Population and Environment* 12 (3): 231–55.

Horst, Paul. 1965. *Factor Analysis of Data Matrices*. Holt, Rinehart and Winston.

Hulme, Mike. 2010. “Cosmopolitan Climates Hybridity, Foresight and Meaning.” *Theory, Culture & Society* 27 (2-3): 267–76.

Hunold, Christian, and Steven Leitner. 2011. “‘Hasta La Vista, Baby!’ The Solar Grand Plan, Environmentalism, and Social Constructions of the Mojave Desert.” *Environmental Politics* 20 (5): 687–704.

Jasanoff, Sheila, and Sang-Hyun Kim. 2013. “Sociotechnical Imaginaries and National Energy Policies.” *Science as Culture* 22 (2): 189–96.

Jessup, Brad. 2010. “Plural and Hybrid Environmental Values: A Discourse Analysis of the Wind Energy Conflict in Australia and the United Kingdom.” *Environmental Politics* 19 (1): 21–44.

Johnson, Kirk. 2010. “Colorado Valley Finds Going Solar Is Harder Than It Looks.” *The New York Times*, June 3. http://www.nytimes.com/2010/06/04/us/04electricity.html.

Johnstone, Barbara. Discourse analysis. Malden, MA: Blackwell, 2008.

Lawhon, Mary, and James T. Murphy. 2012. “Socio-Technical Regimes and Sustainability Transitions Insights from Political Ecology.” *Progress in Human Geography* 36 (3): 354–78.

Logan, J. R. 2017. “Tri-State Drops Monument Transmission Line Proposal.” *The Taos News*. Accessed March 11. http://www.taosnews.com/stories/tri-state-drops-monument-transmission-line-proposal,32632.

Lovich, Jeffrey E., and Joshua R. Ennen. 2011. “Wildlife Conservation and Solar Energy Development in the Desert Southwest, United States.” *BioScience* 61 (12): 982–92.

Malpas, Jeff. Heidegger's topology: being, place, world. Mit Press, 2008.

Marafiote, Tracy, and Emily Plec. 2006. “From Dualisms to Dialogism: Hybridity in Discourse about the Natural World.” *The Environmental Communication Yearbook* 3 (1): 49–75.

Mitcham, Carl, and Jessica Smith Rolston. 2013. “Energy Constraints.” *Science and Engineering Ethics* 19 (2): 313–19.

Molyneaux, Lynette, Liam Wagner, Craig Froome, and John Foster. 2012. “Resilience and Electricity Systems: A Comparative Analysis.” *Energy Policy* 47 (August): 188–201.

Mulvaney, Dustin. 2013. “Opening the Black Box of Solar Energy Technologies: Exploring Tensions Between Innovation and Environmental Justice.” *Science as Culture* 22 (2): 230–37.

Muoio, Danielle, 2017 Feb. 24, and 201 7. 2017. “Tesla Will Begin Selling Its Solar Roof This Year — Here’s Everything You Need to Know.” *Business Insider*. Accessed March 11. http://www.businessinsider.com/tesla-solar-roof-solar-city-features-2017-2.

“Obama Administration Approves Roadmap for Utility-Scale Solar Energy Development on Public Lands.” 2012. October 12. https://www.doi.gov/news/pressreleases/Obama-Administration-Approves-Roadmap-for-Utility-Scale-Solar-Energy-Development-on-Public-Lands.

Olson-Hazboun, Shawn K., Richard S. Krannich, and Peter G. Robertson. 2016. “Public Views on Renewable Energy in the Rocky Mountain Region of the United States: Distinct Attitudes, Exposure, and Other Key Predictors of Wind Energy.” *Energy Research & Social Science* 21 (November): 167–79.

Outka, Uma. "Environmental Justice in the Renewable Energy Transition." (2012).

Parkins, John R., Christy Hempel, Thomas M. Beckley, Richard C. Stedman, and Kate Sherren. 2015. “Identifying Energy Discourses in Canada with Q Methodology: Moving beyond the Environment versus Economy Debates.” *Environmental Sociology* 1 (4): 304–14.

Pasqualetti, Martin J. 2011a. “Social Barriers to Renewable Energy Landscapes.” *Geographical Review* 101 (2): 201–23.

———. 2011b. “Opposing Wind Energy Landscapes: A Search for Common Cause.” *Annals of the Association of American Geographers* 101 (4): 907–17.

Peterson, Tarla Rai, Jennie C. Stephens, and Elizabeth J. Wilson. 2015. “Public Perception of and Engagement with Emerging Low-Carbon Energy Technologies: A Literature Review.” *MRS Energy & Sustainability* 2: E11.

Pierce, James, and Eric Paulos. "Materializing energy." In Proceedings of the 8th ACM Conference on Designing Interactive Systems, pp. 113-122. ACM, 2010.

Pimentel, David, M. Herdendorf, S. Eisenfeld, L. Olander, M. Carroquino, C. Corson, J. McDade, et al. 1994. “Achieving a Secure Energy Future: Environmental and Economic Issues.” *Ecological Economics* 9 (3): 201–19.

“Regional Profile: San Luis Valley Region.” 2017. State of Colorado Department of Local Affairs. Accessed March 4. https://dola.colorado.gov/dlg/demog/profiles/region8.pdf.

