Energy democracy and the co-evolution of social and technological systems

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October, 2018

A thesis submitted to McGill University in partial fulfilment of the requirements of the degree of Doctor of Philosophy

alternative energy *Renewable/Alternative*. any energy system other than the traditional fossil, nuclear, and hydropower energy sources that have been the basis of the growth of industrial society over the past two centuries; e.g., solar, wind, or hydrogen energy.

Dictionary of Energy, Second Edition (Cleveland & Morris, 2015, p. 20)

renewable energy *Renewable/Alternative.* any energy resource that is naturally regenerated over a short time scale and either derived directly from solar energy (solar thermal, photochemical, and photoelectric), indirectly from the sun (wind, hydropower, and photosynthetic energy stored in biomass), or from other natural energy flows (geothermal, tidal, wave, and current energy). Contrasted with nonrenewable energy forms such as oil, coal, and uranium.

Dictionary of Energy, Second Edition (Cleveland & Morris, 2015, p. 498)

"A solar transition will require fundamental changes in political economy. The environment for energy choice, both in terms of markets and policies, will have to be expanded, and this expansion will necessitate actions which will destabilize current energy politics and economics" (Byrne & Rich, 1983, p. 169).

"Critique is easy, reconstruction more difficult" (Norgaard, 1994, p. 26).

ABSTRACT

As integrated sociotechnical systems, renewable energy systems co-evolve with new social arrangements, as social institutions of the fossil-fuel era are transformed for an age of renewables. This research explores this proposition by examining the recent phenomenon of energy democracy in three ways: 1) by drawing out and critically engaging with the implicit theory underlying energy democracy 2) by assessing the ways energy democracy has or has not enabled policy changes, and 3) by examining energy democracy initiatives in practice to understand how renewable energy is currently put to work for social transformation.

Decentralized energy systems such as those based on renewables offer greater flexibility and more readily organize and enable distributed political and economic power, and vice versa, a relationship described as distributed energy-politics. The research proceeds to identify a set of three goals and 26 intended outcomes for energy democracy and presents a descriptive summary of 22 policy instruments associated with an energy democracy agenda. An assessment of congruence among outcomes and instruments finds more attention given to reclaiming the energy sector and less to resisting dominant energy regimes. The final analysis finds a set of nine initiatives for energy democracy presently operating in eastern Canada and the northeastern United States. The research synthesizes a shared transition narrative among these initiatives, converging around commitments to high levels of renewables, public and local control over energy systems, and broad social change through energy transition. Three distinct types of energy democracy and their associated narratives are proposed as "local and regional communities," "public partnerships," and "social movements," reflecting differences related to problem framings, form and specificity of solutions, critical or oppositional stance, historical positioning, and scale, agency and mode of social organization.

Together this research demonstrates that renewable energy systems can, and already do, work to change a fossil-fuel society, yet a transformative energy future requires ongoing sociopolitical mobilizations across multiple levels of change. This work implies that if greater technological change is desired, more attention needs to be given to the selection and stabilization of the corresponding institutions necessary for societies powered by renewable energy.

RÉSUMÉ

En tant que systèmes sociotechniques intégrés, les systèmes d'énergies renouvelables co-évoluent avec de nouveaux arrangements sociaux, tandis que les institutions sociales de l'ère des combustibles fossiles sont transformées pour une ère d'énergies renouvelables. Cette recherche explore cette proposition en examinant le phénomène récent de la démocratie énergétique de trois façons: 1) en identifiant et en se livrant de manière critique à la théorie implicite sous-jacente à la démocratie énergétique 2) en évaluant les façons dont la démocratie énergétique a ou n'a pas permis des changements dans les politiques publiques, et 3) en examinant les initiatives de la démocratie énergétique dans la pratique, pour comprendre comment les énergies renouvelables sont actuellement mises en œuvre à des fins de transformation sociale.

Les systèmes énergétiques décentralisés, tels que ceux basés sur les énergies renouvelables, offrent une plus grande flexibilité et se prêtent plus facilement à une organisation décentralisée du pouvoir politique et économique, et vice versa, une relation décrite comme l'énergie-politique distribuée. Cette recherche identifie un ensemble de trois objectifs et 26 résultats escomptés pour la démocratie énergétique et présente un résumé descriptif de 22 instruments de politiques publiques associés à un programme de démocratie énergétique. Une évaluation de la congruence entre les résultats et les instruments montre qu'une attention relativement forte est portée à la récupération démocratique du secteur de l'énergie et une attention moindre à la résistance aux régimes énergétiques dominants. L'analyse finale montre qu'un ensemble de neuf initiatives pour la démocratie énergétique sont présentement opérationnelles dans l'est du Canada et dans le nord-est des États-Unis. La recherche synthétise un récit de transition partagé entre ces initiatives, mettant l'accent sur un engagement à un niveau élevé d'énergies renouvelables, un contrôle public et local sur les systèmes énergétiques, et un changement social plus large porté par la transition énergétique. Trois types distincts de démocratie énergétique et leurs récits associés sont proposés: «communautés locales et régionales», «partenariats publics» et «mouvements sociaux»; ceux-ci reflétent les différences liées à la définition des problèmes, à la forme et à la spécificité des solutions envisagées, à la position critique ou d'opposition, au positionnement historique, et à l'échelle, l'agence et le mode d'organisation sociale.

Dans l'ensemble, cette recherche démontre que les systèmes d'énergies renouvelables peuvent changer et influence déjà la société actuelle de combustibles fossiles, mais un avenir de

transformation énergétique exige des mobilisations sociopolitiques permanentes et à différentes échelles. Ce travail implique que si l'on souhaite un plus grand changement technologique, il faudra accorder plus d'attention au sélection et stabilisation d'institutions adaptées à des sociétés alimentées par les énergies renouvelables.

ACKNOWLEDGEMENTS

I first wish to acknowledge the many communities of people across the region and around the world working for energy democracy. My greatest hope for this research is that it proves useful to your efforts. I look forward to learning from you where this work can go from here.

Gratitude is its own reward. Taking a moment to consider the help I have received through this process allows me to realize that, despite the loneliness that often accompanies graduate work, I have been fortunate to have had the assistance of so many good people at each step of the way. First my supervisors, Peter G. Brown and Jennie C. Stephens. Peter has helped shape this work in innumerable ways, from emphasizing the finer details of argumentation, clarity, accessibility and presentation, to encouraging a broader, interrogative position and an unconventional and intellectually open approach to the work. Above all, it is his effort to create and nurture the Economics for the Anthropocene project for which I am especially grateful, affording me and many others an opportunity to search deeply and thoughtfully for unique and meaningful ways to confront persistently and increasingly perilous conditions. Jennie has been a rock of support through this process, consistently sharing enthusiasm as well as sound advice, and remaining positive, generous, insightful and focused. Jennie's personal and professional guidance and collaboration has been indispensable for shaping and completing this work.

I thank my community of friends and colleagues in the Economics for the Anthropocene program, and especially the McGill E4A lab, for feedback and encouragement along the way. A special note to Jen Gobby, my superhero agent of change! I would not have made it this far without you. A thanks to those within E4A who helped me begin this work, including Geoff Garver, Diedre Zoll, Jon Erickson, and Josh Farley, and to those who provided much needed support throughout, including Margaret Forrest, Dina Spigelski, and Liz Zahirovic. Romain Svartzman, Laura Gilbert, and my dear friend Sheila Kerr provided timely assistance with translation.

I also acknowledge the valuable contributions of many within the Department of Natural Resource Sciences and the broader community at McGill University, including NRS Graduate Program Director Benoît Côté, committee members Richard Janda and Gordon Hickey for early drafting and feedback, Elena Bennett for proposal development, and Simone Clamann, Lise Grant, and Susan Gregus at the Macdonald Office of Graduate and Postdoctoral Studies, Ann

Gossage at NRS, and Christina Zhu at the McGill School of Environment for essential academic and administrative support. Key course instructors that informed the research include Madhav Badami, Robert Godin, and Renee Sieber, as well as Rosemary Collard and Benjamin Sovacool through Concordia University and Vermont Law School, respectively. McGill library staff who helped with data collection and management include Jane Burpee, Emily MacKenzie, and Berenica Vejvoda. This work was supported through funding from the Social Sciences and Humanities Research Council of Canada and the Department of Natural Resource Sciences.

Others who helped at key points along the way include: the good people at the Next System Project and the Democracy Collaborative who shaped the direction of the research, including Gar Alperovitz, John Duda, Joe Guinan, Thomas Hanna and Gus Speth; Kevin Jones at Vermont Law School for early proposal development; the participants in the Energy Democracy Symposium at The University of Utah and the topic editors of the ensuing research topic on energy democracy, especially Andrea Feldpausch-Parker, Leah Sprain, and David Hess; Dessislava Kirilova at the Qualitative Data Repository for key support in developing the database; editors and reviewers who improved the manuscripts and shaped the special issues, including Laurence Delina, Anthony Janetos, Florian Kern, and Karoline Rogge; academic colleagues willing to discuss insights and lessons learned, including Conrad Kunze and Derya Tarhan; thesis examiners who provided additional feedback and perspective contributing to final revisions; and those working on the ground including Al Weinrub, Jarrid Green, James Haslam, Laura Mistretta, and Emma Schoenberg.

Lastly, I thank my inner circle, all of my family who witnessed the day-to-day realities while the end product remained largely a mystery. A special thank you to my mother, Polly, who somehow never doubted I would finish, even in moments when I was sure I would not and should not. A huge thank you to Mani and Kai for providing me many needed opportunities to step away from this work, and then motivating me to pick it back up again. And as always, I acknowledge the support and inspiration of the natural world that makes possible and gives meaning to this work. Thank you all!

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LIST OF ABBREVIATIONS

CBA	Community Benefit Agreement
CCA	Community Choice Aggregation
CSI	Center for Social Inclusion
CSN	Confédération des Syndicats Nationaux (Québec)
CUPE	Canadian Union of Public Employees
EDA	(New York) Energy Democracy Alliance
EDI	Energy Democracy Initiative
EID	Energy Investment District or Energy Improvement District
EV	Electric Vehicle
FIT	Feed-in tariff
GDP	Gross Domestic Product
GEI	Global Energy Interconnection
GJ	Gigajoule
IRENA	International Renewable Energy Agency
kW	KiloWatt
MLP	Multilevel Perspective
MW	MegaWatt
NEGEF	New England Grassroots Environment Fund
NIMBY	Not In My Backyard
PACE	Property Assessed Clean Energy
QDR	Qualitative Data Repository
RES	Renewable Energy Standard

RPS	Renewable Portfolio Standard
SDG	Sustainable Development Goals
SETS	Social-Ecological-Technical System
SEU	Sustainable Energy Utility
STEPS	Social, Technological and Environmental Pathways to Sustainability
TRANSIT	TRANsformative Social Innovation Theory
TUED	Trade Unions for Energy Democracy
WWS	Wind-Water-Solar (energy)

PREFACE AND CONTRIBUTION OF AUTHORS

This thesis is composed of an overall introduction, a review of relevant literature, three chapters of original research, and a comprehensive discussion and conclusions. As a manuscript-based thesis, each of the three chapters of research is identical to the published version including individual reference lists. Formatting of these chapters has been changed only for consistency of headings, citation style, and script and page format per the guidelines of the Graduate and Postdoctoral Studies Office of McGill University.

The following elements of the thesis are considered original scholarship and distinct contributions to knowledge. Chapter 3 advances theoretical development of the politics of renewable energy systems by proposing a novel way to understand the relationships between energy systems and political power and the how technologies and politics may or may not change together through processes of transition. Analysis through the lens of energy-politics provides a means to understanding how energy and energy-related technologies enable distribution or concentration of power. Through empirical research in chapters 4 and 5, awareness of energy democracy is expanded first in terms of goals, outcomes and policy instruments, and second regarding shared and diverse transition narratives, respectively. Chapter 4 demonstrates the application of energy democracy for guiding energy policy design and evaluation of renewable energy transition, while chapter 5 proposes a descriptive and analytical typology for examining and comparing transition counter-narratives. A data set is developed from the work in chapter 5 to support initiative-based and participatory research on energy democracy and renewable energy transition across the region of northeastern North America. Addressing an acknowledged gap in the scholarship on sustainability and sociotechnical transitions, this examination of energy democracy contributes to understanding of the political dynamics at work in renewable energy transition. Contributions to both knowledge and practice are further summarized in section 6.3.

Matthew Burke is the primary author of all chapters of the thesis. Mr. Burke has led all stages of the research and is fully responsible for its content and publication. Dr. Peter G. Brown provided academic supervision, funding, intellectual input and guidance, and methodological and theoretical development in support of all chapters. Dr. Jennie C. Stephens, thesis co-supervisor, co-authored the papers for chapters 3 and 4 (Burke & Stephens, 2017, 2018), providing for these

chapters valuable comments and suggestions, review and editing, support in navigating submission and peer review, and funding for publication, in addition to academic supervision, feedback, and writing support for all chapters.

List of publications of the thesis:

Burke, M. J. (2018). Shared yet contested: Energy democracy counter-narratives. *Frontiers in Communication*, *3*:22. https://doi.org/10.3389/fcomm.2018.00022

Burke, M. J. (2018). Energy democracy in northeastern North America [data set]. *Qualitative Data Repository*. https://doi.org/10.5064/F6BUAX58. QDR Main Collection. V1

Burke, M. J., & Stephens, J. C. (2018). Political power and renewable energy futures: A critical review. *Energy Research & Social Science*, *35*, 78–93. https://doi.org/10.1016/j.erss.2017.10.018

Burke, M. J., & Stephens, J. C. (2017). Energy democracy: Goals and policy instruments for sociotechnical transitions. *Energy Research & Social Science, 33,* 35-48. https://doi.org/10.1016/j.erss.2017.09.024

An abridged version of this thesis has been published as Burke, M. J. (2018). Energy democracy and the co-production of social and technological systems in northeastern North America. In A. Szolucha (Ed.), *Energy, Resource Extraction and Society: Impacts and Contested Futures* (pp. 88–104). Abingdon, Oxon; New York, NY: Routledge.

CHAPTER 1: INTRODUCTION[1]

1.1 Background and rationale

This research examines energy democracy to improve the understanding and practice of renewable energy transition among both academic and activist communities. At once a novel concept, a growing social movement, and a set of organizing principles for renewable energy transition, energy democracy can be understood as the democratization of energy systems through processes of transitioning to renewable energy. Adding to this definition, energy democracy indicates:

> a way to frame the international struggle of working people, low-income communities, and communities of color to take control of energy resources from the energy establishment and use those resources to empower their communities—literally (providing energy), economically, and politically. It means bringing energy resources under public or community ownership and/or control, a key aspect of the struggle for climate justice…and an essential step toward building a more just, equitable, sustainable, and resilient economy (Fairchild & Weinrub, 2017, p. 6).

While such movements are increasingly visible among civil society and activist communities, they remain outside much conventional discourse on renewable energy, and largely out of view of academic scholarship. This work thus broadly aims to amplify these efforts and alternatives and bring them into view among academic communities and the broader public. Working from the other direction, scholarly work offers a rich tradition of inquiry on political ecologies, social movements, social-ecological and sociotechnical systems, science and technologies studies, and sustainability transitions. These interdisciplinary fields of study guide this research, shaping the approach and providing an analytical and reflexive lens. This work aims to make use of this scholarship to empirically and critically examine this emerging social phenomenon, further drawing out relevant theoretical grounds through the process of inquiry. This introductory chapter presents the background and rationale of the research, demonstrates the relevance of energy democracy, and states the overall research objectives and methodological approach.

[1] An abridged version of this chapter has been published as the introduction to (Burke, 2018a).

The failings of conventional energy systems motivate the renewable energy transition. As commonly understood, 'renewable energy transition' refers to a process of changing from modern energy systems based predominantly on fossil fuels, to those based principally or entirely on renewable energy sources and their enabling technologies. Centralized energy systems based on 'conventional' fuels including fossil fuels and nuclear energy enable yet increasingly threaten modern civilization (Byrne & Toly, 2006). To many, current patterns of modern life seem unimaginable without secure access to these energy sources, yet due to their contributions to global warming and risks of nuclear confrontation, these same sources are increasingly viewed as a danger to the continuation of society and the survival of human and nonhuman life on Earth. This paradoxical and dangerous context increasingly frames the efforts to achieve a transition to low-carbon and renewable energy systems (Brown, Larsen, Roney, & Adams, 2015; Kern & Rogge, 2016; Verbong & Loorbach, 2012).

A growing number of actors and institutions, working across multiple levels of energy governance, now seek to transition to renewable energy. Numerous jurisdictions are actively developing plans and creating targets for high-levels of renewable energy deployment over the coming decades (REN21, 2017). The International Renewable Energy Agency (IRENA) has rapidly expanded since its inception in 2009 to become a key intergovernmental organization promoting renewable energy (Müller, 2017; Urpelainen & Van de Graaf, 2015). In 2015, the United Nations adopted the Sustainable Development Goals (SDG) including SDG 7 to "ensure access to affordable, reliable, sustainable and modern energy for all" by 2030 (United Nations, 2017). With the Paris Agreement of 2015, a global commitment has been made to deeply decarbonize the global economy (Geels, Sovacool, Schwanen, & Sorrell, 2017a; Kern & Rogge, 2016; REN21, 2016), with nations around the world committing to achieve Nationally Determined Contributions that often include renewable energy targets (World Bank, 2017). Renewables now contribute high proportions of newly installed global generating capacity (Frankfurt School-UNEP Centre/BNEF, 2017). These efforts are intended to provide a foundation for an arising era of renewable energy (Ruotsalainen, Karjalainen, Child, & Heinonen, 2017), the 'age of renewables' (IRENA, 2015), and may serve to guide renewable energy development as the 'next great experiment' of industrial civilization (Gross & Mautz, 2015).

Efforts to transition to renewable energy are guided by a core set of objectives and their underlying logics. Despite minimal coordination among these varied institutions (Sovacool & Florini, 2012), three overarching objectives presently characterize, animate, and as argued here, constrain energy governance as envisioned and implemented across the globe (Cherp, Jewell, & Goldthau, 2011; Dubash & Florini, 2011; Karlsson-Vinkhuyzen, Jollands, & Staudt, 2012; Roehrkasten, 2015). The first objective for future energy systems is to sustain economic growth. Regardless of fuel source, the stated or implicit purpose of modern energy systems since at least the middle of the twentieth century has been to support ongoing and expanding economic activity of nations as measured by Gross Domestic Product (GDP) (OECD, 2012). This commitment to growth is reflected in the favored position given to the issue of energy security, which rests on prevailing societal views of energy as both a commodity and strategic resource (National Research Council, 1984). The second objective of contemporary energy governance is energy access. Especially among developing nations, efforts for energy access and the reduction of energy poverty govern systems of international finance and technical assistance (Cherp et al., 2011). This priority rests on a view of energy as a social necessity (National Research Council, 1984). Finally, viewing energy more as an ecological resource (National Research Council, 1984), the third objective of global energy governance is to reduce carbon emissions and strive for environmental sustainability. This objective has roots in energy concerns of the 1970s and has received greater attention since the early 1990s (Cherp et al., 2011), primarily involving intergovernmental organizations. Taken together, these guiding logics clearly present tensions, surfacing for example in the confusion as to whether renewable energy is primarily about economic opportunity or human survival. Notwithstanding such tensions, systems of energy governance increasingly situate renewable energy deployment as a means to unify these goals, providing energy needed for economic growth while also reducing global poverty and environmental degradation, specifically related to climate change (Roehrkasten, 2015).

This broad convergence around objectives masks the divergent perspectives regarding ideal pathways to renewable energy futures. At least two seemingly contradictory approaches for scaling up and out renewable energy systems are now promoted. A first approach, receiving considerable attention among powerful decision makers worldwide, is a global energy interconnection (GEI). This approach proposes a global energy system fully developed by 2050 and consisting of large-scale and remotely-sited renewable electric generation facilities, ultra-

high voltage transnational and transcontinental interconnections, regional and national smart grids, and the supporting global cooperative governing mechanisms (Chatzivasileiadis, Ernst, & Andersson, 2017; Liu, 2015). Characterized as more centralized and top-down, GEI broadly aligns with the three principal objectives of energy governance. Here renewable energy would serve an agenda of neoliberal economic and industrialized sustainable development, drawing upon narratives of green growth and ecological modernization (Curran, 2015; Gupta & Vegelin, 2016; Kumi, Arhin, & Yeboah, 2014), and seeking to extend a modern social order that has co-evolved with the use of fossil fuels (Norgaard, 1994, 1995). This manner of renewable energy development sustains what Kumi et al. (2014) describe as the "paradox of the neoliberal economic agenda" (p. 542), in which market-based mechanisms, privatization, trade liberalization, and reductions in the role of governments, serve to enable greater concentrations of power.

A distinct pathway for transition reprioritizes or outrightly rejects the prevailing set of objectives for modern energy systems. A second approach, characterized as a largely decentralized and democratic model for renewable energy transition, is represented by various actions occurring across all levels of society (Angel, 2016b; S. Becker & Kunze, 2014; Boselli & Leidreiter, 2017; Martinot, 2017; Sweeney & Treat, 2017) including: initiatives in the Global South that promote decentralized, community-controlled renewable energy to address energy poverty (Ockwell & Byrne, 2017; Wu, Schiffer, & Burns, 2016); civil society organizations, trade unions, municipalities and others organizing to democratize renewable energy systems (Becker & Naumann, 2017), and campaigns to advance globally integrated networks of decentralized, 100 percent renewable energy regions (Global 100% RE, 2017). These examples reflect the arguments advanced by Byrne and Rich (1983) and Mitchell (2011), that the renewable energy transition requires a new set of political tools and evaluative criteria, which the existing political economy fails to provide. Positioning these modes of renewable energy governance as distinct and conceivably mutually exclusive development trajectories underscores the point that renewable energy transition involves not only a substitution of non-renewables with renewables, but also a competition among various and innumerable alternatives for renewable energy futures (Papachristos, 2017).