Rieur, E., and M. Alahmad. 2014. “On the Discourse of Energy as Material: Future Feedback Technologies and Directions for Experiencing Energy.” *IEEE Transactions on Industrial Informatics* 10 (1): 742–51.

Sakellariou, Nicholas. "A Framework for Social Justice in Renewable Energy Engineering." In Engineering Education for Social Justice, pp. 243-267. Springer Netherlands, 2013.

“San Luis Valley Ecosystem Council - Renewable Energy.” 2017. Accessed March 11. http://www.slvec.org/projects/renewable-energy.

Schmolck, Peter, and John Atkinson. 2002. “PQMethod (Version 2.11).” *Computer Software]. Available at Http://schmolck. Userweb. Mwn. De/qmethod*.

Smil, Vaclav. 2008. *Energy in Nature and Society : General Energetics of Complex Systems*. Cambridge, Mass. : MIT Press,.

Smil, Vaclav. Energy Transitions: Global and National Perspectives. ABC-CLIO, 2016.

Smith, Adrian, and Andy Stirling. "The politics of social-ecological resilience and sustainable socio-technical transitions." Ecology and Society 15, no. 1 (2010).

Smith, Jessica M., and Abraham SD Tidwell. 2016. “The Everyday Lives of Energy Transitions: Contested Sociotechnical Imaginaries in the American West.” *Social Studies of Science* 46 (3): 327–50.

“Solar PEIS Documents.” 2017. Accessed March 10. http://solareis.anl.gov/documents/index.cfm.

Späth, Philipp, and Harald Rohracher. 2010. “‘Energy Regions’: The Transformative Power of Regional Discourses on Socio-Technical Futures.” *Research Policy*, Special Section on Innovation and Sustainability Transitions, 39 (4): 449–58.

Stephens, Jennie C., Elizabeth J. Wilson, and Tarla Rai Peterson. 2008. “Socio-Political Evaluation of Energy Deployment (SPEED): An Integrated Research Framework Analyzing Energy Technology Deployment.” *Technological Forecasting and Social Change* 75 (8): 1224–46.

Stevens, Jan, and Richard Asher Frank. Current Policy and Legal Issues Affecting Recreational Use of Public Lands in the American West. Resources for the Future, 2009.

Tidwell, Abraham S. D., and Jessica M. Smith. 2015. "Morals, Materials, and Technoscience The Energy Security Imaginary in the United States." *Science, Technology & Human Values* 40 (5): 687–711.

Trahan, Ryan Thomas. 2010. "Electricity Transmission in the US–Legal Issues and Trends." *Browser Download This Paper*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1625759.

Van der Horst, Dan. 2007. "NIMBY or Not? Exploring the Relevance of Location and the Politics of Voiced Opinions in Renewable Energy Siting Controversies." *Energy Policy* 35 (5): 2705–14.

Walker, Gordon, and Noel Cass. 2007. "Carbon Reduction, 'The Public' and Renewable Energy: Engaging with Socio-Technical Configurations." *Area* 39 (4): 458–69.

Warburg, Philip. 2015. *Harness the Sun: America's Quest for a Solar-Powered Future*. Beacon Press.

Warren, Charles R., Carolyn Lumsden, Simone O'Dowd, and Richard V. Birnie. 2005. "'Green On Green': Public Perceptions of Wind Power in Scotland and Ireland." *Journal of Environmental Planning and Management* 48 (6): 853–75.

Watts, Simon, and Paul Stenner. 2012a. *Doing Q Methodological Research: Theory, Method & Interpretation*. Sage. https://books.google.com/books?hl=en&lr=&id=PwfTZu-JEmoC&oi=fnd&pg=PP1&dq=watts+and+stenner&ots=tyESNbHrW5&sig=NqJCL7hGSP9QmvgVAJK0ISIbWbo.

———. 2012b. *Doing Q Methodological Research: Theory, Method & Interpretation*. Sage. https://books.google.com/books?hl=en&lr=&id=PwfTZu-

JEmoC&oi=fnd&pg=PP1&dq=watson+stenner+2012+Q-methodology&ots=tyCRKgJy_5&sig=CWdlcz2xJRc8p6AebQEzfncH-lA.

Wenz, Peter. "Does Environmentalism Promote Injustice for the Poor." In Environmental Justice and Environmentalism: The Social Justice Challenge to the Environmental Movement, 57-84. Cambridge: MIT Press.

Wüstenhagen, Rolf, Maarten Wolsink, and Mary Jean Bürer. 2007. “Social Acceptance of Renewable Energy Innovation: An Introduction to the Concept.” *Energy Policy* 35 (5): 2683–91.

Yenneti, Komali, and Rosie Day. 2015. “Procedural (in) Justice in the Implementation of Solar Energy: The Case of Charanaka Solar Park, Gujarat, India.” *Energy Policy* 86: 664–73.

Yenneti, Komali, Rosie Day, and Oleg Golubchikov. 2016. “Spatial Justice and the Land Politics of Renewables: Dispossessing Vulnerable Communities through Solar Energy Mega-Projects.” *Geoforum* 76: 90–99.

Zimmerer, Karl S. 2011. “New Geographies of Energy: Introduction to the Special Issue.” *Annals of the Association of American Geographers* 101 (4): 705–11.