Renewable energy transition thus opens an opportunity for more profound societal change. The diversity of pathways to renewables indicates that current sociopolitical arrangements do not represent the only possibility for governing transitions. Recognizing renewable energy transition as a highly contingent and political process raises questions concerning the form and degree of corresponding changes across social, political, economic, and cultural dimensions. Informed by earlier foundational and historical inquiries into the relationships between energy use and societal structures (e.g., Adams, 1975; Byrne & Rich, 1983; Cottrell, 1955; National Research Council, 1984; Smil, 2017; White, 1943), recent inter- and trans-disciplinary scholarship has sought to understand and characterize deep societal change for integrated social and technological systems. This significant body of research employs a variety of terms to describe these more profound societal alterations, including green, great or social-ecological transition or transformation (Brand & Wissen, 2017).

For energy and sustainability transitions, processes of fundamental social change have frequently been characterized as transformations. The concept of 'transformation' is used variously across problem domains and disciplines, drawing from a broad set of historical work (e.g., Polanyi, 2001[1944]) as well as literature on social movements, socio-technical transitions, and social innovations (Chappin & Ligtvoet, 2014; Child & Breyer, 2017; Feola, 2015; Few, Morchain, Spear, Mensah, & Bendapudi, 2017; Geels & Kemp, 2007; Moore et al., 2014; O'Brien, 2012; Patterson et al., 2017). Some authors have applied the term to narrow forms of change, for example, to refer to innovations that leave incumbent powers unaffected (Geels & Kemp, 2007) or solely to describe technological aspects of change (Child & Breyer, 2017). However, transformation and associated transformative social innovations are often used to refer to shifts characterized as more radical, comprehensive, lasting, unpredictable and emergent. As such, transformations involve the alteration or replacement of established or dominant institutions and hegemonic social relations and practices, the empowerment and disempowerment of social actors, and the emergence and selection of co-evolutionary or co-productive changes in energy systems and their social-material context (Avelino et al., 2017; Haxeltine et al., 2016, 2017; Jonas, 2017; Patterson et al., 2017; Roggema et al., 2012; Schneidewind, Augenstein, & Scheck, 2013; Schot & Kanger, 2018).

Transformations involve the co-evolution of social and technological systems. As issues of governance and political economy, energy transitions require and embody fundamental changes in the structure of sociopolitical relationships upon which energy systems are based (Byrne & Rich, 1983). Transitions in modes of consumption and production are viewed as core processes and outcomes of broader societal transformations that also involve changes in economic and social structures and reconfiguration of power relations (UNRISD, 2016). In this context, 'co-evolution' of technology and society refers to processes of change that arise and potentially stabilize through ongoing, mutual, and largely unpredictable human-technological relationships, interactions, and feedbacks over time, involving interdependencies among what are typically characterized as social/institutional and material/technical elements of 'sociotechnical systems' (Geels, 2005a; Frank W. Geels, 2002; Kemp, Loorbach, & Rotmans, 2007; Labussière & Nadaï, 2018a; Patterson et al., 2015, 2017; Rotmans, Kemp, & van Asselt, 2001). A co-evolutionary framing for sociotechnical systems suggests that technological innovations influence but do not determine the fitness and evolution of social organization, which, in turn, may shape but does not determine the fitness and evolution of technological systems (Kemp et al., 2007; Norgaard, 1995). For this research on renewable energy transition, the value of thinking in terms of co-evolution and co-production lies in the way it urges an openness to and emphasis upon the emergence and potential stabilization of new socially transformative elements over time (Jasanoff, 2004; Norgaard & Kallis, 2016).

Transformations thus imply social, radical, and emergent, rather than technological, incremental, and managed forms of change (Brand & Wissen, 2017). Echoing Norgaard's (1994) characterization of co-evolutionary processes as beyond prediction and control, Stirling (2014a) similarly draws a distinction between transformation and transition. Transition is understood as a form of social change "driven by technological innovation, managed under orderly control, by incumbent structures according to tightly-disciplined frameworks for knowledge, towards a specific known (presumptively shared) end" (Stirling, 2014a, p. 1), such as the three core objectives of global energy governance. In contrast, transformations are characterized by "more plural, emergent and unruly political re-alignments, involving social and technological innovations driven by diversely incommensurable knowledges, challenging incumbent structures and pursuing contending (even unknown) ends" (p. 1). The distinction is important in understanding and practicing social change because, as Stirling argues, experience demonstrates

that “it is repeatedly unruly, bottom-up ‘transformations’ rather than top-down structured ‘transitions’ (in these senses), that typically achieve the most profound (sometimes rapid) radically progressive social changes” (p. 1).

While change is assured, the key questions concern the type of change involved with energy transition. Whether transition or transformation, change is a certainty in the present context of climate change and capitalist/industrialist political economies. The value of considering these different forms of change lies in their many implications for changing energy systems (Chappin & Ligtvoet, 2014; Child & Breyer, 2017), suggesting that: incremental, top-down, and market-driven forms of managed change have failed to achieve the desired changes; profound societal changes that address root causes and draw on fundamentally different logics are required; deep and lasting societal change has been forged through hopeful, democratic social struggles and an opening of possibilities rather than being smoothly and rapidly steered through technical compliance and social control under a sense of urgency; both top-down and bottom-up approaches risk being narrowed to business-as-usual forms of capitalist modernization; and greater, although not exclusive, roles are needed for grassroots innovations, social movements, civil society, and alternative and marginalized interests, to drive these changes in consumption and production and reshape structures of governance and power relations (Brand & Wissen, 2017; Few et al., 2017; Geels, 2014; Hildyard, 2016; Kumi et al., 2014; Leach et al., 2012; Scoones, Leach, & Newell, 2015; Stirling, 2014a, 2014b). Essential questions therefore involve the manner and quality of changes and the logics that guide them, implying a crucial role for the democratic restructuring of social, ecological, and technological interactions (Brand & Wissen, 2017).

Neither the possibilities for transition nor transformation are in any way assured, however. Contemporary claims abound regarding an unstoppable upsurge of renewables, frequently invoking economic arguments, as if renewables can somehow advance independently from the influences of social and political swings. Transformative possibilities have also been overstated in the past, and expectations of an inevitable age of renewables may conversely serve to restrain actual progress. During the 1970s, claims regarding the inevitability of transition, based on perceived inherent qualities and benefits of these technologies, tended to depoliticize the transition by neglecting the necessary social and political struggles (Byrne & Rich, 1983).

Reflecting on this period of techno-optimism among many advocates for renewable energy, Byrne and Rich (1983) moderated the possibilities of these technologies, suggesting that "(w)hile a solar transition will not guarantee a preferred system for the governance of our energy future, it can offer opportunities different from those which currently exist" (p. 183). Decades later, however, Glover (2006) concluded that these technologies had failed to achieve their promise for either substitution or transformation, arguing that over time "renewable energy has gone mainstream in every sense, transformed from a radical agenda to a conformist condition" of ecological modernization (p. 261). Currently, a preponderance of perspectives regards a renewable energy transition as a means for sustaining rather than changing prevailing political economies, as demonstrated by proposals such as a Green New Deal or a New Climate Economy (McCarthy, 2015; New Climate Economy, 2018).

A better understanding is urgently needed regarding co-evolutionary dynamics of renewable energy transition and opportunities and constraints for transformation. The possibility for achieving this energy transition without significant sociopolitical change and collective effort is unrealistic and arguably undesirable. This transition is a contingent and political process on multiple levels, which may open opportunities for deep societal change (Sovacool & Hess, 2017, p. 736), yet without taking these issues seriously, renewable energy transition will tend to remain supplementary to existing energy systems. To approach this transition primarily as a matter of technological substitution is likely to miss transformative opportunities and instead extend the era of fossil fuels and its associated unjust and unsustainable social, ecological and technological patterns (Byrne & Rich, 1983; Cederlöf, 2015; Norgaard, 1994). Within a context of a development agenda not only incapable of achieving the desired energy transition but indeed making matters worse (Klein, 2015; Smith, 2011), and with consequences of this failure reaching catastrophic proportions, there is a need to deepen our understandings regarding how these co-evolutionary dynamics function and what they demonstrate for more fundamental social change and collective empowerment. From this perspective, it is imperative to examine and identify the promising and necessary sociopolitical relationships for bringing about renewable energy transition, to seriously evaluate the opportunities and risks of this transition, and to carefully consider the implications for collective choice of energy futures (Byrne & Rich, 1983).

1.2 Energy democracy and social transformation

Energy democracy offers an opportunity to understand and advance transformative change through renewable energy transition. Over the past decade, groups organizing around *energy democracy* have surfaced out of climate and environmental justice and labor movements, most often in the Global North yet increasingly worldwide (Angel, 2016a; Becker & Naumann, 2017; Chavez & Dove, 2015; Kunze & Becker, 2014; Morris & Jungjohann, 2016; Sweeney, 2014). These various initiatives seek an energy future based largely on collectively-owned and decentralized renewable energy technologies and guided by commitments to democracy, social and environmental justice, and ecological integrity (Becker & Naumann, 2017; Boselli & Leidreiter, 2017; Weinrub & Giancatarino, 2015). Through energy democracy, renewable energy would provide physical power for meeting human needs, serving the public good, and generating wellbeing across inclusive communities, involving especially those harmed by fossil fuel extraction and use (CSI, 2010). This energy future would further emphasize distributed generation and overall reductions in energy use (Sweeney, 2014). Energy democracy renews the work of earlier nonconventional and ecologically-minded advocates of renewable energy (Laird, 2003), seeking to foster "an informed and conscious community that understands the right relationship of people to natural resources and the need to live in ecological balance" and support a view of energy less of a commodity and more of "a democratically controlled, common resource for enriching and servicing our communities" (Weinrub & Giancatarino, 2015, p. 4). Renewable energy as governed by energy democracy would provide a key component of collectively-led, human-scale community development more broadly.

One might imagine an energy future organized through energy democracy. This world might be one of sociotechnical experimentation, employing varied sets of unique, creative, idiosyncratic, and socially- and ecologically-integrated approaches for capturing, storing, moving and using renewable energy sources. Working first at the local level and building outward, existing institutions are reformed and new and diverse organizations are developed. Collective initiatives continuously improve the capacity for energy citizens across all social sectors to share ownership and control of a diverse set of energy sources and technologies. Always resisting structures of concentration and accumulation, these initiatives reorient energy and economic development toward mutual wellbeing of people and planet. A variety of decentralized energy transitions can be envisioned, employing many different technologies, financing instruments, organizational

forms, and so on, reflecting substantial social-ecological diversity yet holding a basic commitment to sharing and caring for energy systems that provide for basic human needs while respecting local and global environmental limits. Following the near or complete elimination of the extraction and use of fossil fuels, air and water around the world once again support flourishing human and ecological communities, notably within and surrounding historically polluted and marginalized locations. Over time and through the course of struggle, this strategy inspires interconnected networks of communities of energy citizens working regionally and beyond. Beginning from the level of the community implies less control over energy transition pathways, however, likely involving messier, more diverse and flexible approaches to sociotechnical development. The aim here is not to provide a complete picture; a more comprehensive articulation of energy democracy futures is developed through the research. Rather, the intention here is simply to sketch the general contours of myriad energy democracy pathways, ultimately dependent upon specific contexts and realities on the ground.

The research on energy democracy is more broadly an inquiry on the transformative potential and performance of renewable energy. This introduction has made the case that while there appears to be a consensus around the general importance of renewable energy, there exist multiple, divergent, and politically-charged pathways, meanings and narratives for renewable energy transition. In this context, the question of selecting for energy futures must be understood as a problem of political economy, eliciting the need to consider "the likely consequences for how, by whom, and in whose interests the political economy of energy will be governed" (Byrne & Rich, 1983, p. 164). The recognized indeterminacy of impacts of renewable technologies and their historical shortcomings further demonstrate the importance of careful, thorough and reflexive inquiry regarding the potential for and the performance of social transformation through renewable energy transition. Advocates of energy democracy, among others, have taken up and reorganized previous work for realizing a transformative vision of energy futures. Through energy democracy, the contemporary work of energy transition becomes not only that of building new infrastructure, but also about achieving social transformation based on principles of equity, justice, sustainability, and resilience. Energy democracy thus provides a unique and necessary perspective on these co-evolutionary dynamics and their possibilities for social transformation.

1.3 Research objectives and methodological approach

This research engages energy democracy as an emerging sociotechnical system. Through inquiry on energy democracy, this research aims to understand how social arrangements change in relation to the renewable energy transition, and how a transition organized by and through energy democracy may or may not influence systemic transformation of energy governance. As an integrated sociotechnical problem*,* it is expected that the transition to renewable energy will involve changes extending far beyond the technological, including values, knowledge, organization and environment (Buscher, Schippl, & Sumpf, 2018; Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018; Jasanoff, 2004; Labussière & Nadaï, 2018a; Norgaard, 1994). From a co-evolutionary perspective, the transition to renewables therefore not only opens opportunities for broader social change, but ultimately influences and requires such changes. Because fundamental changes to systems of energy governance are essential for renewable energy transition, this research makes the argument that the transition to renewable energy enables and is enabled by the theory, policies and social initiatives of energy democracy. Framing renewable energy transition as a problem of governance and a process of political struggle, the overall objectives of this research are to:

1. draw out and critically engage with the theory underlying energy democracy (chapter 3);
2. identify and assess the core objectives and policies advanced by advocates of energy democracy (chapter 4), and;
3. examine energy democracy initiatives in practice to understand how renewable energy is currently put to work for social transformation (chapter 5).

Two relevant scholarly perspectives shape the methodological approach to scientific inquiry for this research. As a systematic process for generating public knowledge, this research requires clarification of the methodological approach to inquiry, meaning the conceptual and philosophical basis on which claims about the world are made (Jackson, 2016). The methodological approach of this research is organized around two well-established and highly-relevant perspectives, that of social-ecological and sociotechnical systems, and that of political ecology.

Co-evolution is framed and theorized through a perspective of social-ecological-technical systems. Understanding transformational change and its limits requires specification of the

aspects of energy governance that enable or constrain transformation (Kuzemko, Lockwood, Mitchell, & Hoggett, 2016). For this research, a conceptual framework for 'social-ecological-technical systems' (SETS) is applied, based on the work of Ostrom and others on social-ecological systems (Ostrom, 2007, 2009) and further refined by McGinnis and Ostrom (2014). This SETS framework is a researcher-constructed model of knowledge about real-world phenomena (Becker, 2012), used to conceptualize and define specific sociopolitical dimensions as elements of 'governance systems' (McGinnis & Ostrom, 2014; Ostrom, 2009). This set of elements includes:

- the relevant policy area
- the geographic range and population of human participants
- the rules in use, including policy instruments
- the systems of property-rights
- the types of governing organizations
- the regime type or logic (e.g., democratic or autocratic)
- the repertoire of available cultural norms and strategies
- the structure of the network connecting governing organizations and the participating populations
- the historical continuity or mode of response (e.g., static v. flexible).

These elements are used to organize and focus the conceptualization of systems of energy governance or energy regimes, which in turn are understood to relate and interact with other subsystems of SETS and the broader setting within which a defined system is embedded (Figure 1.1).

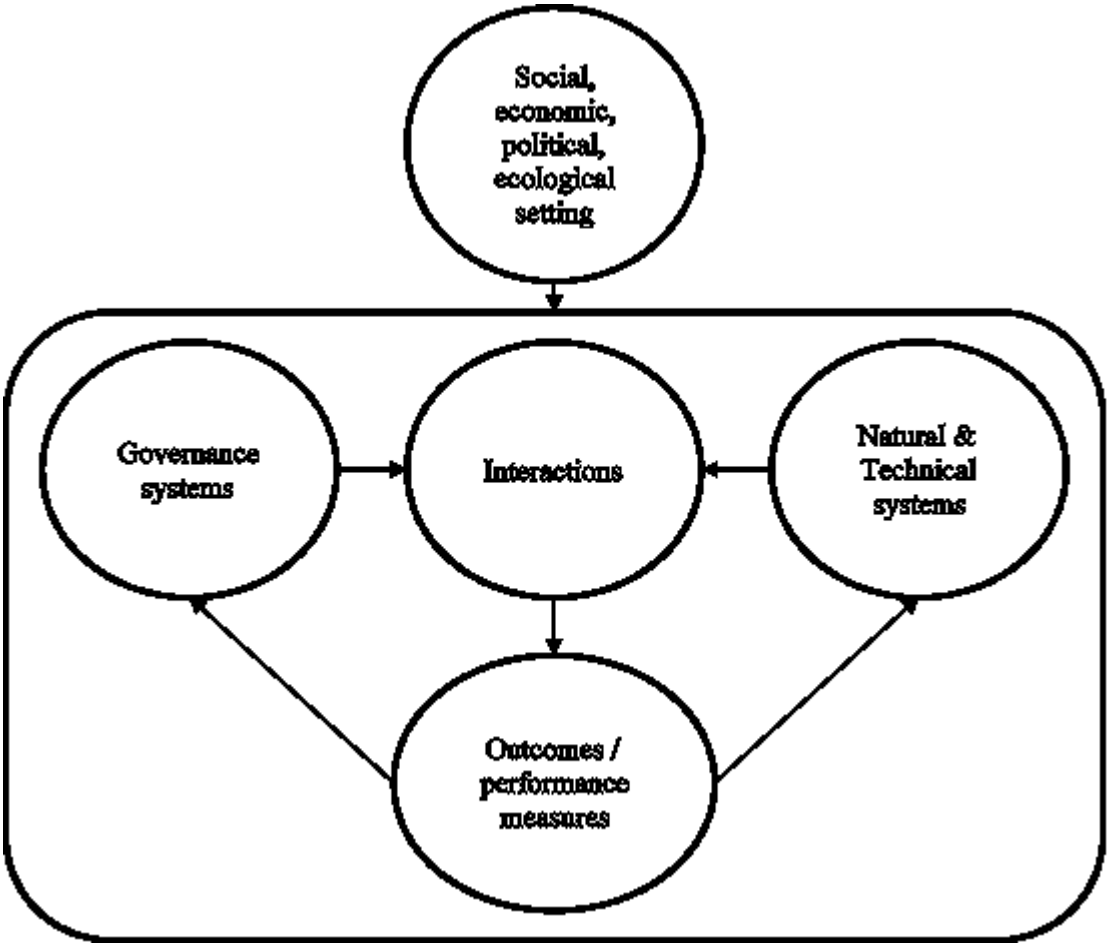

Figure 1.1. A theoretical framework for social-ecological-technical systems (adapted from Ostrom, 2009)

The perspective on co-evolution also integrates theories on sociotechnical systems. Important limitations of the SETS framework include the challenge of integrating technological systems (McGinnis & Ostrom, 2014) and the difficulty to readily characterize changes over time (Binder, Hinkel, Bots, & Pahl-Wostl, 2013). Examining the co-evolutionary relationships between social and technological systems is therefore further facilitated by integrating scholarship on social-ecological-technical systems with that of sociotechnical systems. The 'multilevel perspective' (MLP) for sociotechnical systems (Geels, 2002, 2005b) offers a widely applied theory of change based on interactions across three analytical levels: the micro-level, the meso-level, and the macro-level. The micro-level represents various ongoing niche innovations or experiments that occur outside the current energy regime and provide the source for new ways of doing things. The meso-level represents the current energy regime and its stabilized patterns of energy governance. The macro-level represents external factors and developments that cannot be controlled directly, including broader biophysical trends and social worldviews. A change of energy regimes is understood to require alignments across these three levels of governance (Geels, 2005c; Geels & Schot, 2007), yet each level varies in its capacity for change. Changes at the micro-level, through the benefit of safe niche spaces, occur regularly and rapidly but largely fail to immediately influence or destabilize the meso-level regime. Changes at the macro-level occur much more slowly and infrequently. Sociotechnical regimes are therefore expected to change gradually. However, relatively rapid periods of change can occur when changes across the three levels align and reinforce one another, opening a window of opportunity. Integration of these understandings on SETS and the MLP (Figure 1.2) supports the analysis of specific elements of governance, their relationships to other subsystems, and their processes of change and stabilization.

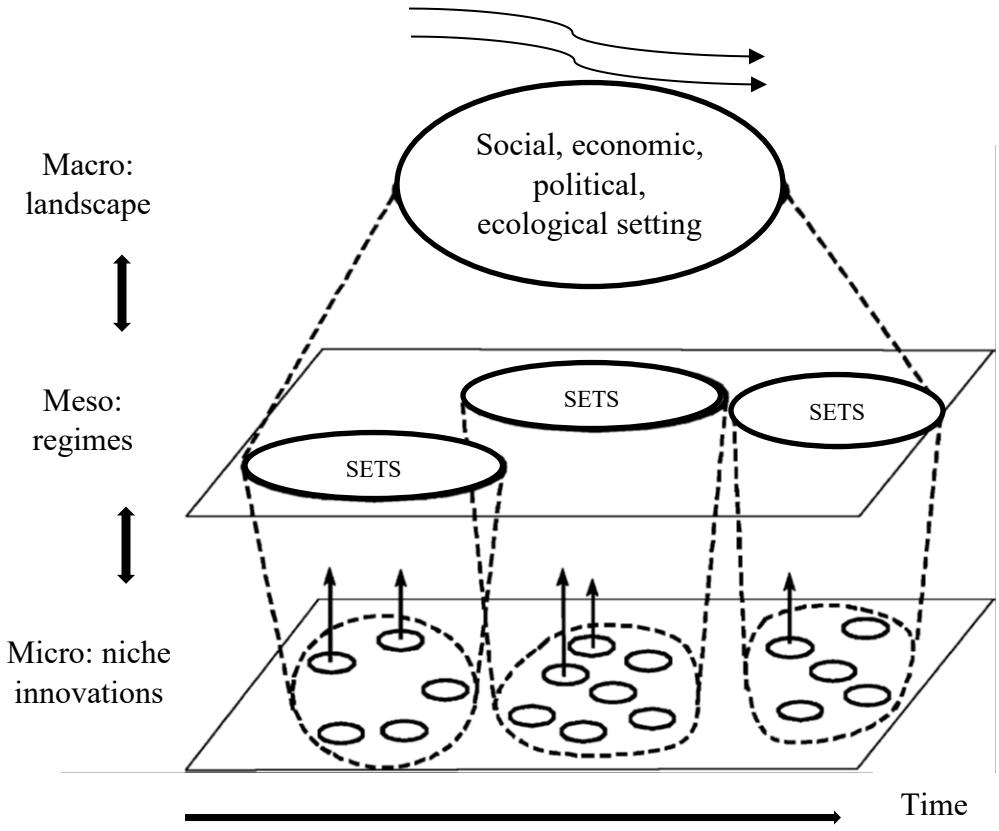

Figure 1.2. Multi-level perspective on dynamics of social-ecological-technical transitions (adapted from Geels, 2002; Geels & Schot, 2007; Ostrom, 2007)

From this integrated perspective, the present moment suggests the possibility for fundamental changes to systems of energy governance. As understood through this framing, this research identifies and assesses changes at the niche level, as demonstrated by energy democracy, and relates these changes to the present sociotechnical regime as defined as elements of governance. As argued previously, energy democracy and other actions and innovations suggest that the micro-level is already exerting pressure to change energy regimes, meaning elements of new regimes already exist even as the present regime continues to operate. Meanwhile, there is considerable evidence that macro-level changes, including climate change and the adoption of the SDGs, are exerting heightened pressures for change upon existing energy regimes. Within this broader context of pressures, the dynamics between rapidly materializing niche innovations and current energy regimes are key for understanding and influencing energy transition; if transformative social innovations are reinforced, then energy regimes can transform.

Finally, perspectives from political ecology contribute both critically and constructively to this research. SETS and the MLP have received criticism for insufficiently recognizing and attending to central issues of politics and social power (e.g., the interests and influence of incumbent actors) (Boonstra, 2016; Fabinyi, Evans, & Foale, 2014; Geels, 2014; Kern & Markard, 2016; Scoones et al., 2015). Further, as an unavoidably normative process, renewable energy transition requires that the researcher take positions, implicitly or explicitly, in relation to socially available norms and values and desired future conditions. Political ecology can contribute meaningfully in these respects. As an approach to research, political ecology makes explicit the normative goals and assumption that serve to define the problems, justify the range of relevant actors, and broaden the considerations of responses, outcomes and impacts (Lawhon & Murphy, 2012; Perreault, Bridge, & McCarthy, 2015). Moving beyond critique of apolitical accounts and normalized institutions, political ecology as research about and for equity and sustainability seeks to create space for and support alternative thinking and action toward positive social transformation (Walker, 2006). Political-ecology accounts strive to dismantle structural relations that contribute to ongoing social and environmental degradation (and their usual explanations) while helping to "seed" new narratives that can support "better, less coercive, less exploitative, and more sustainable ways of doing things" (Robbins, 2012, p. 20), toward "a more socially and ecologically just world" (Bryant, 2015, p. 22). Thus, rather than seeking to demonstrate the hopelessness of projects for transformation, the broader purpose of this research is to urge an

openness regarding the possibilities for transformation made possible through actions already being performed (Graham & Roelvink, 2010), and by way of these actions, to "read the potentially positive futures barely visible in the present order of things, and to imagine how to strengthen and move them along" (p. 342).

The organization of the thesis proceeds as follows. This introductory chapter is followed by a literature review covering key topics related to renewable energy transition, including its sociopolitical context, current and historical social movements for renewable energy transition, and political ecology scholarship on renewable energy transition. Chapters 3, 4 and 5 constitute the research manuscripts for this thesis, prepared according to a manuscript-based format, with each connected and introduced with interconnecting text to the chapter. Finally, following an additional interconnection, chapter 6 presents an overall discussion and conclusions for this thesis.

CHAPTER 2: LITERATURE REVIEW

2.1 Sociopolitical context of renewable energy transition

The very meaning of energy is contested, critiqued, historically contingent, and politically charged. Modern human energy systems include several of the countless ways that life on Earth has developed to capture, make use of, and dissipate low-entropy matter-energy. However, across disciplines including the physical sciences, 'energy' is a notoriously slippery term, commonly referring to a wide variety of phenomena or processes including heat, motion, light, electricity and chemical energies, and often defined in terms of a capacity to do work (Heinberg & Fridley, 2016a; Smil, 2008, 2009, 2017; Stephenson, 2017). There are several key problems with this understanding, however. The concept of energy as a universal currency, and the standardization of its measurement, minimize important qualitative differences among these diverse phenomena. These qualitative differences are increasingly important when understanding the possibilities for renewable energy to substitute conventional fuels. Defining energy in relation to work also presupposes the socially constructed value of its effects. Smil thus argues that it is more helpful to define energy as "the ability to transform a system" (Smil, 2008, pp. 12–13).

Physical definitions have further shaped, and conflicted with, the way societies have tended to think about energy, which in turn has influenced the way decisions about energy are made (National Research Council, 1984). The amalgamation of diverse processes under a singular and novel abstraction of energy emerged from within a particular historical context, wherein the problem of energy involved its conversion and application to certain ends. The problem was to understand how to efficiently convert energy resources into so-called productive work for a developing industrial society, largely to the benefit of those who owned the means of conversion. This modern conceptualization of energy is associated with the social construction of industrialized sense of time and labor-as-work. These understandings have further enabled the enclosure, commodification and control of these physical phenomena, and have been used to advance processes of accumulation, extend machine production, and increase societal dependence on high levels of use of finite energy resources (Cederlöf, 2015; Devine-Wright, 2007; Foxon, 2018; Illich, 2009; Labanca, 2017; Lohmann & Hildyard, 2014; Shove & Walker, 2014). This history involves not only ecologically and socially destructive practices but has also served to obstruct or minimize other views of these multiple energies, seeing them less as

commodities or strategic materials for human exploitation and more as ecological and social resources and necessities (National Research Council, 1984), bases of social power and power relations (Adams, 1975), or threads of interconnected relationships among all living and nonliving phenomena (Frigo, 2017). It is therefore practically and politically relevant to acknowledge that different views on energy carry very different implications for society, and specifically for decision making about energy and technologies.

Understandings of renewable energy come out of this historical and political context. The concept of 'renewable energy' typically refers to non-exhaustible forms or fluxes of energy, meaning those that the natural environment continuously replenishes on a human timescale. These include primary sources derived from the sun either directly, including thermal and photo-electric energy, or indirectly, such as wind and biomass, or from other natural movements and cycles (Armaroli & Balzani, 2011; Ellabban, Abu-Rub, & Blaabjerg, 2014; Goldemberg, 2012). A singular definition of renewables can again minimize important differences among various sources and their enabling technologies, differences evident in comparing the most mundane bioenergy sources used worldwide with technologically complex, modern systems including wind power, solar photovoltaics, and hydroelectricity (Chatti, Archer, Lennon, & Dove, 2017). Further, their renewability is debatable and context dependent. Although the flows of these sources may be continuously replenished, when applied in the context of large-scale development designed to meet projected energy demands of industrial societies, the renewability of a host of processes requires consideration, from capture, conversion, storage, movement, use, maintenance, and reproduction. Clearly these processes demand additional energy and material inputs. Thus, beyond the widely discussed technical challenges of variable energy systems, the idea of renewability is more fundamentally complicated by the ongoing dependence of these technologies on systems of unsustainability, including fossil fuel infrastructure, industrial production, material extraction and throughput, long-distance supply chains, spatial expansion and enclosures, environmental degradation, continued economic growth and accumulation, and high levels of financial investment involving networks of economic and political power (Abbasi & Abbasi, 2012; Dunlap, 2018b; Foxon, 2018; Georgescu-Roegen, 1984; Heinberg & Fridley, 2016b; Huber & McCarthy, 2017; Jones, 2013; Lohmann & Hildyard, 2014; McCarthy, 2015; Nadaï & Labussière, 2018; Raman, 2013; Szklo & Schaeffer, 2006; Thombs, 2017).

Transition studies influence current understandings of renewable energy transitions. Among the growing set of work on sustainability transitions (Markard, Raven, & Truffer, 2012), recently scholarship on energy transition has been largely informed by work emphasizing transitions or system innovations. Here, 'transitions' are understood to involve "processes of structural change in major societal subsystems. They involve a shift in the dominant 'rules of the game', a transformation of established technologies and societal practices, movement from one dynamic equilibrium to another—typically stretching over several generations" (Meadowcroft, 2009, p. 324). Transitions involve negotiating and influencing gradual, ongoing, and large-scale societal and sociotechnical systems change, characterized as multi-directional and co-evolutionary, and emerging through alignments across levels of innovations, regime, and the broader contextual landscape (Elzen, Geels, & Green, 2004; Geels, 2002; Geels & Schot, 2007; Geels, Sovacool, Schwanen, & Sorrell, 2017b; Rojey, 2009; Rotmans et al., 2001). An 'energy transition' may therefore be understood as a decades-long period of change in the structure or composition of primary energy supply and use, from an existing to a new pattern of energy provision, resulting in an alteration in the state of an energy system (Grubler, Wilson, & Nemet, 2016; Smil, 2010). While energy transitions are understood to involve changes in economic, political, institutional, and cultural dimensions (Berkhout, Marcotullio, & Hanaoka, 2012; Stephens, Peterson, & Wilson, 2014), technological substitution plays a central role in transition studies, and as such, the object of study and action for renewable energy transition is often the move from fossil fuels to renewable energy (Breslau, 2013), from finite stocks to replenishable flows of energy in the language of systems (Sgouridis & Csala, 2014).

Differences in perspective also complicate the idea of energy transition. A number of important debates and critiques around energy transition studies have come forward in recent years (Geels, Schwanen, Sorrell, Jenkins, & Sovacool, 2018). Key issues related to renewable energy transitions include the feasibility of renewable or low-carbon transitions (Diesendorf & Elliston, 2018; Hansen, Narbel, & Aksnes, 2017; Heard, Brook, Wigley, & Bradshaw, 2017; Jacobson, Delucchi, Cameron, & Frew, 2017; Loftus, Cohen, Long, & Jenkins, 2015; Moriarty & Honnery, 2016; Shaner, Davis, Lewis, & Caldeira, 2018; Smil, 2015), a perceived over-reliance on techno-economic perspectives and approaches (Rolffs, Ockwell, & Byrne, 2015; Ruotsalainen et al., 2017), the relative importance of macro-level changes and trends as compared to social practices, lived experiences, and end uses (Shove & Walker, 2014), the degree of agency or social control

of energy transitions (Avelino et al., 2017; Kern & Rogge, 2016; Rauschmayer, Bauler, & Schäpke, 2015; Verbong & Loorbach, 2012), and the inconsistencies for defining and tracking energy transitions over time (Grubler et al., 2016; Smil, 2016; Sovacool, 2016a; Sovacool & Geels, 2016). Thus, all the constituent terms of renewable energy transition are controversial and have received criticism for their treatment regarding what exactly is to be transitioned, by and for whom, and toward what end.

A central scholarly critique and debate surrounding renewable energy transition concerns the issue of transition as a political process. Despite increasing recognition among renewable energy scholars that sociopolitical barriers are at least if not more significant as technical or financial factors for renewable energy transition (Delucchi & Jacobson, 2011; Jacobson & Delucchi, 2011), this view has not led to a sufficient understanding of how these factors work to motivate or constrain transition. A number of problematic aspects of energy transition studies relevant to this research have been identified, including inadequate consideration of social power/knowledge, agency, social movements, labor, ownership, democracy, accountability, and accumulation, and insufficient understandings of the ways that existing social, economic, and political structures and relationships shape and constrain the realm of possibility for change (Geels, 2014; Hildyard, 2016; Lawhon & Murphy, 2012; Meadowcroft, 2009, 2011; Paredis, 2010; Shove & Walker, 2007; Smith & Stirling, 2010; Smith, Voß, & Grin, 2010; Stirling, 2014b). Transitioning away from concentrated patterns of control of energy systems under fossil fuel regimes toward renewable energy systems raises important questions around the possibilities for redistributing these patterns of control and remaking social relations (Blair, 1976; Byrne & Rich, 1983; Engler, 1977; National Research Council, 1984; Norgaard, 1994; Sampson, 1975). Although there has been considerable progress in recent years to address these important questions of power and politics in energy and sustainability transitions (Avelino, Grin, Pel, & Jhagroe, 2016; Avelino & Rotmans, 2009; Bues & Gailing, 2016; Geels, 2014; Geels et al., 2017b; Healy & Barry, 2017; Hess, 2014; Kenis, Bono, & Mathijs, 2016; Laird, 2013; McCarthy & Thatcher, 2017; Meadowcroft, 2016; Mitchell, 2011; Scoones et al., 2015; Stirling, 2014b; Van de Graaf, 2013), the need remains to address these issues more explicitly and with greater conceptual clarity (Ahlborg, 2017; Audet, 2015; Avelino et al., 2016; Kern & Markard, 2016; Kumi et al., 2014; Scoones et al., 2015; Sovacool, 2014).

2.2 Social movements and renewable energy transition

Advocates have repeatedly viewed renewable energy as a transformational opportunity and necessity. Throughout recent history, energy technologies have been enrolled in the construction of social identities and idealized futures. Among renewables, hydroelectric power is arguably unmatched for its entangled and problematic history, involving political ambition, national identities, ideologies of modernity and development, and the contrasting actual experience of massive and often devastating socioecological transformation (Desbiens, 2013; Sneddon, 2015; Sovacool & Brossmann, 2013). Beginning especially in the 1970s, an increasing number of critical advocates explicitly rejected such approaches to renewable energy development, asserting instead more democratic, egalitarian, and environmentally-benign approaches based on solar and wind technologies, and emphasizing concerns for energy scarcity, environmental degradation, and decentralization (Byrne & Rich, 1983; Glover, 2006; Laird, 2003; Mittlefehldt, 2018). As demonstrated by examples including Mumford's "democratic technologies" (1964), "appropriate technologies" inspired by Schumacher (1973), Lovins' "soft energy path" (1976), Bookchin's "eco-technologies" (1980), Henderson's "Solar Age" (1988), and Scheer's "Solar Manifesto" (2012), the transition to alternative and renewable energy has long been understood among advocates as a means for and outcome of societal transformation (Glover, 2006; Laird, 2003; Mittlefehldt, 2018).

Despite these countercultural roots, transformative aspirations for renewable energy have largely been abandoned. As Glover explains, "(s)omewhere along the line, renewable energy went from the domain of counter culture to corporate mainstay, from communes to communication strategies, from naturalism to natural capitalism, and from love-ins to logos" (2006, p. 247). This turn has been attributed in large part to a persistent alignment with and reliance upon existing institutions and instruments of social and economic power and control among renewable energy innovations, demonstrating their inability to break from the political economies and social orders of conventional energy (Byrne & Rich, 1983; Glover, 2006; Norgaard, 1994; Raman, 2013; Smith, 2011). This historical trajectory has led Glover to conclude that renewable energy on a large scale for industrialized economies implies sophisticated and exclusionary technologies as components of centralized energy systems under oligarchical ownership patterns, designed to serve neoliberal agendas of economic globalization

(2006, pp. 263–264). The centralized approach described previously points to the real possibility for this outcome.

Social activism has again turned to renewable energy transition as a key arena for change. Radical initiatives and alternatives, specifically resistance and social movements, are seen to occupy a central role for transformation today (Temper, Walter, Rodriguez, Kothari, & Turhan, 2018). In the context of climate change, ongoing ecological destruction, rising social inequity, and a widespread recognition of the failure of mainstream efforts to achieve sustainable societies (Gupta & Vegelin, 2016; Kumi et al., 2014), these initiatives are again organizing around renewable energy, linking the prospect of transition with broader concerns for social justice and ecological sustainability (Klein, 2014). Such initiatives take a variety forms and identities including environmental and climate justice activism (Martinez-Alier et al., 2014; Temper et al., 2018; Tokar, 2015), just transitions (Healy & Barry, 2017; Heffron & McCauley, 2018; Newell & Mulvaney, 2013; Stevis & Felli, 2015), ecovillage networks (Kunze & Avelino, 2015), transition towns (Hopkins, 2008; Amanda Smith, 2011), degrowth (Kunze & Becker, 2015), ecological society and eco-socialism (Löwy, 2015; Magdoff & Williams, 2017; Schwartzman, 2016), community energy and energy commons (Becker & Kunze, 2014; Blanchet, 2016; Byrne, Martinez, & Ruggero, 2009; Cloke, Mohr, & Brown, 2017; Giancatarino, 2013; Gui & MacGill, 2018; Hoffman & High-Pippert, 2005; Koirala, Koliou, Friege, Hakvoort, & Herder, 2016; Mann, 2016; G. Walker & Devine-Wright, 2008), and intersections among them. Like their historical precedents, these contemporary examples differ in their strategies, discourses, goals, and visions for energy futures (Mittlefehldt, 2018), reflecting active inquiry and debate among scholars and advocates of renewable energy regarding what can, should, and ultimately does change through a transition, and why these questions matter. Yet also like earlier advocates, these initiatives and movements are held together by a skepticism, and often an antagonism, toward mainstream approaches for renewable energy futures (Laird, 2003), as well as a shared belief in the possibility and even necessity for a transition organized through deep social, political, and cultural change.

2.3 Political ecology and renewable energy transition

Political ecology can draw needed attention to the broader context and relationships of renewable energy transition. In contrast to what Paul Robbins terms “apolitical” ecology (2012,

p. 14), which naturalizes and thus makes invisible politics and power relations underlying environmental change, research and application of political ecology emphasizes political economic context as fundamental to problems and predicaments of social-environmental change and socioecological degradation. As a diverse body of research and an international, intercultural, and interdisciplinary community of practice and praxis, political ecology sees ecological systems, and by extension, energy systems (Huber, 2015a), as essentially power-laden. This view urges a consideration of the relationships between social and ecological outcomes and political processes and struggles (Bryant, 2015; Osborne, 2017; Perreault et al., 2015; Robbins, 2012). Applying Robbins' description to the problem of contemporary energy transition, political ecology addresses through theory and empirical research "the condition and change" of energy systems, "with explicit consideration of relations of power" (2012, p. 20).

Accounts of political ecologies of energy have focused on conflicts surrounding energy resources (Huber, 2015a; Sovacool, 2016b). For renewable energy, these accounts demonstrate a range of potential and actual points of conflict. Prominent among these include: tensions around the historical production of electricity systems (Cederlöf, 2015; Hughes, 1983); core political questions of who controls renewable energy and for what purpose (Huber & McCarthy, 2017; Lohmann & Hildyard, 2014); obstacles to renewables under capitalism (Warlenius, 2015) and ways renewables may serve to reproduce capitalist social relations (McCarthy, 2015); the influential roles of financiers and financial institutions (Castree & Christophers, 2015; Lohmann & Hildyard, 2014); marginalization of vulnerable populations and degradation of the environment (Krupa & Burch, 2011); public resistance to renewable energy projects (Pasqualetti, 2011); resource mapping, the global land rush, and spatial-political dimensions (Huber & McCarthy, 2017; Huber, 2015b; Ley, 2017; McCarthy & Thatcher, 2017; McEwan, 2017; Sovacool, 2016b); and political ecology accounts of specific technologies such as agrofuels, biofuels, and biomass (Ariza-Montobbio, Lele, Kallis, & Martinez-Alier, 2010; Dietz, 2015; Magdoff, 2008; van der Horst & Evans, 2010), hydroelectric dams (Fletcher, 2010), industrial-scale wind energy (Dunlap, 2018a; Phadke, 2011; Zografos & Saladie, 2012), and rooftop solar (Franklin & Osborne, 2017).

Political ecology offers a highly relevant yet underutilized approach for examining opportunities and obstacles for transformative change through renewable energy transition. Despite these and

related exemplary works, the view remains that political ecology has not sufficiently grappled with issues of energy systems and renewable energy transition (Cederlöf, 2015; Huber, 2015a). This lack of attention is unfortunate because political ecology offers a valuable approach for understanding energy transitions as processes of socio-technical transitions (Lawhon & Murphy, 2012), and for advancing strategies to address the interlinked social and ecological crises through fundamental change (Brand & Wissen, 2017).

INTERCONNECTING TEXT TO CHAPTER 3

Chapter 3 has been published as Burke, M. J., & Stephens, J. C. (2018). Political power and renewable energy futures: A critical review. *Energy Research & Social Science*, *35*, 78–93. https://doi.org/10.1016/j.erss.2017.10.018

While energy democracy and various historical examples see a transformative opportunity in renewable energy transition, the theoretical basis for this relationship between renewable energy technologies and sociopolitical systems is underdeveloped. The research proposes to understand and demonstrate this transformative potential and performance of renewable energy first by drawing out and critically engaging with the context and theoretical basis for these co-evolutionary dynamics. Chapters 1 and 2 have introduced the research by positioning renewable energy transition as a political and potentially transformative process involving the co-evolution of social and technological systems. Inspired by the energy democracy movement, chapter 3 examines understandings of the relationships between concentrated or distributed renewable energy and political power. The objectives of this chapter include: 1) theorizing and exploring the relationships between renewable energy and political power, 2) critically assessing tensions associated with an energy democracy agenda, and 3) drawing out the implications for democratizing renewable energy development in practice.

CHAPTER 3: POLITICAL POWER AND RENEWABLE ENERGY FUTURES: A CRITICAL REVIEW

3.1 Introduction

Our present era of fossil-fueled economies, societies and civilizations (Malm, 2012; Smil, 2017; Szeman & Diamanti, 2017) has given rise to an anomalous and dangerous moment for contemporary humanity and our shared biosphere (Love & Isenhour, 2016). The accelerating trends of planetary warming evidenced through storms and ice melts, droughts and hunger, unrest and migration, increasingly compel a heightened sense of urgency regarding the need to rapidly end the age of fossil fuels. A growing consensus now views the transition to renewable energy systems, frequently understood as a process of fuel substitution, as a key strategy to address the climate crisis.

Despite a growing sense of urgency, the deployment of renewable energy technologies has been frustrated, it would seem, by democratic procedures. In many cases, local conflicts around renewables energy installations, especially wind power but also solar facilities, have delayed or even halted the uptake of renewables (Peterson, Stephens, & Wilson, 2015), mirroring the many worldwide historical conflicts around the development of technologies such as hydroelectric (Kaunda, Kimambo, & Nielsen, 2012) and nuclear power (Rosa & Dunlap, 1994; Watts, 2012). It would thus appear an unlikely and even poorly considered time to call for greater democratic engagement with the renewable energy transition.

Within the past decade, however, renewable energy advocates and social and environmental justice activists have been organizing around a call for *energy democracy*. Energy democracy can be understood as a contemporary expression of decentralized grassroots movements of the 1970s, the 1980s and before. These earlier movements frequently sought to connect antinuclear activism and concerns about the geopolitical instability of fossil fuels with calls for local direct action and visions of "technological democracy" (Hager, 1992; Morris & Jungjohann, 2016; Tokar, 2015). The origins of the present discourse around energy democracy can be traced to various activist communities within Europe and the United States who have been developing an explicit energy democracy agenda for nearly ten years. The term and notion of 'energy democracy' has since been taken up among climate justice activists, some trade unions and

academics, and political parties, and put into practice through project-level, municipal, regional and national experiments[2] (Angel, 2016a).

Compared to fossil fuels, renewable energy offers many perceived advantages in addition to fuel switching, including the relative availability of distributed renewable resources, the access to and modularity of their enabling technologies, and the potential for new forms of ownership (Soutar & Mitchell, 2018). These advantages have inspired a movement committed to advancing social and environmental justice through a transition toward renewable energy technologies. These efforts are seen as an extension of various, widespread social movements working to address climate and economic crisis by not only resisting fossil fuel use and a market-driven green economy agenda but also by advocating for decentralized, democratized, and community-based renewable energy futures. This approach calls for reclaiming the energy sector and shifting political power to workers, households, communities, and the public, in opposition to a centralized, corporate, utility-scale renewable energy model (Angel, 2016a; Chavez & Dove, 2015; Soutar & Mitchell, 2018; Sweeney, 2014; Sweeney, Benton-Connell, & Skinner, 2015; Weinrub, 2014; Weinrub & Giancatarino, 2015). Some leading organizations explicitly promoting energy democracy include the Local Clean Energy Alliance, Trade Unions for Energy Democracy, the Institute for Local Self Reliance, the Center for Social Inclusion, Transnational Institute, and the Rosa Luxemburg Foundation (Angel, 2016a; Energy Democracy Project, 2015; Weinrub, 2014). Energy democracy also connects with related terms such as energy justice, energy sovereignty, energy citizenship, and energy decolonization that similarly integrate political claims within agendas for energy transitions (Angel, 2016a; Chavez & Dove, 2015; Healy & Barry, 2017; Lennon, 2017; Soutar & Mitchell, 2018).

Energy democracy as yet defies specific definition (Angel, 2016b); while a multitude of priorities are embraced within the movement, several commonalities hold the energy democracy agenda together. Energy democracy is a part of the process of ongoing struggles for economic and political democratization as expressed through the practical project of energy transitions (Angel, 2016b; Thompson & Bazilian, 2014; Weinrub, 2014). Seeing opportunity in renewable

[2] The authors note a limited set of empirical research and case studies on specific examples or initiatives of energy democracy particularly within the academic literature. From academic and non-academic sources, see for example Angel (2017), CSI (2013), Green (2015, 2016), Kunze and Becker (2014), Morris and Jungjohann (2016), Sweeney, (2015), and Weinrub (2014).

energy technologies, especially solar and wind technologies, energy democracy targets energy systems as key sites of political-economic contests, shifting power over diverse aspects of these sectors, including generation, distribution, finance, technology and knowledge (Angel, 2016b), and pursuing a goal of high levels of deployment of renewable energy (Energy Democracy Project, 2015). In particular, energy democracy seeks to empower low-income communities and communities of color (CSI, 2010; Energy Democracy Project, 2015; Local Clean Energy Alliance, 2016; Weinrub & Giancatarino, 2015), embracing the idea that those most marginalized are well-positioned to envision and lead toward different energy futures (Energy Democracy Project, 2015).

The energy democracy agenda seeks to advance democratization and participation through democratically-planned and public- and community-owned and -operated renewable energy systems that serve the public interest and deliver tangible community benefits, such as decent and stable employment, public space and transportation, and new public institutions. Energy democracy eschews not only centralized commodity-based energy models based on fossil fuels and nuclear energy but also historical inequalities, neoliberal ideologies, alliances with large corporate profit interests, privatization, market-driven and growth-based approaches and concentrations of economic and political power (Angel, 2016b; Chavez & Dove, 2015; Farrell, 2014b, 2016; Giancatarino, 2012; Kunze, 2014; Kunze & Becker, 2014; Sweeney, 2014, 2015; Weinrub & Giancatarino, 2015). Energy democracy also means ensuring fair access to energy, taking responsibility for the quality of ecological systems, and changing attitudes about energy consumption toward conservation and sufficiency (Kunze, 2014; Kunze & Becker, 2014; Morris & Jungjohann, 2016; Sweeney, 2014; Weinrub & Giancatarino, 2015). Ultimately, energy democracy redefines individual consumers as citizens, energy commodities and provisions as public goods, and infrastructure as public works or common resources (Ahlborg, Boräng, Jagers, & Söderholm, 2015; Goldthau, 2014; Sweeney et al., 2015; Thompson & Bazilian, 2014).

Advocates are not blind to the significant barriers confronting this agenda. Community ownership may be constrained by persistent structural exclusions such as unfavorable systems of tax incentives (Farrell, 2014a; Giancatarino, 2012) and lack of investment in marginalized communities (CSI, 2013); historical rules and governing institutions favoring centralized electricity infrastructures and utilities (Farrell, 2011; Goldthau, 2014); inadequate and deeply

undemocratic systems of financing involving fund managers concentrated in the global north who make key decisions about energy futures for the benefit of impatient investors with expectations of high rates of return (Lohmann & Hildyard, 2014); and resistance from the incumbent interests, including the fossil fuel industry (Hess & Mai, 2014), nuclear and large-scale hydroelectric (Lohmann & Hildyard, 2014), and globally mobile capital (Angel, 2016a).

Nevertheless, energy democracy advocates point to a variety of approaches that can help to overcome these obstacles and advance an energy democracy agenda. Most broadly, energy democracy would ensure public and community control and ownership of the energy sector, while policies and programs would seek to build capacity for communities to inclusively and effectively exercise this control for purposes identified by and accountable to the communities themselves (Farrell, 2014b; Weinrub & Giancatarino, 2015). Re-establishing this control is viewed as an essential first step (Sweeney, 2015). Democratic ownership and control can take many forms, and creating diverse and flexible ownership structures of generation resources is central to the energy democracy agenda (Farrell, 2014b, 2016; Weinrub & Giancatarino, 2015). The need for large-scale coordination, re-distribution and investment requires that governments occupy a key role for facilitating, planning and owning energy systems, although the public sector itself requires a re-democratization following widespread corporate capture (Angel, 2016a, 2016b; Chavez & Dove, 2015; Duda, Hanna, & Burke, 2016; Weinrub, 2014). The state, municipalities, trade unions, and cooperatives are all recognized as critical arenas of contestation for energy democracy, offering no assurances of greater democracy but widely seen as promising approaches, particularly at the local and municipal level (Angel, 2016a; Duda, 2015; Duda et al., 2016; Green, 2015, 2016; Huybrechts & Mertens, 2014; Sweeney, 2015; Thompson & Bazilian, 2014).

Finally, energy democracy advocates recognize that energy systems are inseparable from larger social and ecological patterns and relationships, and therefore energy democracy requires careful, inclusive and strategic construction of alliances (Lohmann & Hildyard, 2014; Sweeney, 2015). Despite a sense of urgency around renewable energy transition, building collective political power and organization is viewed as a necessity, requiring short-, medium- and long-term goals and strategies (Weinrub & Giancatarino, 2015). Building alliances could begin by learning from other movements working toward a deeper transformation through energy

transitions (Angel, 2016b; Lohmann & Hildyard, 2014); increasing collaboration among potential allies, for example, ecological and social movements, labor unions and energy sector workers, public managers and administrators, low-income communities and communities of color, and small businesses and research institutions (Angel, 2016a; Duda, 2015; Giancatarino, 2013; Lohmann & Hildyard, 2014; Sweeney, 2015; Thompson & Bazilian, 2014; Weinrub & Giancatarino, 2015); and strengthening local institutions (Thompson & Bazilian, 2014).

Energy democracy may provide a shared discourse and unifying vision for building alliances and institutions, and synthesizing values and struggles within a common agenda for reclaiming and restructuring energy systems as well as broader economic and political systems (Angel, 2016b; Sweeney, 2014). This call for energy democracy is strategic: democracy implies a broadly appealing agenda for greater inclusivity, equity, and influence among communities involved with renewable energy transitions. The call is also pragmatic: a massive shift of technologies within the modern energy sector presents innumerable challenges as well as potential benefits. Greater democratic engagement would offer communities a means to steer energy transitions and shape the development of renewable energy futures.

Energy democracy and energy transitions are also fundamentally political (Laird, 2013; Meadowcroft, 2009). Given the seemingly pervasive grip that fossil fuel industries and their financial and political allies command over contemporary political life, energy democracy activists seek to make visible within the public sphere the hidden infrastructures, privatized decisions and distant consequences of modern energy systems. The instinct to politicize renewable energy transition reflects an implicit understanding that the transition from fossil-fuel dominant systems to those based on renewables offers an unprecedented yet potentially unrepeatable opportunity. As with new forms of media communications, new energy technologies present an opportunity to more deeply engage with questions of technological determinism (de la Cruz Paragas & Lin, 2016). Through selection and construction of these large-scale infrastructural technologies, the world will again be re-ordered: decisions and investments will be made, groups of actors will be politically re-positioned, and material structures as well as social and ecological patterns will be established that may endure for generations (Winner, 1980). The form of politics used to steer renewable energy transitions will greatly influence the possibility for more democratic futures (Mitchell, 2011).

In other words, if governed largely to preserve existing power relations, the renewable energy political economy may replicate existing dynamics of power, continuing to strengthen the powerful and weaken the marginalized (Duda, 2015). Energy democracy sees renewable energy transitions as unavoidably political processes as well as key opportunities for advancing renewable energy and democracy together. This framing rejects the view of energy transition as simple technological substitution; rather renewable energy transitions cannot avoid the re-ordering of social and political relations. Energy democracy urges us to consider how, by whom and for whom renewable energy transitions proceed. In this way, energy democracy stands in sharp opposition to the strategy of "renewable energy by any means necessary" (Sweeney et al., 2015, p. 2), and instead embraces energy as politics by other means (Szeman & Diamanti, 2017).

This paper is motivated in part by the recognition of the significant challenges of this approach to renewable energy transitions, as an effort to sharpen the view of the task at hand. Energy democracy proposes a deep structural shift in energy systems as well as socioeconomic and political systems, and therefore requires critical reflection and open dialogue. As noted, advocates of energy democracy recognize these barriers and further realize that new strategies still must be developed. Nevertheless, energy democracy advocates argue that because the renewable energy transition is fundamentally a political struggle, efforts to shift from fossil fuels and decarbonize societies will not prove effective without confronting and destabilizing dominant systems of energy power.

With energy democracy as a point of entry, this review has three primary objectives:

1) to theorize and explore the relationships between renewable energy and (democratic) political power.

2) to critically assess tensions associated with an agenda to democratize renewable energy systems.

3) to draw out the implications for democratizing renewable energy development in practice.

The following section of the paper describes the methods used for this review, drawing from an energy-political lens. Addressing the first objective, section 3.3 synthesizes various perspectives drawn from the literature on the relationships between energy technologies and democratic politics. In recognition that theoretical development of the politics of renewable energy systems

remains limited (Yi & Feiock, 2014), this synthesis of perspectives then enables the proposal of a theory of democratic energy politics for the renewable era. Section 3.4 then addresses the second objective by identifying and assessing potential limitations within energy democracy, acknowledging the challenges of an energy democracy agenda. This section critically engages with the theory of renewable democratic politics to strengthen the energy democracy agenda and suggest new approaches for supporting more democratic renewable energy futures.

Section 3.5 addresses the third objective related to practice. Here it is proposed that the democratic possibilities of renewable energy transitions and the possibilities for deeper sociotechnical transformation through these transitions, as sought by energy democracy, require that renewable energy technologies be deployed through strongly democratic models of energy development. Renewable energy systems offer a possibility but not a certainty for more democratic energy futures. Both concentrated energy politics and weak energy democracy may delay renewable energy transitions or facilitate a shift to more concentrated energy development strategies. Such strategies work to re-organize distributed energy flows into aggregated and concentrated stocks of energy, investment instruments, technological research, ownership patterns, etc. This section further calls into question the underlying political dynamics that frame renewable energy transition, suggesting that democratic governance may be entirely appropriate and potentially necessary despite the context of climate emergency. Renewable systems and democratic politics can be mutually supporting, and therefore it is proposed that renewable energy transitions be approached as means for democratic development. Finally, section 3.6 concludes by asserting that despite limitations the move toward renewable energy can be strengthened not weakened by an energy democracy agenda. By allowing an opportunity to carefully consider the assumptions driving renewable energy transition, energy democracy may allow a renewal of energy systems as well as democratic politics.

3.2 Methods

This review proceeded in two broad stages. We began by conducting a conceptual review of the term energy democracy drawing from nonacademic and academic literature explicitly employing the term. Several peer-reviewed articles were included, representing a growing body of scholarly work that engages directly with activist and community- based renewable energy initiatives (e.g., Kunze & Becker, 2015). Beginning in October 2015, online searches were conducted through

various search engines publicly available in Canada and the United States, using search terms "energy democracy" and "energy and democracy" which yielded roughly two dozen reports, articles, websites and videos. Over the next 12 months, additional sources were added through searches of activist group websites, commonly cited references, notifications from relevant list serves, and participation in webinars.

Through this engagement with the perspectives of the energy democracy movement, and inspired by Mitchell's provocative questions regarding the political possibilities for the end of the oil age (Mitchell, 2011), it became clear that the review deserved to be broadened to consider theoretical foundations of the relationships between renewable energy and political power. For this second stage, extending June through October 2016, the search terms were expanded to include "energy political power", "renewable energy democracy", "renewable energy political power" and related terms, avoiding only nominally similar terms (e.g. "democratic party", "democratic republic"). Searches were performed through academic libraries, Web of Science, Scopus, and popular search engines to select English-language peer-reviewed academic literature and published books related to these objectives.

The review of sources proceeded in four iterative steps. First, the set of sources were coded to identify definitions, findings and conclusions, and calls for research. Additional sources were added based on references cited within the initial collection, especially historically significant works (e.g., Mumford, 1934), resulting in approximately 100 sources reviewed in total. Processing then involved repeated topical sorting of coded materials, identifying patterns and relationships, writing analytic memos and noting reflections (Miles, Huberman, & Saldaña, 2014). Topics that emerged iteratively for the conceptual review on energy democracy broadly included origins and advocates, definitions, purpose, barriers, principles and policies. Topics for the theoretical development broadly included energy and democracy, renewable energy and political power, and tensions, gaps and ambiguities. The breadth of work reviewed and topical categories that emerged then inspired the decision to approach the coded material through two distinct lines of inquiry to more deeply engage with the emergent themes, namely, the emerging concept of energy democracy and its uptake, and the relationships between renewable energy systems and political power. The review of the concept of energy democracy and of the energy

democracy movement is summarized here in section 3.1 and considered more fully in chapter 4 (Burke & Stephens, 2017).

Identified through the process of review of existing literature, the concepts of *energopower* and *energopolitics* (Boyer, 2011, 2014; Szeman, 2014) were together employed as an analytical lens to guide and focus the examination of the relationships between political power and energic power. Energopower and energopolitics extend to energy Foucault's notions of biopower, meaning governance over life and populations, and biopolitics, meaning the processes through which life and populations have become objects of (state) political strategy (Foucault, 2009; Szeman, 2014). Energopower is understood as the dynamics of power over modern life organized and enabled through energy, and conversely, the forms of energy organized and enabled through dynamics of power. Energopolitics are further understood as the operations of power in effort to leverage the transformational capacity of modern energy sources (Boyer, 2011, 2014; Szeman, 2014). These concepts support an understanding of political and energic change and stability as dimensions of broader cultural dynamics, which holds open the possibility of further inquiry from diverse points of entry. As such, the concepts are adapted here for a broader audience as *energy-politics*. In addition to its relevance to the energy democracy movement, this analytical lens of energy-politics was selected to help emphasize the relational dimensions between systems of energy and political power (Bues & Gailing, 2016) rather than strictly on the energy technologies themselves, while taking seriously the unique role that fossil-based energy systems play in the governance of modern life and the shaping of modern cultures (Szeman & Diamanti, 2017).

The third step involved organizing the sorted materials within a conceptual outline used to guide the initial drafting of the review sections. Finally, once drafted, analytical memos and reflections noted through the course of this process were revisited, further sorted and used to synthesize and critically assess the reviews, confirm or modify topics and organization, and draw out key implications and gaps to support theoretical development.

3.3 Theory and potential for renewable energy politics

This section first synthesizes various perspectives from the literature on the relationships between energy sources and technologies and democratic politics to propose a theory of energy-politics (3.3.1), and then explores the political possibilities for renewable energy futures (3.3.2).

3.3.1 Relating energy and democracy through energy-politics

The claims of the energy democracy movement urge close consideration of the relationships between modern energy and political power.[3] Understanding these relationships first requires some clarification regarding what is meant by power, politics and democracy in this context as all carry varied meanings. The idea of power involves both physical power as a measure of the rate of doing work or making transformations, commonly expressed in units of energy, as well as political and economic power commonly considered as a form of social control, authority or influence (Hall & Klitgaard, 2012). Emphasizing its relational quality, power involves the relative ability of an actor or group of actors to change the behavior of others (Hancock & Vivoda, 2014). Some groups hold greater capacity for shaping social action as compared to others (Stirling, 2014), as in "power over" others (Boonstra, 2016). This understanding of power reflects that of Max Weber who viewed power in terms of the possibility for an actor to assert their will in the face of resistance, through whatever means available (Weber, 1978). Sources or measures of power as understood in social sciences take many forms including monetary wealth, access to natural biophysical materials, muscle exertion, civil authority, social connections, reputation, belief systems and artifacts such as weapons and technology (Boonstra, 2016; Russell, 2004). Politics can refer to the processes of distributing resources and the power that explains their distribution (Hancock & Vivoda, 2014). Politics can also involve processes of using and controlling energy resources for purposes not necessarily related to energy. Energy becomes the mechanism through which other agendas are achieved (Holden, 2009). Energy sources and their technologies are both a source and a result of power dynamics among opposing actors (Geels, 2014; Sovacool, 2006).

The meaning of democracy for sociotechnical systems is far from obvious (Mumford, 1964). For scholars, democracy typically can be understood as a participatory model of politics where governance is accountable to citizens, the most distinctive element of democracies (Schmitter & Karl, 1991). Greater levels of citizen participation, such as direct citizen control (Arnstein, 1969), offer stronger models of democracy (Hoffman & High-Pippert, 2005). For purposes here, democracy is understood as not simply present or absent, but rather as existing on a continuum

[3] For an accessible yet critical compilation of historical essays and perspectives on social, political and cultural dimensions of modern energy systems see Nader (2010). For an international perspective on the political economy of energy systems see Van de Graaf et al. (2016).

of more or less democratic forms (Ahlborg et al., 2015; Brown & Mobarak, 2009; Storm, 2008), a view that allows for a sophisticated set of standards for critically examining democratic systems rather than relying on any specific necessary condition (Marshall, Gurr, & Jaggers, 2016). Like governance, sociotechnical systems can be understood as strongly or weakly democratic depending on, for example, the values attached to the technologies or the forms of political organization and citizen control that these technologies enable. Such democratic elements do not arise on their own, rather they are designed into the sociotechnical system, intentionally or not (Hendriks, 2009). For activists, democracy refers not only to a mode of governance, but also to a rhetorical claim for social and environmental justice (Mitchell, 2011). It is the dual meaning of democracy, as both a form of sociotechnical governance and a visionary political claim, that informs the concept of energy democracy and its constituting element of energy citizenship.

Winner (1980) offered a theory of technological politics, asserting that "within a particular complex of technology…some aspects may be flexible in their possibilities for society, while other aspects may be (for better or for worse) completely intractable" (p. 135). This theory rejects the view that technology is infinitely flexible, drawing attention to the way human ends are made to adapt to technical means and how choices of technologies may require or strongly enable certain political relationships (Winner, 1980). Different technologies form relationships with different groups of social actors (Sovacool, 2006). Modern large-scale energy technologies are understood not as determinant of human societal relationships and political systems, but as co-evolving with them, as integrated sociotechnical systems (Goldthau, 2014). A theory of technological politics would require an examination of the degree to which certain technologies may embody or strongly enable democratic values and the flexibility of their constituting elements. Those who wish to see democratic institutions persist must give attention to the choice of energy systems (Mumford, 1964), and inversely those who favor certain energy technologies must consider whether they can support or even survive democratic governance (Weinberg, 1990).

The diverse and at times contradictory findings of academic research suggest a highly complex and uncertain relationship between energy and democracy in general. Smil (2004) finds little relationship between political freedoms and energy use. Calling to question a simplistic view that

principles of freedom and democracy progressed in large measure due to increased energy supply, Smil notes that such principles originated and were more recently advanced within relatively low energy societies while numerous examples exist of high energy oil states suppressing their populations (Smil, 2004). Although choices of energy systems do powerfully influence social outcomes, an effect described as a *soft determinism* (de la Cruz Paragas & Lin, 2016; Hughes, 1983), very different social systems can arise from the similar material bases and the path of social change following technological change is difficult to predict (Laird, 2013). Likewise, despite sharing similar technical components, the specific configuration of electric power systems made in different societies have shown considerable variation, reflecting differences in local traditions, societal aspirations, political arrangements and principles underlying economic practices (Hughes, 1983).

Various observers of technology and society have long recognized this co-evolutionary dynamic, often with a concern for the potentially deleterious influences of modern technologies upon people and society. Mumford (1964) famously argued that modern Western society faces a choice between democratic and authoritarian technics. Similarly, the recognition of promising social and political change, particularly through renewable energy technologies, has been linked to Lovins' argument for the adoption of "soft" energy technologies and the soft energy path (Lovins, 1976). Lovins saw in diverse, accessible and appropriate applications of renewable energy technologies the opportunity for new sociopolitical arrangements, while recognizing that the hard path, that of not only nonrenewable energy sources but also highly complex and large-scale sociotechnical arrangements, remains dominant. Technologies are viewed as representative of the values of the society for which they are invented, and these values can be transported and expanded across time and space (Illich, 2013; Mumford, 1964).

Hall and Klitgaard (2012) articulate a relevant theory of energy technological politics: "When the physical power to run an economy was solar, the economic and political power tended to be more widely distributed. The increased use of fossil fuels, which are concentrated energy, tends to concentrate both economic and political power" (p. 145). This basic theory underlies the energy democracy movement's approach to renewable energy activism. Energy technologies based on concentrated energy sources, such as fossilized stocks of sunshine stored as hydrocarbons, ultimately and over time organize and enable more concentrated forms of power

and centralized or authoritarian political relationships, and vice versa. This relationship refers to a *concentrated energy-politics*, characterized as weakly democratic. Decentralized energy technologies, such as those drawing directly from renewable and primary sources produced from continuous flows of solar energy on Earth, offer greater inherent flexibility and can more readily organize and enable distributed political and economic power, and vice versa. This relationship is described as *distributed energy-politics*, and conversely characterized as strongly democratic. These theoretical relationships allow for the examination of specific forms of energy and energy technologies.

Before turning to renewables, the relationships involved with nonrenewables are briefly reviewed. That technological artifacts embody political qualities has always been a controversial claim, yet the claim continues to be made by both critics and boosters alike (Sovacool & Brossmann, 2013; Winner, 1980). For nuclear energy, the fuel for conventional nuclear fission requires finite stores of uranium. Exploiting these fuels requires accumulated investments and centrally-operated technologies. Henderson (1988) argued that energy technologies such as nuclear power, are "*inherently* totalitarian" (emphasis in original) and "incompatible with democratic forms of government" due to their complexity, tendency for centralized authority, high levels of social and capital investment, risk and vulnerability, and the way these technologies systematically disenfranchise the public from decisions as evidenced by widespread public opposition (see also Commoner, 1979). Weinberg (1990) conversely saw nuclear power as the highest achievement of democratic societies, asserting that nuclear energy and the atomic bomb would help transition authoritarian systems into democracies and bring in a lasting period of peace. Indeed, in the United States, nuclear electricity had been promoted historically and politically as a necessary means for protecting democracy against communism (Sovacool & Brossmann, 2014).

According to Weinberg (1990), there exists no irreconcilable tension between these concentrated energy technologies and democracy. However, Weinberg also suggested that a basic tradeoff may exist between democratic pluralism and technological efficiency, by which he meant centralization and the perceived economies of scale as associated with nuclear energy technologies. Deepened forms of democracy could restrain the adoption of centralized technologies.

Empirically, the relationship of nuclear energy and democracy appears consistent with the proposition of concentrated energy-politics. Although nuclear energy has endured under democratic regimes, this technology has co-evolved based upon narrow (and political) calculations of costs and benefits and highly centralized administration. Observations of nuclear programs across numerous countries suggest that overly optimistic visions of the future benefits of the technology by planners and promoters has served to override public concerns about present costs (Sovacool & Brossmann, 2014). Additionally, because of the risks of both immediate and long-term catastrophes associated respectively with nuclear reactors and radioactive waste, strict and precise protocol must govern nuclear energy presently and far into the future. Despite half a century of tremendous, deliberate political and economic backing, nuclear energy has so far failed to live up to its promise as the energy source of peaceful modernity (Stirling, 2014). Both grassroots, democratic resistance as well as unsustainable financial requirements, meaning an inability to sustain accumulation, suggest tensions between nuclear energy and democratic politics.

For fossil fuels, Ross (2001) finds a tendency for reliance on oil (and non-fuel mineral) wealth to have antidemocratic effects, particularly in poor countries. The link between oil and authoritarianism may be due to a combination of social and political factors that work to demobilize the public. Hall and Klitgaard (2012) see a historical connection between the access to petroleum and the concentration of economic and political power as noted, evidenced for example by the consolidation of the oil industry. This energy source and its associated accumulations of wealth and power are co-evolutionary historical anomalies. Lohmann and Hildyard (2014) similarly argue that the combination of fossil fuels with heat engines and commodified labor in the context of capitalist political economies has enabled processes of extraordinary accumulation. Earlier societies had discovered and used steam engines and fossil fuels, but not in a way directed entirely for processes of accumulation. In this sense, modern energy companies are financial as well as technical firms, pursuing consolidation of both energy and capital (Lohmann & Hildyard, 2014). Likewise, Malm (2012) proposes that fossil fuels provide the requisite infrastructure, sustained through public institutions, that allows transnational energy firms to exploit the inexpensive labor needed for the accumulation of globally mobile capital.

Mitchell (2009, 2011) uncovers important differences between forms of fossil fuels and the ways they are co-produced with modern democracy. Unprecedented access to concentrations of non-renewable stocks of hydrocarbons in the form of coal contributed to the rise of mass democracy in the late nineteenth and early twentieth centuries, due in large part to the need for labor to extract and transport coal through relatively narrow, dispersed and interconnected channels. These conditions gave workers in mines, railyards, and docks new and unprecedented political power, exercised especially through general strikes that would slow, disrupt or shut off entirely the access of increasingly urbanized and industrialized societies to these sources of energy. In response and in effort to weaken working-class mobilization, the industry and its political allies yielded to pressure for welfare democracy and universal suffrage. Oil, on the other hand, could be moved more readily from one region to another with less need for clusters of workers. The desire to control labor as well as to protect profits from transnational competition elicited first the shift from coal to oil and then the consolidation of the oil industry within a handful of transnational companies. These shifts served to limit democratic politics through the latter half of the twentieth century (Mitchell, 2011).

Although there may be no inherent quality of fossil fuel sources that demands concentrated political power, or vice versa, it appears that some forms of fossil fuels, petroleum sources in particular, are especially compatible with concentrated political and economic power due to the ways that they are made to be concentrated and their effects to demobilize populations. There appears to be some consensus supporting the possibility that concentrated forms of energy and energy technology tend to enable and be enabled by concentrations of political power, although the relationship varies across sources and technologies.

3.3.2 Political possibilities for renewable energy futures

Turning next to renewables, this section considers the possibilities of energy-politics associated with renewable energy sources, meaning forms of power over modern life that enable and are enabled by renewable energy systems, to understand the potential compatibility of renewable energy sources and technologies with distributed and democratic patterns of political and economic power.[4] Because energy democracy advocates overwhelmingly favor wind and solar

[4] For an empirical study on the mechanisms through which politics influences renewable energy development across U.S. states see Yi and Feiock (2014).

electricity (Farrell, 2011), we limit our discussion here to the consideration of grid interconnected wind-water-solar (WWS) energy, namely wind and hydroelectric energy and concentrated solar and solar photovoltaics. In accordance with the broader focus of this special issue on energy futures, these generating technologies are widely considered as among the most promising energy systems for supporting a global renewable energy future (Jacobson & Delucchi, 2011). We also acknowledge, however, the possibility or even necessity for energy futures based on heterogeneous locally appropriate combinations of renewable energy sources including tidal, wave, and geothermal energy.

Key physical properties are understood to influence the politics of WWS renewable energy sources and technologies. Compared to concentrated stores of hydrocarbons, renewables sources are generally weaker yet more widely distributed forms of energy (Mitchell, 2009). This possibility for distributed and decentralized energy is seen among advocates as the best opportunity to reassert democratic control of energy sources and renewable energy development (Weinrub, 2014). Distributed generation technologies range in size, from very small 1 kW generators up to between 5 and 30 MW facilities. Distributed generation typically connects to the distribution or sub-transmission sections of the electric grid, reducing distance between generation and load (Costello, 2011; Farrell, 2011). Decentralization also increases the political salience of renewables relative to their output. Whereas the processes of extraction of fossil and nuclear fuels historically have remained largely out of public view in many industrialized nations heavily reliant on these sources, distributed renewables increase the visibility and in some cases the relative visual and local environmental impact per unit of output (Wüstenhagen, Wolsink, & Bürer, 2007). Additionally, due to the frequently smaller size of renewable facilities, more of them are to be built, which increases the number of siting decisions to be made (Wüstenhagen et al., 2007).

As with nonrenewable concentrated energy sources and technologies, the forms of energy-politics of renewables cannot be easily generalized across all renewable sources and technologies. Distributed renewable energy systems do not necessarily imply a distinct social or political order (Hoffman & High-Pippert, 2005). However, in the case of interconnected WWS energy for a 100 percent renewable future, a few commonalities appear relevant for their possible political implications. Solar and wind energy introduce greater variability to the grid,

requiring both new approaches to grid operations as well as re-organization of physical infrastructure. By interconnecting geographically dispersed and technologically diverse WWS generators to a common transmission grid, the short-term and seasonal intermittency of sunshine and wind across the grid can be smoothed to reliably match supply and demand. Connecting solar and wind to hydropower across a broad region, for example, can support reliable grid operations and may require extra-long-distance transmission. Variability can also be reduced by "smart" demand-response management, such as adding loads including smart appliances or electric vehicle charging stations to support flexible supply. Better weather forecasting and analysis and excess energy storage, either decentralized or centralized, are also recognized necessities for scaling up interconnected renewables (Delucchi & Jacobson, 2011).

Turning to specific WWS technologies, the politics of large-scale hydroelectricity are notoriously contentious. Large-scale hydroelectric dams generate electricity by concentrating large flows of falling water. Like nonrenewable systems discussed previously, hydroelectric dams typically involve centralized management and consolidation of capital investments (Sovacool & Brossmann, 2013). These so-called megaprojects often have been viewed as resounding technical successes even as their construction has resulted in massive displacements, alterations of entire river basins, and loss of human and nonhuman life. Hydroelectric dams at once provide flood control while also contributing to significant evaporation and generation of greenhouse gas emissions (Sovacool & Cooper, 2013). Again, like nuclear, hydroelectricity has been deliberately promoted as a supporting infrastructure for modernity, democracy and new social orders, by taming natural forces and supplying continuous, low-cost and renewable electricity even to underserved regions. In the US, for example, promotion of international development of hydroelectric dams was linked to efforts to expand business interests and oppose communism (Sovacool & Brossmann, 2013). Yet empirically the relationship is more complex. Relatively poorer, populous and less democratic countries have developed greater levels of hydroelectricity than wealthier, more democratic countries (Hess & Mai, 2014), while democratic regions that have developed significant hydroelectricity have done so through weakly democratic political processes that initially failed to meaningfully include marginalized groups (Desbiens, 2013).

Due to the decreasing availability of sites and potential for increasing costs and conflict of hydroelectricity, a broad group of actors are turning away from hydroelectric power in favor of renewable energy sources and technologies viewed as more accessible and democratic (Abramovay, 2014). This move is supported by advancements in storage technologies that may allow batteries to serve the function of stable base supply (Abramovay, 2014). The view of energy democracy advocates is that there is an opportunity to broadly share the ownership and benefits of solar and wind generation and democratize the electric grid due to the widespread availability of solar and wind sources (Weinrub & Giancatarino, 2015), the modularity of the technologies, and the potential to rapidly install these systems (Farrell, 2011) even in locations with relatively poor resource potential (Morris & Jungjohann, 2016).

Although both solar and wind technologies support relatively small-scale, distributed deployment (Farrell, 2011), both also face limitations for community-based ownership (Farrell, 2016). Wind energy technologies are often constructed at large scales and great expense, involving large financial investments made by a small number of investors (Fast, 2013b). These factors may contribute to reported conflicts among perceived supporters and opponents of wind energy facilities (Fast, 2013b). Wind is frequently deployed in relatively remote locations, which increases the distance to users and reduces the potential for community ownership or shared output. Solar has seen tremendous growth in distributed generation, but here collective ownership has been limited because most installations are built to serve single residential or commercial property owners (Farrell, 2016). Nevertheless, distributed photovoltaic solar technology is often viewed as the preferred technology for energy democracy (Farrell, 2011) due to the possibilities for including communities and broadly sharing benefits. For example, although modules and invertors may not be produced locally, solar photovoltaic is seen as an opportunity to support local employment and involvement of labor by stimulating demand for local installations, locally-manufactured components, and local planning (Sweeney, 2015). Other renewable systems are seen as potentially compatible with an energy democracy agenda depending on local resource availability, including geothermal, small hydro, combined heat and power, or biomass/biogas (Weinrub & Giancatarino, 2015), although these have received much less attention. Solar and wind technologies therefore offer flexibility rather than certainty, meaning that these technologies do not necessitate but may facilitate more democratic societies (Winner, 1980).

Renewable systems open the grid to political contest in ways not seen since the grid's early development, and therefore energy democracy seeks to reclaim control of the electricity grid. As compared to existing fossil fuel-based systems, renewable energy futures require sharply increasing electrification of end uses such as transportation and heating, potentially increasing the political salience of grid technologies. Additionally, distributed generation with two-way flows calls into question the need for the historic contract granting utilities monopoly power over the grid. The microgrid is viewed as a key technological innovation that may facilitate distributed control of the electric grid. Microgrids are a collection of interconnected loads and distributed generation and storage resources within a clearly defined boundary that can be managed as a unit within the larger grid, allowing connection and disconnection under either grid-connected or island mode operations (Grimley & Farrell, 2016). Open grid management would allow any user to also connect as a producer, or prosumer (Farrell, 2014b).

Beyond the physical technologies, community control also requires building capacity for financial investment and technical and managerial capacity. Policies are therefore required that allow people to participate collectively and not only as individuals (Farrell, 2014b), channeling existing energy expenditures and shifting public resources and institutional investments toward new investment models for community ownership (Weinrub & Giancatarino, 2015). Technical capacity includes manufacture, installation and maintenance of electricity systems, as well as development of new systems of public management that allow democratic community control, requiring new training programs at all levels (Angel, 2016a; Sweeney et al., 2015).

A critical factor for energy democracy is the development model through which these technologies are deployed. The energy democracy movement recognizes that the choice of different scales of deployment, from the largest megaprojects to the smallest community solar project, potentially lead to very different renewable energy futures (Weinrub & Giancatarino, 2015). The development of the transmission grid is further viewed as sufficiently flexible to support divergent renewable energy futures (Farrell, 2011). Echoing Lovins and others, energy democracy sees two opposing models or visions of renewable energy development pathways (García-Olivares, 2015; Weinrub & Giancatarino, 2015; Wolsink, 2012), a centralized model and a decentralized model (Table 3.1).

Table 3.1. Two strategic frameworks for advancing renewable energy futures (adapted from Weinrub and Giancatarino, 2015)

Topic	Centralized model of renewable energy	Decentralized model of renewable energy
Analysis of the crisis	The climate crisis is separate from the economic crisis. This implies that the climate crisis can be resolved without addressing the economic crisis, and vice versa.	The economic and climate crises are inextricably linked—an integrated crisis reflecting the collision of globalized capitalism with the Earth's ecological limits.
Solution to the Crisis	The solution to the climate crisis is to replace fossil fuel energy with renewable energy in order to transition to a de-carbonized capitalism. The solution to the economic crisis is seen as a separate matter.	Replace the globalized capitalist system and its inherent growth dynamic with sustainable economic development based on renewable energy to meet the needs of human beings, rather than the needs of capital accumulation.
Structural aim	De-carbonize the current economic system without fundamentally changing it.	Transition to a new, de-carbonized, ecologically-sound, life-sustaining economic system that can serve the needs of the world's peoples.
Programmatic approach	Reduce greenhouse gas emissions—mainly through market mechanisms and new technology, but within the current structure of corporate economic and political power.	Create an alternative, equitable, social and economic order based on democratic principles and an energy platform that seeks to replace the corporate energy establishment with alternative institutions.
Socio-economic change agents	Those who have benefitted most from the current globalized capitalist system: corporations and supporting states.	Those most impacted by globalized capitalism: workers, low-income communities, and communities of color.
View of energy	Energy is a commodity, the basic enabler of capital accumulation and an expanding growth economy, all of which increases the contradictions of the existing economic and political system.	Energy is a resource, a basic enabler of economic life—to be democratized and harnessed to meet human needs and transition the world to an ecologically sustainable economic future.

Both approaches are deemed technically possible under certain conditions (García-Olivares, 2015). Yet despite the potential desirability of pursuing multiple development pathways simultaneously (Miller, Iles, & Jones, 2013), competition for limited resources may make these options mutually exclusive (Farrell, 2011; Lovins, 1976; Wolsink, 2012). Energy megaprojects involve the construction of large capital intensive and transnational technological systems, often requiring billions of dollars of investment and spanning over large geographical areas and multiple political jurisdictions. As with any sociotechnical system, they include not only physical elements but also financing agreements, regulatory systems, skills, knowledge, maintenance and so on (Sovacool & Cooper, 2013), which shape and enable social and political relationships. The flexibility of solar and wind may therefore involve either concentrated or distributed energy-politics.

The centralized renewable energy model uses extended high-voltage transmission networks, super-grids, to connect renewable megaprojects (García-Olivares, 2015), including remotely-sited large solar photovoltaic arrays and wind projects to populous load centers (Farrell, 2011). A variety of factors appear to be driving the growth in both size and number of energy megaprojects, including perceived economies of scale (i.e. lower per unit costs associated with larger size facilities), localized accumulation of expertise, increasing regulation that disproportionately affects smaller projects, competition with national energy companies, as well as a belief that such projects represent modernity and high cultural achievement (Sovacool & Cooper, 2013). Hydroelectric dams and wind power projects have been increasing in size, while large-scale solar projects have been proposed for many of the Earth's solar resource-rich deserts and equatorial regions (Sovacool & Cooper, 2013).

Energy democracy advocates view this centralized renewable energy model as a product of concentrated financial and economic power as well as institutional inertia following a century of centralization, and rarely resulting from democratic community-level action (Farrell, 2011; Weinrub & Giancatarino, 2015). The centralized renewables strategy seeks to decarbonize the existing economy rather than transform it (Weinrub & Giancatarino, 2015). With few exceptions, these centralized projects serve the interests of the politically and economically powerful, empowering corporations rather than communities while overriding democratic restraints (Weinrub & Giancatarino, 2015). Ratepayers pay for these large-scale projects and associated

transmission for many years and land is often acquired through use of eminent domain (Farrell, 2011). Energy democracy advocates argue that the so-called "NIMBY" (i.e., not-in-my-backyard) response to large-scale renewable projects is more constructively viewed as an appropriate response by citizens who recognize democratic potential in solar and wind energy yet find these technologies developed under a centralized model. In many cases this model appears to deliver lucrative profits to absentee owners who already possess significant economic and political power (Farrell, 2011). Failing to share benefits of new energy infrastructure may inspire ongoing resistance and slow or prevent the deployment of renewable energy systems (Farrell, 2011). Even remotely-sited large-scale projects meet public resistance (Farrell, 2011) by a globally mobilized citizenry.

By contrast, a decentralized model of renewable energy development is seen to enable development of renewables at the community level, allowing for new economic and ecological relationships (Weinrub & Giancatarino, 2015). This approach largely depends on distributed generation technologies, meaning smaller more geographically dispersed power generation units situated closer to end users (Wolsink, 2012) and connected through microgrids (Bronin, 2010). For decades observers have declared a variety of benefits of the decentralized renewable energy model beyond electricity output (Farrell, 2011). Small- and medium-scale renewable systems, deployed at the scale of urban neighborhoods or rural villages, are expected to reduce overhead including capital and administrative costs, reduce energy costs, reduce transmission and distribution losses, increase grid reliability (Lovins, 1976), and reduce incidence of blackouts (Farrell, 2011). Smaller operations reduce the distance between generation and point of use, and allow users to generate and sell energy (CSI, 2010). Community-scale projects require smaller land areas, minimizing the need for costly transmission and distribution lines and use of eminent domain (Farrell, 2011; Giancatarino, 2013). Optimal economies of scale are realized at relatively modest sizes for wind and solar facilities, making mid-size projects more cost effective than larger projects (Farrell, 2011). Distributed generation is also expected to significantly reduce financial risk and allow deployment of renewables at a faster pace (Morris, 2001).

According to energy democracy advocates, decentralized energy supports decentralization of authority, favoring community control and ownership of renewable energy resources rather than extending the legacy of corporate ownership (Morris, 2001; Weinrub & Giancatarino, 2015).

Decentralized authority means greater self-reliance, local approval and planning, as well as greater local accountability and responsibility for social and environmental impacts of electricity use (CSI, 2010; Morris, 2001; Tokar, 2015; Walker, 2008). Community-based renewable energy models could increase public participation, particularly in rural areas (Rogers, Simmons, Convery, & Weatherall, 2008). Community-scale projects could support local economic circulation (i.e. the multiplier effect (Goerner, 2013)) and local income via sales and returns on investments and create more local jobs than large-scale projects, while creating opportunities for residents to be owners and decision makers (Giancatarino, 2013; Walker, 2008).

By retaining economic benefits locally and sharing benefits more broadly, the distributed renewable energy model is expected to build a stronger political constituency that will support the expansion of renewable energy and oppose fossil fuel systems (Farrell, 2011). Local energy solutions are seen to offer the potential to build relationships among neighbors and capacity for self-reliance among communities, allowing people and communities greater autonomy from currently dominant institutions (Tokar, 2015). Energy democracy advocates point to these effects to make the case that decentralized renewable energy technologies are more strongly compatible with democracy and more likely to co-evolve with distributed political and economic power. Through these processes, the grip of concentrated energy-politics is loosened, and new relations of distributed energy-politics take hold.

3.4 Tensions in an energy democracy agenda

This section examines the tensions and gaps for energy democracy, broadly related to three themes: limits of democracy (3.4.1), qualities of energy technologies (3.4.2), and the breadth of competing agendas for which future renewable energy systems may be made to serve (3.4.3).

3.4.1 Limits of democracy

Concerning democracy, energy democracy ultimately involves not only a political claim but also a mode of governance. However, there are recognized limits of democratic governance that deserve greater attention among advocates and practitioners. These limits generally relate to democratic procedures and democratic outcomes.

Procedurally, greater democratization of energy systems may be limited in several ways. Deepened forms of energy democracy require the emergence of an engaged energy citizenry, yet there is evidence that for a variety of reasons citizens may not have sufficient willingness or

motivation to increase their long-term participation with technically complex systems and decision making, even given financial incentives (Goldrich, 1986; Hoffman & High-Pippert, 2005; Mitchell, 2011; Rogers, Simmons, Convery, & Weatherall, 2008; Sovacool, 2011b). Many participants, including those in government and business, may not view decentralization, participation or community-ownership as highly relevant, necessary or pragmatic (Laird, 2013; Rogers et al., 2008; Sovacool, 2011b; Walker, 2008; Wood, 2009), thus limiting the prospect for a new form of energy citizenship.

Similarly, modern forms of democracy, even under higher levels of participation, do not necessarily lead to the models of strong democracy envisioned by the energy democracy movement, such as community ownership (Calland & Nakhooda, 2012; Hager, 1992; Hoffman & High-Pippert, 2005; Schmitter & Karl, 1991). Energy democracy clearly involves collective action, yet distributed renewables systems at the residential and commercial level may not provide sufficient opportunities to organize collective self-governance (Ostrom, 2010; Schmitter & Karl, 1991). Democracy also involves a potentially agonistic pluralism requiring engagement across diverse and even irreconcilable perspectives while increasing the number of actors and decision points, which can limit the prospect for radical change (Cirone & Urpelainen, 2013; Tsebelis, 2002; West, Bailey, & Winter, 2010).

Advocates of energy democracy have engaged minimally with questions of effective outcomes of democratized energy systems. While there may be good reason to distribute concentrated political power, decentralized energy-politics must also deliver desirable outcomes. Maintaining accountability and responsibility for effectiveness is needed to sustain political support (Hendriks, 2008; Jasanoff & Kim, 2013; Moss, 2014). Local energy may be conducive to more conservative politics (Morris & Jungjohann, 2016) that reinforce existing local power dynamics (Bain, 2011), or democratically prioritize short-term economic benefit over other social and environmental concerns. It remains unclear how these possibilities relate to the energy democracy agenda.

Energy democracy also needs to consciously and effectively extend democratic practice to broader levels to overturn the energy status quo (Becker & Kunze, 2014; García-Olivares, 2015; Goldrich, 1986; Goldthau, 2014; Tokar, 2015). Typically, energy democracy in practice has focused on the local level, although it may be that entirely decentralized renewable energy

systems are technically feasible only under a limited set of conditions, for example, in communities with low demand and little industry (García-Olivares, 2015). Within the energy democracy movement, there is an emerging interest in finding ways to democratize energy systems on a broader scale while retaining the core commitment to the vision of distributed energy-politics (Angel, 2016a). Two potentially complementary proposals, drawing primarily from academic communities, for scaling up decentralized renewable energy systems include a regional model and a polycentric model. Regional models typically require the development of new institutions operating across a geographic area larger than a municipality or state/province and smaller than a large nation state. Energy regions may be organized around a set of existing projects such as local cooperatives, geographic renewable resource zones, or by connecting transmission systems (Fast, 2013b; García-Olivares, 2015; Van der Schoor, Lente, Scholtens, & Peine, 2016; Wiseman, 2011).

Polycentric or networked renewable energy governance functions by connecting and blending existing stakeholders at multiple scales and across social sectors, reshuffling their authority away from more hierarchical modes of governance toward a model of power sharing (Hendriks, 2008; Sovacool, 2011a). Nested institutions are organized functionally rather than geographically, while regulatory units may retain some autonomy over geographical areas (Goldthau, 2014; Sovacool, 2011a). Multiple authorities may overlap political jurisdictions, resulting in redundancy where different actors or levels can ensure that services are provided (Sovacool, 2011a). Despite various potential advantages, decentralized, networked or polycentric models of governance and local control have not always performed well (Goldthau, 2014; Hendriks, 2008; Sweeney, 2014; Wiseman, 2011), may suffer from issues of fragmentation, institutional illegitimacy and lack of authority (Falkner, 2014) and may not ensure social justice (Tokar, 2015).

Two additional issues of outcomes appear especially relevant to the energy democracy movement: the pace of transition from fossil fuels to renewable energy, and the potential for conflicts with ecologically beneficial outcomes. Pragmatists argue that responding to climate change requires that large-scale wind and solar and long-distance transmission be built as quickly as possible (Jones, 2013). Therefore, opening up to alternative interests is considered much too impractical (Stirling, 2014). Energy democracy may look to the possibility for hybrid

energy systems of both large- and small-scale, maintained under democratic control, as a way of addressing this tension (Sweeney, 2015).

Additionally, scholarship on green democracy recognizes a tension between democratic procedures and substantive ecological outcomes (Goodin, 1992; Sovacool & Brossmann, 2013; Wong, 2016). Like energy democracy, green democracy rejects authoritarianism and instead seeks to address environmental problems through democratization (Wong, 2016), yet others argue that in advanced modern consumer societies, more democracy leads to less ecological sustainability (Blühdorn, 2013). In practice, local actors have been found to underrate global environmental issues (Fast, 2013a). Resolving this ends-means dilemma would require additional policies and reforms that can safeguard ecological outcomes, such as environmental rights (Wong, 2016).

3.4.2 Political ambiguities of renewable energy technologies

Another set of key tensions for energy democracy relates to the specific qualities or features of renewable energy technologies that may or may not enable distributed energy-politics. While sunshine and wind are widely and freely available, the supporting technologies and infrastructures are not (Wiseman, 2011; Wolsink, 2012). Therefore, democratizing energy systems requires social or public engagement along the entire global energy supply chain (Sweeney, 2014), including technological life cycles and systemwide energy flows. This implies that democratization of energy systems does not simply mean localizing energy, because the points of generation and end use, even if closely connected, represent only a fraction of the larger industrial system supporting renewable energy technologies. An energy-political analysis of the strength of democratic compatibility for decentralized renewable energy technologies would thus consider the technological system as a whole, including both the temporal life cycles of each constituting technological element as well as the spatial networks of energy flows.

Taking a solar photovoltaic generating facility as an example, the life cycle of this technology involves multiple phases including resource extraction, manufacture, transport, installation, operations, maintenance, decommissioning, materials reuse and recycling, disposal, and site restoration (Sherwani, Usmani, & Varun, 2010). Each of these life cycle phases involves energy and material inputs, waste outputs, human labor, and so on, and each phase requires an understanding of its compatibility with distributed energy-politics. The greatest social and

environmental impacts of these technologies typically occur at points of extraction (Jones, 2013). A strongly democratized solar facility would thus need to prioritize the democratization of the sites of extraction of the constituting inputs, for example, silver for solar photovoltaics or aluminum and steel for mounting structures. So-called rare earth minerals such as those used in manufacturing of photovoltaic modules (as well wind turbines, efficient lighting, electric vehicles, etc.), despite not always being rare, are nevertheless generally found in concentrated locations (Massari & Ruberti, 2013). The number of companies that process and trade these materials are few and their extraction involves high capital investment as well as high risks and impacts to environment and workers (Massari & Ruberti, 2013). Democratizing renewable energy may involve the use of more abundant and less concentrated inputs and suitable substitutes, while expanding resource recycling (García-Olivares, 2015; Massari & Ruberti, 2013).

For the manufacturing phase, patterns of power relations used “within the factory gates” are often extended throughout society (Winner, 1980). A democratized energy system would require democratization of all major industries and firms contributing technological components to energy systems (Angel, 2016b), for example, by restructuring as democratically-managed worker-owned cooperatives. Likewise, the life cycle phases of installation, operations and maintenance, and decommissioning would require democratic governance through the duration of the project, perhaps 30–50 years. An advantage for renewables, these phases create the opportunity for a larger number of higher quality employment than in conventional energy sectors, which may increase the interests and strategic importance of labor (Calland & Nakhooda, 2012). New forms of employment emerging within the renewable energy field offers the potential to diversify the energy sector to include more women and under-represented minorities (Pearl-Martinez & Stephens, 2016). On the other hand, jobs in the renewables sector currently tend to be nonunionized while more highly distributed generation may prevent the opportunity for workers to organize (Angel, 2016b).

Spatially, renewable energy generally "flows" from resource collection, electricity generation, transmission, distribution, storage and end use. Land is obviously needed to collect wind and solar energy, but the implications of renewable energy transitions for spatial reconfiguration of social, economic and political patterns remains underappreciated (Bridge, Bouzarovski,

Bradshaw, & Eyre, 2013). For example, the legacy of private property ownership as well as the land areas required for siting mid-scale wind and solar facilities remains highly exclusionary, particularly for low income people and people of color (CSI, 2010; Wolsink, 2012). The need for more land for renewable energy systems (i.e., energy sprawl (Bronin, 2010)) could fuel further land speculation and concentration of ownership. The energy generated by renewable energy facilities also flows and blends within larger networks that include baseload, intermediate and fast peaking facilities as well as storage (Farrell, 2011). Multiple types of generating facilities will therefore require scrutiny even under an energy future supplied predominantly by solar and wind.

Regarding transmission and distribution, the grid is clearly contested space for energy democracy. Some argue that large grids can be democratically controlled (García-Olivares, 2015), yet the experience of other megaprojects warrants skepticism regarding governance of a future super-grid. Large-scale, complex transmission systems tend toward centralization of ownership and management (Jones, 2013). Technical elites generally operate with significant autonomy from democratic oversight save for stakeholder advisory functions (Hoffman & High-Pippert, 2005; Morris, 2001). Historically, grid access and ownership has been exclusionary and has not sufficiently ensured grid parity (CSI, 2010). Transmission also suffers similar land access constraints as that of generating facilities (Wolsink, 2012). The grid also raises questions around the political power of labor. As noted, workers have occupied a politically strategic position under coal-based energy systems, yet in a highly interconnected renewable grid network, it is not clear whether labor (or a community) could effectively constrain energy supplies for political influence (Angel, 2016b; Mitchell, 2009).

A smart grid also presents ambiguities and does not necessarily alter the political flexibility of the grid (Farrell, 2011). In a distributed smart grid or "energy internet" scenario, much of the decision making and operations could remain within the scope of technical operators. Demand side management conventionally views end users as on-demand receivers of electricity, and risks extending regulatory relations to the level of individual consumers and end use devices. On the other hand, with supporting policy, the smart grid may make it possible for consumers to use, store and supply energy to the grid as prosumers (Abramovay, 2014; Wolsink, 2012). Smart grids involve networks of information and data, raising the question of democratization of these

data systems (Wolsink, 2012). Transmission systems could be extended to access diverse users or alternatively to reach the largest markets and commercial and industrial loads (Jones, 2013). Microgrids may enable local renewable generation, storage and exchange (Grimley & Farrell, 2016), yet moving to community-owned microgrids also requires restructuring grid operations and management systems, including new governing actors (Wolsink, 2012), new legal institutions (Bronin, 2010), greater policy support (Grimley & Farrell, 2016), and an active energy citizenry working to reclaim the grid (Morris & Jungjohann, 2016).

Storage has not received the same scrutiny as the grid, yet it will likely become increasingly important for an energy democracy agenda. Storage can be managed like an energy source and is thus also politically flexible. Energy storage made attractive to big investors may enable concentrated renewable electricity among a smaller number of large-scale storage facilities (e.g., "giant batteries" (Ryan & Eckhouse, 2017)) or alternatively facilitate distributed storage among marginalized communities (Olinsky-Paul, 2015). Similarly, the infrastructure for recharging electric vehicles may be developed as distributed systems across homes and work places or as centralized fueling stations resembling conventional gasoline stations (Wolsink, 2012). An energy-politics lens allows careful consideration of the political possibilities of all these technological elements constituting a renewable energy system.

Perhaps most critically, the end uses of the energy flows require a consideration of their implications for democracy. What purposes would or should a decentralized renewable energy system serve within a democratized energy system? Who benefits, and who decides? The social, political, economic and cultural context (Szeman & Diamanti, 2017) that energy systems are made to serve will largely determine the degree to which distributed renewable energy systems can be made democratic. Energy democracy advocates and scholars have not yet closely engaged with the question of the democratic potential of specific end uses and technologies. However, the movement has been increasingly clear that the purpose of democratized energy systems is not to advance capital accumulation and an expanding growth economy but rather to meet human needs and create an ecologically sustainable economy (Angel, 2016b; Weinrub & Giancatarino, 2015). This view sets the energy democracy movement apart from many if not most contemporary advocates of renewable energy transition pushing for a "big green" energy development

approach. This perspective also positions energy democracy in opposition to the defining ideological agendas of our time.

3.4.3 Competing agendas

An additional set of tensions in the energy democracy agenda relates to broader contextual influences, landscape pressures or dominant agendas of societies. While clearly a variety of such competing agendas will shape and possibly limit the processes and outcomes of energy democracy, it is worth considering more directly how these dynamics could play out. The key competing agendas identified include capitalism and market ideology, the ideology of unlimited growth, and the modernist/industrialist agenda. The energy democracy movement, as well as academic and critical scholarship, recognize that these issues deserve heightened attention (Angel, 2016a; Weinrub & Giancatarino, 2015). These agendas provide the ideological fuel for the organization and concentration of power over modern life through energy systems. Essentially these issues point to tensions involved with a strategy of specifically targeting the energy sector for reform and transformation within a broader, globalized political economy (Strachan, Cowell, Ellis, Sherry-Brennan, & Toke, 2015; Thompson & Bazilian, 2014).

Energy democracy seeks to build on and extend various oppositional movements resisting the corporate fossil fuel agenda by providing a broadly-inspiring political vision that can confront the capitalist growth imperative through transformation of the energy sector (Morris & Jungjohann, 2016; Sweeney, 2015; Weinrub & Giancatarino, 2015). In this way, the energy democracy movement clearly rejects the transnational corporate project of privatization and capital accumulation and instead aligns with citizens, workers and communities. How to break and replace existing dependencies remains less clear (Angel, 2016a). Strong resistance and staunch opposition to a renewable future from those currently benefiting from the fossil fuel legacy system have proven to have powerful influence on societal priorities in energy (Frumhoff, Heede, & Oreskes, 2015; Geels, 2014). This legacy of alliances with concentrated power appears quite apparent in the debate over the appropriate role of the state (Angel, 2016a; Shaw et al., 2015) but also over the role of markets and investments for energy democracy. Financing a potentially large-scale and rapid renewable energy transition while reducing dependence on alliances with globally mobile fossil capital poses obvious challenges (Angel, 2016a; Lohmann & Hildyard, 2014; Malm, 2012). The dependencies of labor in particular are viewed as a

potential impediment to the energy democracy agenda (Angel, 2016a; Weinrub & Giancatarino, 2015).

Distributed renewable energy systems display flexibility with respect to either concentrated or distributed financial alliances. This flexibility is demonstrated by seemingly contrary ideologies within the renewable energy industry, at once viewed as an opportunity for large financial gain and aggregation of investment capital using logics of the investor class (Lohmann & Hildyard, 2014; Wesoff, 2017) while also celebrating the democratization of finance through small-scale loans and the expansion of small, local installers (Beebe, 2017). Similarly, energy democracy advocates have variously argued for this new agenda using liberal economic logic (e.g., market-based incentives, personal electric vehicles) as well as more transformational or critical social perspectives (e.g., energy as a public good; post-extractivism) (Tarhan, 2017). Energy democracy requires a more certain position regarding this agenda to avoid uncritically advancing dominant economic logics.

To some degree, energy democracy advocates have also recognized the need to question the assumption of ever-increasing growth in energy consumption, thus considering the needs served by energy systems and how and by whom these needs are defined (Angel, 2016b; Sweeney et al., 2015). However, there remains ambiguity as to whether energy democracy includes a degrowth strategy (Kunze & Becker, 2015) or emphasizes the potential for renewables to fuel new economic growth (Giancatarino, 2012). The assumption of need for increasing levels of energy has received sharp criticism. Illich (2013) notably argued that beyond a certain threshold, increasing levels of per capita energy use create power imbalances and social inequity. Low energy use allows for a diversity of forms of social life while high energy use requires technocracy, regardless of political economic model. Smil (Smil, 2004) finds no measurable benefit to quality of life above average annual energy consumption rates of 110 GJ per capita, but rather high energy consumption does correlate with high environmental impact and greater global inequity. If renewable energy systems are built to support infinite economic and energic growth and consumption, the financial costs may require many trillions of dollars, increasing the reliance on fossil fuels and concentrated economic power to make the transition (Lohmann & Hildyard, 2014). Energy democracy may begin to coalesce around a notion of selective growth

based on genuine human needs, within a broader commitment to degrowth and decreased total energy use (Kunze & Becker, 2015).

Finally, energy systems and energy use are intimately tied up with visions of modernism, industrialism and human progress (Love & Isenhour, 2016; Sovacool & Brossmann, 2013, 2014; Szeman & Diamanti, 2017). However, the energy democracy movement has yet to address these issues directly. Solar and wind renewable sources are found in highly concentrated areas such as the world's deserts (Sovacool & Cooper, 2013) or polar arctic regions, which can support consolidation of the industry. Meanwhile, globally interconnected super-grids have been proposed to connect solar and wind megaprojects using long-distance, high-voltage transmission lines (Chatzivasileiadis, Ernst, & Andersson, 2013; Liu, 2015). Given this possibility, democratizing renewable energy may demand a more clearly articulated stance on the modernist/industrial agenda. For example, democratic energy systems may require higher levels of mature technologies, meaning optimal for a human scale, and a rollback to over-industrialization (Illich, 2013). Likewise, energy democracy may require greater emphasis on technically diverse, locally appropriate, non-electric, "low" renewable technologies (Lovins, 1976). Together, the competing agendas of capital accumulation, endless growth, and modernist industrialism may continue to marginalize or limit the more radical opportunities for energy democracy and constrain the possibility for distributed renewable energy systems to coevolve with democratic politics (Szeman & Diamanti, 2017).

3.5 Discussion: renewable energy as democratic development

Given the possibility for an unprecedented energy transition and the plurality of energy futures envisioned (Delina & Janetos, 2018), energy democracy arrives at a critical time for the future of energy, inspiring many timely and politically important questions regarding renewable energy futures: How can energy systems be built to advance democratic development independently of economic development? How will public works be rebuilt and by whom? How would different groups of people in specific contexts choose to build energy systems differently? Who among developers, financiers, governments, communities, workers, etc. are best positioned to drive the deployment of renewables and why? Should systems of knowledge, finance, and electricity transmission extend out primarily toward wealth and power or toward more diverse and less powerful groups? Who will have control over the flows of energy in the renewable future and

what are the political consequences of constraining these flows? If the energy democracy agenda is not embraced, will energy futures perpetuate social and ecological injustices? More fundamentally, how is it that people around the globe have committed themselves to a potentially unrepeatable project of planning and constructing an entirely new modern energy system with little serious public discussion about what purpose it should serve, how big it should be, who should own it, and how and by whom all this should be decided? Energy democracy challenges us to place the political questions of energy technologies and systems at the center of efforts and inquiry regarding renewable energy futures.

Yet democratizing energy systems also requires confronting some basic tensions. Beyond the rhetorical claims, energy democracy requires good democratic governance. There is a need for improved models of democratic governance within the energy sector. Democratic procedures need to be improved at all levels and local community capacities and capabilities (Madriz-Vargas, Bruce, & Watt, 2018) need to be supported, especially related to the technical aspects of energy systems. How can energy democracy in practice ensure meaningful participation, for example, over highly technical matters? Locally and regionally? How can a broader sense of energy citizenship be developed, forms of citizenship that involve more thorough engagements than conventional processes of voting (Defila, Di Giulio, & Ruesch Schweizer, 2018) while overcoming citizens' reluctance to engage (Soutar & Mitchell, 2018)? The question of democratic outcomes also deserves attention, especially related to the issues of environmental protections and the concerns over pace of transition. How does energy democracy ensure a sufficiently rapid energy transition while protecting local and global ecosystems? What new ecological practices are required for managing renewable energy systems?

The democratic potential of the entirety of renewable energy systems over time also requires a careful appraisal. Land use and resource extraction present unique challenges for democratization given presently concentrated ownership patterns. Globalized industrial systems will require greater attention to the choice of technologies and the ways that different technologies may empower different communities of place as well as communities of interest. What role will non-electric and less industrialized technologies play in advancing democratized energy futures? What level of prominence will private electric vehicles take in relation to public transport systems? How can energy systems in their entirety, including non-renewables as well

as renewables, be democratized and not simply localized? What strategies are needed to redistribute political power across all stages of globalized technological life cycles and energy supply chains? Ultimately this line of questioning leads to a re-assessment of the purpose of modern energy systems, whatever the source or technology. How can the agenda of modern energy be restructured to support democratization of finance? How can labor re-align with an energy democracy agenda? Can energy democracy support strategic growth for communities in need and degrowth for overdeveloped areas?

The energy democracy movement advances a potentially transformative vision and agenda for renewable energy futures, yet the history of unfulfilled energy imaginaries should serve as a reminder of the need for critical reflection. Voices from within the movement have already pointed to some of these tensions (Angel, 2016b). Further inquiry from scholars and advocates including those reviewed here may serve to support democratic energy futures. Based on this review, a research agenda for energy democracy would prioritize: inquiry on models of strongly democratic energy governance at all levels; community capacity-building targeting especially technical and financial capacities; policies to complement democratic reforms; systematic democratic assessments of life cycles and supply chains of renewable energy technologies and development of explicitly democratic, small-scale, low technologies; better understanding of strategic alliances particularly with labor and local environmentalists; and a deeper examination of the relationships between energy democracy and post-capitalist, post-growth, and postindustrial agendas. Additionally, the present work would benefit from further empirical research and inquiry through specific contexts and cases, employing participatory and normatively reflective methods where possible (e.g., Delina, 2018; Moallemi & Malekpour, 2018). Addressing these concerns and approaches may expand the opportunity for energy democracy to support the democratic development of renewable energy.

Lessons learned in this special issue may provide insight regarding how and why decentralized or distributed energy technologies tend to enable distributed political and economic power and vice versa. For example, the ease of access to ownership of the modular end-use technologies allows more participants into the decision-making space regarding the production of energy systems (Gui & MacGill, 2018). The new roles that renewables allow of energy citizens as producers and owners inspire new patterns of thinking among individuals, which serves to

increase interest in policy and decision-making (Defila et al., 2018). Similarly, the new roles inspire an increase in the quantity of available discourses and imaginaries available, which then influences policy shifts, technological changes and experimentation (Tozer & Klenk, 2018). Renewables increase competitiveness in electricity markets, which undermines traditional monopolistic and oligopolistic regimes and creates space for new constituencies and alliances (Mori, 2018). Renewables enable a greater diversity of local practices, increasing learning processes that extend the range of development of renewables (Schaube, Ortiz, & Recalde, 2018). Spatial remoteness of communities has historically facilitated decentralized political and economic organization while making infrastructural development less attractive, yet remote areas may hold abundant renewable resource potential (Gui & MacGill, 2018). The complexity and coordination involved in diverse renewable energy infrastructures requires governance structures that engage with a wide spectrum of stakeholders and interests (Gui & MacGill, 2018). Social movements can mobilize diverse communities around normative objectives and shared identities to implement and sustain renewable energy initiatives (Mey & Diesendorf, 2018). Additional research could serve to unpack these and other specific factors and processes through which communities, political economies and renewable energy technologies co-evolve. Also, given the push for increasing renewables within the context of existing dominant regimes, further work is needed for understanding how and why more concentrated forms of technologies may enable distributed technologies and vice versa (Gui & MacGill, 2018; Mori, 2018).

Two points, the issues of *pace* and *compatibility*, stand out as particularly relevant for understanding renewable energy transitions as democratic development opportunities. Regarding pace, energy democracy calls into question not only the democratic possibility but also the necessity for rapid renewable energy transitions. Emerging under the pressures of the oil age, contemporary renewable energy systems are likely to develop in particular ways. Although renewable energy offers tremendous social and environmental advantage over fossil fuels, renewable systems reduce the possibility for concentrated power (centralized decision making, high rates of return, control over labor, etc.). Concentrated power thus delays renewable energy transitions until mechanisms can be put in place to sustain existing power relations.

Since the oil crises of the 1970s, the historically slow progress to renewables in many parts of the world reflects the difficulty of dramatically upscaling decentralized technical systems while

retaining and extending consolidated political power and accumulation. Rather than laying the groundwork for democratizing energy (e.g., building new institutions for community control), the dominant efforts for renewable energy transition prioritize development of mechanisms for the politically and economically powerful to reap their expected benefit from new energy systems, such as by aggregating distributed projects to attract larger investors. Renewable energy transitions proceed slowly so as not to disrupt capitalism (as in meeting projected demand) and according to the logic of the market (as in an economic opportunity). Research and development are now underway to overcome these challenges, investigating long-distance high-voltage transmission, largescale storage, and mapping and acquisition of renewable resource zones. In effect, this work involves finding ways to concentrate relatively distributed energy sources. Increasing the capacities to concentrate renewable energy enables new opportunities for concentrating political and economic power.

Under these pressures, democratic energy-politics may ultimately delay or modify renewable energy transitions. Weak energy democracy, characterized by participation in siting procedures, may impede renewable energy deployment and/or elicit more remote siting and long-distance transmission under centralized operations, and thus drive a more centralized or hybrid renewable-conventional energy transition. Siting decisions are a way to extend some local control without allowing more fundamental issues to be publicly debated or ownership to be shifted. Strong energy democracy, on the other hand, may drive a more distributed energy system, redistribute and strengthen democratic political power, and ultimately result in an accelerated energy transitions guided primarily at the community level. The renewable energy transition as such can be viewed as more a democratic opportunity than an economic opportunity. The evolution of democracy has been stalled by the era of concentrated energy-politics enabling and enabled by petroleum. An energy democracy agenda may renew democratic politics through energy transitions, and a broad set of policies are available to empower communities and regions for this effort. From an energy democracy perspective, the challenge of transition is not so much about creating more ideal economic conditions for renewables or deploying renewables as an economic development strategy. Rather, the urgent need is to create better democratic governance to enable distributed renewables, and likewise to deploy renewables as a democratic development strategy. These dynamics add complexity to the prospect for rapid and democratic energy transitions.

Yet energy-politics also raises the question of the desirability of rapid energy transitions. The renewable energy transition is not simply a race against climate change nor primarily about substitution of fuel sources. The burning of fossil fuels must rapidly be put to an end, both to reduce the damages of the climate emergency and to reduce the power of incumbent energy interests. Climate change and climate justice require rapid decarbonization, and energy democracy justifiably places resistance to fossil fuels and decarbonization at the top of a short-term agenda (Geels, 2014; Sweeney, 2013), which itself raises a host of issues of how to equitably and democratically end fossil fuel production and use (Lenferna, 2018). However, climate mitigation requires a broad set of strategies including reducing fossil fuel investments and subsidies (Sovacool, 2017), lowering of aggregate consumption levels, and changing land use practices (McKinsey & Company, 2009), strategies that may yield greater short-term social and environmental benefit than rapidly deploying renewables.

Moreover, whether the pace of deployment of renewable energy systems improves the Earth's climate remains less certain. Less ambiguous improvements for the climate would require that each unit of renewable energy generated displace at least the equivalent unit output of fossil fuels, whereas renewables may prove largely additive to rather than substitutive of non-renewables (York, 2012). From a strictly biophysical perspective, renewables are likely better deployed at a pace no faster than global and local environments can safely accommodate, as measured not only by added greenhouse gas emissions but also using various other relevant indicators of ecological limits including aggregate biodiversity loss and land use change resulting from new infrastructural development (Steffen et al., 2015). Renewable energy futures as developed under the legacy of logics of the fossil fuel era thus risk inducing critical global social and environmental problems of the future (Jones, 2013).

In other words, although the present climate emergency requires a rapid response to decarbonize societies, this response does not necessarily require a simultaneous and rapid expansion of renewable energy systems. The renewable energy transition when unpacked appears more as a political calculation rather than a matter of science or climate justice. Undoubtedly the energy democracy movement takes seriously the threats of climate change, yet it also challenges us to understand the political reasons for rapid transitions. Whose interests will be most served through new energy infrastructures? Will a rapid energy transition seek to extend concentrated

power into new energy regimes, or conversely build new political power among communities, energy citizens, unions and so on?

Supporting the latter case, energy democracy may still pursue rapid transition, but not solely to stabilize the climate. In this case a swift transition serves to accelerate the transfer of political power and possibly save democracy from the suffocating grip of concentrated energy-politics. Energy democracy is viewed as the best if not only means for achieving a timely, just and environmentally sustainable energy transition by giving genuine political voice, decision-making power, and economic benefit and opportunity to labor unions, communities and the public (Farrell, 2016; Kunze, 2014; Kunze & Becker, 2014; Sweeney, 2013, 2014). This shift in political power may then enable greater resistance to the fossil fuel agenda, and thus allow more meaningful climate responses. There may then be an urgency to the energy democracy agenda, but it is a qualified urgency. A democratic response to climate emergency requires immediate resistance to fossil fuels coupled with the deployment of renewable energy systems at a pace that sustains and can be sustained by democratic governance, lest projects of democratization collapse and renewable solutions rapidly transform into the next human catastrophe.

This development model likely would favor community-owned solar and wind, microgrids, small-scale storage before "big green" energy infrastructures, at least until such larger systems can be built up through democratic process and control. Yet it also implies a broader set of democratic strategies, including reducing the need for electricity and transportation, enlisting diverse appropriate "soft path" technologies, and prioritizing climate adaptation, food and water systems and restoration. In short, energy democracy presents an opportunity to ask what the need is for energy systems, and for whom, before ramping up new industrial-scale (renewable) energy systems. Energy democracy helps reveal how the common meaning of the renewable energy transition neatly collapses within a single agenda what are in fact two distinct energy trends involving different timelines and different political consequences.

Turning to the issue of compatibility, renewable energy systems may offer a greater compatibility with democracy, but soft determinism implies that energy democracy is not a certainty even under a renewable future. Understanding the potential relationships between specific forms of concentrated energy and political power requires a careful examination of the distinct patterns enabled by specific energy sources and infrastructures. It may be too simplistic

to say that a certain energy source or technology is or is not concentrated. Rather it is necessary to explore how and where energy sources are *made* to be concentrated and to which actors they most directly relate. As with our understanding of democracy, concentrated energy sources may involve democratic elements to greater or lesser degrees. The potential for concentrated power relations may then be characterized by degree rather than simply as either centralized or decentralized, concentrated or distributed, and so on (Gui & MacGill, 2018). Different forms of concentrated or distributed energy are co-produced with different political economies and even different forms of democracy. This implies a need for greater attention among advocates to characteristics and differences across specific technologies rather than a blanket advocacy for "renewable energy" as an unspecified group.

Strong energy democracy is characterized by community-based control across *all* elements of renewable energy systems, from extraction to operations to disposal, and from resource collection and generation to transmission and distribution to storage and end use (Healy & Barry, 2017). Each stage of the lifecycles and energy flows of renewable energy systems could be assessed for its political attributes and its compatibility for concentration or democratization. Solar panels, geothermal wells, wind farms, long-distance cables, monitoring stations, data and software systems, walls of batteries, smart meters, EV charging stations, the internet of things; each of these technological systems involve political dynamics. Analysis through energy-politics draws attention to the ways that energy and energy-related technologies enable distribution or concentration of power, and in turn, whether the politically powerful or politically powerless are enabling these technologies. Strongly democratic renewable energy transitions require loosening alliances with concentrated economic and political power and strengthening alliances with distributed economic and political power throughout all stages of energy systems.

Understood as such, the renewable energy transition is a long-term, ongoing political event involving very different renewable energy alliances. Societies will not so much as choose one renewable energy future or another nor intentionally re-order energy sociotechnical systems. Energy futures, whether renewable, democratized or otherwise, will emerge over time out of the dynamics among groups aligned around more concentrated or more distributed political and economic power (Lohmann & Hildyard, 2014). Unavoidably entangled within this struggle are modern homeowners, landowners, ridgelines, diverse ecosystems, technicians, grid operators,

system planners, electricity market analysts, installers, line workers, small business owners, renewable energy advocates, etc. Under current conditions of political fragmentation, energy democracy may be a means for building a coalition of energy democracy actors at local and regional levels. Despite this key political possibility, renewable energy systems remain largely out of view of local and regional politics save for weakly democratic procedural questions. This review seeks to position the issue of political power at the center of the debate around energy futures and to raise the profile of energy democracy. The possibilities for sociotechnical transformations require that renewable energy technologies be deployed through strongly democratic models of energy development.

3.6 Conclusions

The energy democracy movement represents a contemporary expression of ongoing struggles for social and environmental justice through engagement with technological systems. Energy democracy redefines individual energy consumers as energy citizens, energy commodities as public goods, and energy infrastructure not as a class of assets but rather as public works or common resources. Recognizing an opportunity in the renewable energy transition, the agenda for energy democracy calls for opposing fossil fuels and other centralized energy systems agenda, reclaiming the energy sector within the public sphere, and restructuring energy systems technologies and governance for greater democracy and inclusivity. Above all, energy democracy allows for a vision of renewable energy transitions as pathways for democratic development.

The energy democracy agenda draws from an implicit theory of technological politics for the renewable era, which considers the degree to which renewable energy sources and technologies enable and are enabled by democratic politics. These relationships between energy systems and political dynamics are softly deterministic, meaning there exists over time a tendency or compatibility between energy technologies and political power. Relative to more centralized energy systems such as petroleum, decentralized or distributed energy technologies such as solar and wind power offer greater flexibility and can therefore more readily organize and enable distributed political and economic power, and vice versa, a relationship described as distributed energy-politics.

The energy democracy vision may unify diverse perspective around a shared strategy for renewable energy futures. Strong energy democracy requires public and community-based empowerment and ownership of renewable energy systems, including land, renewable generation facilities, microgrids, and small- to medium-scale storage technologies in addition to a host of supporting policies and principles for building capacity at the community and regional levels. To achieve this vision, greater attention will need to be given to strengthening democratic practice and ensuring desirable outcomes. Efforts for democratizing energy systems will further need to extend through all stages of technological life cycles and across the entire chain of energy flows, from sun and wind and on to end use. Energy democracy offers an occasion for deeper engagement with the question around the end purpose and benefits that energy systems, renewable or otherwise, should be made to serve and provide. Energy democracy does not take for granted that renewable energy systems should be built to further capital accumulation, endless growth, or industrial expansion, and thus the discourse of energy democracy allows the prospect for more critical and inclusive consideration of the need and purpose for renewable energy futures.

In this present age of oil, decentralized politics and decentralized energy systems co-evolve within the existing context of centralized energy-politics. Renewable energy transitions, distributed generation and democratic politics all currently suffer under concentrated energy-politics. This point implies that stronger forms of democratic engagement with energy transitions are required to overcome the tendency for concentrated power to either delay the deployment of renewables so that existing power dynamics can be reliably sustained, or to extend present patterns into new energy regimes through a centralized model of renewable development. In a time of climate emergency, weak forms of democracy may also delay the transition or elicit centralization, and thus persistent local resistance to renewables may reflect a missed opportunity to redistribute political and economic power.

As a democratic development model, renewable energy transitions require an accelerated reduction in the use of fossil fuels for social, ecological and political reasons, but do not necessarily entail an immediate ramping of renewable energy infrastructures. The pace of renewable energy deployment is a political calculation and requires attention to the needs and interests served under different scenarios. As social transformations, just, democratic and

ecological energy transitions demand a commitment to building community capacity for democratic energy governance while avoiding a perpetuation of the many social and ecological injustices of existing dominant energy systems. Renewable energy transitions will likely emerge through ongoing and long-term dynamics of political power involving differences in visions, alliances and political consequences. Energy democracy opens the possibility for renewed and renewable forms of democracy, created through deepened and more inclusive engagements with the development of renewable energy futures. If distributed energy-politics reasonably expresses the possibilities for renewable energy and political power in a time of climate emergency, then energy democracy provides a hopeful and well-timed response.

Funding sources

This research was supported by the Social Sciences and Humanities Research Council of Canada, the Department of Natural Resource Sciences at McGill University and the College of Social Science and Humanities and the Global Resilience Institute of Northeastern University.

Acknowledgements

The authors wish to gratefully acknowledge the editors of this special issue and two anonymous reviewers for suggestions that improved the manuscript. We further wish to thank Dr. Peter G. Brown and colleagues within the Economics for the Anthropocene program at McGill University for constructive feedback on a preliminary version of this research.

References

Abramovay, R. (2014). Innovations to democratize energy access without boosting emissions. *Ambiente e Sociedade*, *17*(3), 1–18.

Ahlborg, H., Boräng, F., Jagers, S. C., & Söderholm, P. (2015). Provision of electricity to African households: The importance of democracy and institutional quality. *Energy Policy*, *87*, 125–135. https://doi.org/10.1016/j.enpol.2015.09.002

Angel, J. (2016a). *Strategies of Energy Democracy*. Brussels, Belgium: Rosa-Luxemburg-Stiftung. Retrieved from http://www.rosalux.eu/publications/strategies-of-energy-democracy-a-report/

Angel, J. (2016b). *Towards energy democracy: Discussions and outcomes from an international workshop* (Workshop report). Amsterdam: Transnational Institute.

Angel, J. (2017). Towards an Energy Politics In-Against-and-Beyond the State: Berlin's Struggle for Energy Democracy: Energy Politics In-Against-and-Beyond the State. *Antipode*, *49*(3), 557–576. https://doi.org/10.1111/anti.12289

Arnstein, S. R. (1969). A Ladder of Citizen Participation. *Journal of the American Institute of Planners*, *35*(4), 216–224. https://doi.org/10.1080/01944366908977225

Bain, C. (2011). Local ownership of ethanol plants: What are the effects on communities? *Biomass and Bioenergy*, *35*(4), 1400–1407. https://doi.org/10.1016/j.biombioe.2010.07.031

Becker, S., & Kunze, C. (2014). Transcending community energy: collective and politically motivated projects in renewable energy (CPE) across Europe. *People, Place and Policy Online*, *8*(3), 180–191. https://doi.org/10.3351/ppp.0008.0003.0004

Beebe, A. (2017). Small, Distributed Solar Companies Are Retaking the Industry. Here's Why. Retrieved February 16, 2017, from https://www.greentechmedia.com/articles/read/small-distributed-solar-companies-are-retaking-the-industry.-heres-why

Blühdorn, I. (2013). The governance of unsustainability: ecology and democracy after the post-democratic turn. *Environmental Politics*, *22*(1), 16–36. https://doi.org/10.1080/09644016.2013.755005

Boonstra, W. J. (2016). Conceptualizing power to study social-ecological interactions. *Ecology and Society*, *21*(1). https://doi.org/10.5751/ES-07966-210121

Boyer, D. (2011). Energopolitics and the Anthropology of Energy. *Anthropology News*, *52*(5), 5–7.

Boyer, D. (2014). Energopower: An Introduction. *Anthropological Quarterly*, *87*(2), 309–333. https://doi.org/10.1353/anq.2014.0020

Bridge, G., Bouzarovski, S., Bradshaw, M., & Eyre, N. (2013). Geographies of energy transition: Space, place and the low-carbon economy. *Energy Policy*, *53*, 331–340. https://doi.org/10.1016/j.enpol.2012.10.066

Bronin, S. C. (2010). Curbing Energy Sprawl with Microgrids. *Connecticut Law Review*, *43*(2). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1594515

Brown, D. S., & Mobarak, A. M. (2009). The Transforming Power of Democracy: Regime Type and the Distribution of Electricity. *American Political Science Review*, *103*(02), 193. https://doi.org/10.1017/S0003055409090200

Bues, A., & Gailing, L. (2016). Energy Transitions and Power: Between Governmentality and Depoliticization. In L. Gailing & T. Moss (Eds.), *Conceptualizing Germany's Energy Transition* (pp. 69–91). London: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-50593-4_5

Burke, M. J., & Stephens, J. C. (2017). Energy democracy: Goals and policy instruments for sociotechnical transitions. *Energy Research & Social Science*, *33*, 35–48. https://doi.org/10.1016/j.erss.2017.09.024

Calland, R., & Nakhooda, S. (2012). Participatory democracy meets the hard rock of energy policy: South Africa's national integrated resource plan. *Democratization*, *19*(5), 912–931. https://doi.org/10.1080/13510347.2012.709688

Chatzivasileiadis, S., Ernst, D., & Andersson, G. (2013). The Global Grid. *Renewable Energy*, *57*, 372–383. https://doi.org/10.1016/j.renene.2013.01.032

Chavez, D., & Dove, F. (2015). The meaning, relevance and scope of energy democracy. Retrieved June 27, 2016, from https://www.tni.org/en/article/the-meaning-relevance-and-scope-of-energy-democracy

Cirone, A. E., & Urpelainen, J. (2013). Political market failure? The effect of government unity on energy technology policy in industrialized democracies. *Technovation*, *33*(10–11), 333–344. https://doi.org/10.1016/j.technovation.2013.06.001

Commoner, B. (1979). *The politics of energy* (1st edition). New York: Knopf.

Costello, D. (2011). Incorporating Community Governance: Planning Sustainable Energy Security. *The International Journal of Environmental, Cultural, Economic, and Social Sustainability: Annual Review*, *7*(4), 349–366. https://doi.org/10.18848/1832-2077/CGP/v07i04/54960

CSI. (2010). *Energy democracy: community-scale green energy solutions*. New York, N.Y.: Center for Social Inclusion. Retrieved from centerforsocialinclusion.org

CSI. (2013). *Energy democracy: community-led solutions - three case studies*. New York, N.Y.: Center for Social Inclusion. Retrieved from centerforsocialinclusion.org

de la Cruz Paragas, F., & Lin, T. T. (2016). Organizing and reframing technological determinism. *New Media & Society*, *18*(8), 1528–1546.

Defila, R., Di Giulio, A., & Ruesch Schweizer, C. (2018). Two souls are dwelling in my breast: Uncovering how individuals in their dual role as consumer-citizen perceive future energy policies. *Energy Research & Social Science*, *35*, 152–162. https://doi.org/10.1016/j.erss.2017.10.021

Delina, L., & Janetos, A. (2018). Cosmopolitan, dynamic, and contested energy futures: Navigating the pluralities and polarities in the energy systems of tomorrow. *Energy Research & Social Science*, *35*, 1–10. https://doi.org/10.1016/j.erss.2017.11.031

Delina, L. L. (2018). Whose and what futures? Navigating the contested coproduction of Thailand's energy sociotechnical imaginaries. *Energy Research & Social Science*, *35*, 48–56. https://doi.org/10.1016/j.erss.2017.10.045

Delucchi, M. A., & Jacobson, M. Z. (2011). Providing all global energy with wind, water, and solar power, Part II: Reliability, system and transmission costs, and policies. *Energy Policy*, *39*(3), 1170–1190. https://doi.org/10.1016/j.enpol.2010.11.045

Desbiens, C. (2013). *Power from the north: territory, identity, and the culture of hydroelectricity in Quebec*. Vancouver: University of British Columbia Press.

Duda, J. (2015, August 3). Energy, democracy, community. Retrieved June 27, 2016, from https://medium.com/@JohnDuda/energy-democracy-community-320660711cf4#.jtxijr47s

Duda, J., Hanna, T., & Burke, M. (2016). *Building community capacity for energy democracy: A deck of strategies* (p. 23). Democracy Collaborative. Retrieved from http://www.thenextsystem.org/building-community-capacity-for-energy-democracy/?mc_cid=2ce36b4895&mc_eid=13ffb04686

Energy Democracy Project. (2015). What is the Energy Democracy Project? Local Clean Energy Alliance. Retrieved from http://www.localcleanenergy.org/EnergyDemocracy

Falkner, R. (2014). Global environmental politics and energy: Mapping the research agenda. *Energy Research & Social Science*, *1*, 188–197. https://doi.org/10.1016/j.erss.2014.03.008

Farrell, J. (2011). Democratizing the Electricity System. *New Rules Project*, *23*. Retrieved from http://atcscam.homestead.com/democratizing-electricity-system.pdf

Farrell, J. (2014a). *Advantage Local: Why local energy matters*. Institute for Local Self-Reliance. Retrieved from https://ilsr.org/report-advantage-local-clean-energy-ownership-matters/

Farrell, J. (2014b). *Beyond Utility 2.0 to Energy Democracy* (Democratic Energy Initiative). Minneapolis; Portland; Washington, DC: Institute for Local Self-Reliance. Retrieved from https://ilsr.org/report-energy-democracy/

Farrell, J. (2016). *Beyond sharing: How communities can take ownership of renewable power* (Energy Democracy Initiative). Institute for Local Self-Reliance. Retrieved from https://ilsr.org/report-beyond-sharing/

Fast, S. (2013a). A Habermasian analysis of local renewable energy deliberations. *Journal of Rural Studies*, *30*, 86–98. https://doi.org/10.1016/j.jrurstud.2012.12.004

Fast, S. (2013b). Social Acceptance of Renewable Energy: Trends, Concepts, and Geographies: Social Acceptance of Renewable Energy. *Geography Compass*, *7*(12), 853–866. https://doi.org/10.1111/gec3.12086

Foucault, M. (2009). *Security, Territory, Population*. (M. Senellart, F. Ewald, & A. Fontana, Eds.). London: Palgrave Macmillan UK. Retrieved from http://link.springer.com/10.1057/9780230245075

Frumhoff, P. C., Heede, R., & Oreskes, N. (2015). The climate responsibilities of industrial carbon producers. *Climatic Change*, *132*(2), 157–171. https://doi.org/10.1007/s10584-015-1472-5

García-Olivares, A. (2015). Substituting silver in solar photovoltaics is feasible and allows for decentralization in smart regional grids. *Environmental Innovation and Societal Transitions*, *17*, 15–21. https://doi.org/10.1016/j.eist.2015.05.004

Geels, F. W. (2014). Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory, Culture & Society*, *31*(5), 21–40. https://doi.org/10.1177/0263276414531627

Giancatarino, A. (2012). *Energy democracy: Supporting community innovation*. New York, N.Y.: Center for Social Inclusion. Retrieved from www.centerforsocialinclusion.org

Giancatarino, A. (2013). *Community-Scale Energy: Models, Strategies and Racial Equity - A Scan of Community Innovation around Efficiency and Renewable Energy*. New York, N.Y.: Center for Social Inclusion.

Goerner, S. (2013). Corrective Lenses: How the Laws of Energy Networks Improve our Economic Vision. *World Futures*, *69*(7–8), 402–449. https://doi.org/10.1080/02604027.2013.835962

Goldrich, D. (1986). Democracy and energy planning: The Pacific Northwest as prototype. *Environmental Review*, *10*(3), 199–214.

Goldthau, A. (2014). Rethinking the governance of energy infrastructure: Scale, decentralization and polycentrism. *Energy Research & Social Science*, *1*, 134–140. https://doi.org/10.1016/j.erss.2014.02.009

Goodin, R. E. (1992). *Green political theory*. Cambridge, UK; Cambridge, MA, USA: Polity Press.

Green, J. (2015). *Energy democracy: Namasté Solar - A profile in cooperative ownership*. New York, N.Y.: Center for Social Inclusion. Retrieved from http://www.centerforsocialinclusion.org/category/publications/

Green, J. (2016). *Energy democracy: Co-op Power - A profile in cooperative ownership*. New York, N.Y.: Center for Social Inclusion. Retrieved from http://www.centerforsocialinclusion.org/category/publications/

Grimley, M., & Farrell, J. (2016). *Mighty microgrids* (Energy Democracy Initiative). Institute for Local Self-Reliance. Retrieved from https://ilsr.org

Gui, E. M., & MacGill, I. (2018). Typology of future clean energy communities: An exploratory structure, opportunities, and challenges. *Energy Research & Social Science*, *35*, 94–107. https://doi.org/10.1016/j.erss.2017.10.019

Hager, C. J. (1992). Democratizing Technology: Citizen & State in West German Energy Politics, 1974-1990. *Polity*, *25*(1), 45. https://doi.org/10.2307/3235019

Hall, C. A. S., & Klitgaard, K. A. (2012). *Energy and the Wealth of Nations*. New York, NY: Springer New York. Retrieved from http://link.springer.com/10.1007/978-1-4419-9398-4

Hancock, K. J., & Vivoda, V. (2014). International political economy: a field born of the OPEC crisis returns to its energy roots. *Energy Research & Social Science*, *1*, 206–216.

Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition." *Energy Policy*, *108*, 451–459. https://doi.org/10.1016/j.enpol.2017.06.014

Henderson, H. (1988). *The politics of the solar age: alternatives to economics* (Rev. edition). Indianapolis, IN: Knowledge Systems, Inc.

Hendriks, C. M. (2008). On inclusion and network governance: The democratic disconnect of Dutch energy transitions. *Public Administration*, *86*(4), 1009–1031. https://doi.org/10.1111/j.1467-9299.2008.00738.x

Hendriks, C. M. (2009). Policy design without democracy? Making democratic sense of transition management. *Policy Sciences*, *42*(4), 341–368. https://doi.org/10.1007/s11077-009-9095-1

Hess, D. J., & Mai, Q. D. (2014). Renewable electricity policy in Asia: A qualitative comparative analysis of factors affecting sustainability transitions. *Environmental Innovation and Societal Transitions*, *12*, 31–46. https://doi.org/10.1016/j.eist.2014.04.001

Hoffman, S. M., & High-Pippert, A. (2005). Community Energy: A Social Architecture for an Alternative Energy Future. *Bulletin of Science, Technology & Society*, *25*(5), 387–401. https://doi.org/10.1177/0270467605278880

Holden, M. (2009). Reflections on how political scientists (and others) might think about energy and policy. In R. E. Goodin, M. Moran, & M. Rein (Eds.), *The Oxford Handbook of Public Policy*. Oxford University Press. Retrieved from http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199548453.001.0001/oxfordhb-9780199548453-e-043?&mediaType=Article

Hughes, T. P. (1983). *Networks of power: electrification in Western society, 1880-1930*. Baltimore: Johns Hopkins University Press.

Huybrechts, B., & Mertens, S. (2014). The relevance of the cooperative model in the field of renewable energy. *Annals of Public and Cooperative Economics*, *85*(2), 193–212.

Illich, I. (2013). *Beyond economics and ecology: the radical thought of Ivan Illich*. New York: Marion Boyars Publishers Ltd.

Jacobson, M. Z., & Delucchi, M. A. (2011). Providing all global energy with wind, water, and solar power, Part I: Technologies, energy resources, quantities and areas of infrastructure, and materials. *Energy Policy*, *39*(3), 1154–1169. https://doi.org/10.1016/j.enpol.2010.11.040

Jasanoff, S., & Kim, S.-H. (2013). Sociotechnical Imaginaries and National Energy Policies. *Science as Culture*, *22*(2), 189–196. https://doi.org/10.1080/09505431.2013.786990

Jones, C. F. (2013). Building More Just Energy Infrastructure: Lessons from the Past. *Science as Culture*, *22*(2), 157–163. https://doi.org/10.1080/09505431.2013.786991

Kaunda, C. S., Kimambo, C. Z., & Nielsen, T. K. (2012). Hydropower in the Context of Sustainable Energy Supply: A Review of Technologies and Challenges. *ISRN Renewable Energy*, *2012*, 1–15. https://doi.org/10.5402/2012/730631

Kunze, C. (2014). What is Energy Democracy? Retrieved June 27, 2016, from http://energie-demokratie.de/what-is-energy-democracy/

Kunze, C., & Becker, S. (2014). *Energy democracy in Europe: A survey and outlook*. Brussels, Belgium: Rosa-Luxemburg-Stiftung. Retrieved from http://www.rosalux.eu/publications

Kunze, C., & Becker, S. (2015). Collective ownership in renewable energy and opportunities for sustainable degrowth. *Sustainability Science*, *10*(3), 425–437. https://doi.org/10.1007/s11625-015-0301-0

Laird, F. N. (2013). Against Transitions? Uncovering Conflicts in Changing Energy Systems. *Science as Culture*, *22*(2), 149–156. https://doi.org/10.1080/09505431.2013.786992

Lenferna, G. A. (2018). Can we equitably manage the end of the fossil fuel era? *Energy Research & Social Science*, *35*, 217–223. https://doi.org/10.1016/j.erss.2017.11.007

Lennon, M. (2017). Decolonizing energy: Black Lives Matter and technoscientific expertise amid solar transitions. *Energy Research & Social Science*, *30*, 18–27. https://doi.org/10.1016/j.erss.2017.06.002

Liu, Z. (2015). *Global energy interconnection*. Amsterdam; Boston; Heidelberg; London; New York; Oxford; Paris; San Diego; San Francisco; Singapore; Sydney; Tokyo: Elsevier.

Local Clean Energy Alliance. (2016). Resources on Energy Democracy. Retrieved June 27, 2016, from http://www.localcleanenergy.org/EnergyDemocracy

Lohmann, L., & Hildyard, N. (2014). *Energy, Work and Finance*. Dorset, UK: Corner House. Retrieved from http://www.thecornerhouse.org.uk

Love, T., & Isenhour, C. (2016). Energy and economy: Recognizing high-energy modernity as a historical period: Introduction to energy and economy. *Economic Anthropology*, *3*(1), 6–16. https://doi.org/10.1002/sea2.12040

Lovins, A. B. (1976). Energy Strategy: The Road Not Taken? *Foreign Affairs*, *55*(1), 65. https://doi.org/10.2307/20039628

Madriz-Vargas, R., Bruce, A., & Watt, M. (2018). The future of Community Renewable Energy for electricity access in rural Central America. *Energy Research & Social Science*, *35*, 118–131. https://doi.org/10.1016/j.erss.2017.10.015

Malm, A. (2012). China as Chimney of the World: The Fossil Capital Hypothesis. *Organization & Environment*, *25*(2), 146–177.

Marshall, M. G., Gurr, T. R., & Jaggers, K. (2016, May 19). POLITY^{TM} IV Project: Political Regime Characteristics and Transitions, 1800-2015 Dataset Users' Manual. Center for Systemic Peace. Retrieved from www.systemicpeace.org

Massari, S., & Ruberti, M. (2013). Rare earth elements as critical raw materials: Focus on international markets and future strategies. *Resources Policy*, *38*(1), 36–43. https://doi.org/10.1016/j.resourpol.2012.07.001

McKinsey & Company. (2009). *Pathways to a Low-carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve.* Retrieved from http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/pathways-to-a-low-carbon-economy

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, *42*(4), 323–340. https://doi.org/10.1007/s11077-009-9097-z

Mey, F., & Diesendorf, M. (2018). Who owns an energy transition? Strategic action fields and community wind energy in Denmark. *Energy Research & Social Science*, *35*, 108–117. https://doi.org/10.1016/j.erss.2017.10.044

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: a methods sourcebook* (Third edition). Thousand Oaks, California: SAGE Publications, Inc.

Miller, C. A., Iles, A., & Jones, C. F. (2013). The Social Dimensions of Energy Transitions. *Science as Culture*, *22*(2), 135–148. https://doi.org/10.1080/09505431.2013.786989

Mitchell, T. (2009). Carbon democracy. *Economy and Society*, *38*(3), 399–432. https://doi.org/10.1080/03085140903020598

Mitchell, T. (2011). *Carbon democracy: political power in the age of oil*. London: Verso.

Moallemi, E. A., & Malekpour, S. (2018). A participatory exploratory modelling approach for long-term planning in energy transitions. *Energy Research & Social Science*, *35*, 205–216. https://doi.org/10.1016/j.erss.2017.10.022

Mori, A. (2018). Socio-technical and political economy perspectives in the Chinese energy transition. *Energy Research & Social Science*, *35*, 28–36. https://doi.org/10.1016/j.erss.2017.10.043

Morris, D. (2001). Seeing the Light. *Institute for Local Self-Reliance*. Retrieved from https://www.pharosproject.net/uploads/files/sources/1/1349813941.pdf

Morris, & Jungjohann, A. (2016). *Energy democracy: Germanys Energiewende to renewables*. Basingstoke: Palgrave Macmillan.

Moss, T. (2014). Socio-technical Change and the Politics of Urban Infrastructure: Managing Energy in Berlin between Dictatorship and Democracy. *Urban Studies*, *51*(7), 1432–1448. https://doi.org/10.1177/0042098013500086

Mumford, L. (1934). *Technics and civilization*. New York, NY: Harcourt, Brace and Co.

Mumford, L. (1964). Authoritarian and Democratic Technics. *Technology and Culture*, *5*(1), 1. https://doi.org/10.2307/3101118

Nader, L. (Ed.). (2010). *The energy reader*. Chichester, West Sussex, UK; Malden, MA: Wiley-Blackwell.

Olinsky-Paul, T. (2015). *Resilient Power: What states should do: A guide to resilient power programs and policy*. Clean Energy Group. Retrieved from http://bit.ly/ResilientStates

Ostrom, E. (2010). Beyond Markets and States: Polycentric Governance of Complex Economic Systems. *American Economic Review*, *100*(3), 641–672. https://doi.org/10.1257/aer.100.3.641

Pearl-Martinez, R., & Stephens, J. C. (2016). Toward a gender diverse workforce in the renewable energy transition. *Sustainability: Science, Practice & Policy*, *12*(1).

Peterson, T. R., Stephens, J. C., & Wilson, E. J. (2015). Public perception of and engagement with emerging low-carbon energy technologies: A literature review. *MRS Energy & Sustainability*, *2*. https://doi.org/10.1557/mre.2015.12

Rogers, J. C., Simmons, E. A., Convery, I., & Weatherall, A. (2008). Public perceptions of opportunities for community-based renewable energy projects. *Energy Policy*, *36*(11), 4217–4226. https://doi.org/10.1016/j.enpol.2008.07.028

Rosa, E. A., & Dunlap, R. E. (1994). Poll Trends: Nuclear Power: Three Decades of Public Opinion. *Public Opinion Quarterly*, *58*(2), 295. https://doi.org/10.1086/269425

Ross, M. L. (2001). Does Oil Hinder Democracy? *World Politics*, *53*(03), 325–361. https://doi.org/10.1353/wp.2001.0011

Russell, B. (2004). *Power: a new social analysis*. London; New York: Routledge.

Ryan, J., & Eckhouse, B. (2017). The Age of the Giant Battery Is Almost Upon Us. *Bloomberg.Com*. Retrieved February 21, 2017 from https://www.bloomberg.com/news/articles/2017-02-21/big-batteries-coming-of-age-prompt-bankers-to-place-their-bets

Schaube, P., Ortiz, W., & Recalde, M. (2018). Status and future dynamics of decentralised renewable energy niche building processes in Argentina. *Energy Research & Social Science*, *35*, 57–67. https://doi.org/10.1016/j.erss.2017.10.037

Schmitter, P. C., & Karl, T. L. (1991). What democracy is... and is not. *Journal of Democracy*, *2*(3), 75–88.

Shaw, K., Hill, S. D., Boyd, A. D., Monk, L., Reid, J., & Einsiedel, E. F. (2015). Conflicted or constructive? Exploring community responses to new energy developments in Canada. *Energy Research & Social Science*, *8*, 41–51. https://doi.org/10.1016/j.erss.2015.04.003

Sherwani, A. F., Usmani, J. A., & Varun. (2010). Life cycle assessment of solar PV based electricity generation systems: A review. *Renewable and Sustainable Energy Reviews*, *14*(1), 540–544. https://doi.org/10.1016/j.rser.2009.08.003

Smil, V. (2004). World history and energy. *Encyclopaedia of Energy*, *6*, 549.

Smil, V. (2017). *Energy and civilization: a history*. Cambridge, MA: The MIT Press.

Soutar, I., & Mitchell, C. (2018). Towards pragmatic narratives of societal engagement in the UK energy system. *Energy Research & Social Science*, *35*, 132–139. https://doi.org/10.1016/j.erss.2017.10.041

Sovacool, B. K. (2006). Reactors, Weapons, X-Rays, and Solar Panels: Using SCOT, Technological Frame, Epistemic Culture, and Actor Network Theory to Investigate Technology. *The Journal of Technology Studies*, *32*(1). https://doi.org/10.21061/jots.v32i1.a.2

Sovacool, B. K. (2011a). An international comparison of four polycentric approaches to climate and energy governance. *Energy Policy*, *39*(6), 3832–3844. https://doi.org/10.1016/j.enpol.2011.04.014

Sovacool, B. K. (2011b). Seven suppositions about energy security in the United States. *Journal of Cleaner Production*, *19*(11), 1147–1157. https://doi.org/10.1016/j.jclepro.2011.03.014

Sovacool, B. K. (2017). Reviewing, Reforming, and Rethinking Global Energy Subsidies: Towards a Political Economy Research Agenda. *Ecological Economics*, *135*, 150–163. https://doi.org/10.1016/j.ecolecon.2016.12.009

Sovacool, B. K., & Brossmann, B. (2013). Fantastic Futures and Three American Energy Transitions. *Science as Culture*, *22*(2), 204–212. https://doi.org/10.1080/09505431.2013.786999

Sovacool, B. K., & Brossmann, B. (2014). The rhetorical fantasy of energy transitions: implications for energy policy and analysis. *Technology Analysis & Strategic Management*, *26*(7), 837–854. https://doi.org/10.1080/09537325.2014.905674

Sovacool, B. K., & Cooper, C. J. (2013). *The governance of energy megaprojects: politics, hubris and energy security*. Edward Elgar Publishing.

Steffen, W., Richardson, K., Rockstrom, J., Cornell, S. E., Fetzer, I., Bennett, E. M., … Sorlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223), 736–747. https://doi.org/10.1126/science.1259855

Stirling, A. (2014). Transforming power: Social science and the politics of energy choices. *Energy Research & Social Science*, *1*, 83–95. https://doi.org/10.1016/j.erss.2014.02.001

Storm, L. (2008). An Elemental Definition of Democracy and its Advantages for Comparing Political Regime Types. *Democratization*, *15*(2), 215–229. https://doi.org/10.1080/13510340701846301

Strachan, P. A., Cowell, R., Ellis, G., Sherry-Brennan, F., & Toke, D. (2015). Promoting Community Renewable Energy in a Corporate Energy World: Promoting Community Renewable Energy in the UK. *Sustainable Development*, *23*(2), 96–109. https://doi.org/10.1002/sd.1576

Sweeney, S. (2013). Resist, Reclaim, Restructure: Unions and the Struggle for Energy Democracy. Trade Unions for Energy Democracy/Rosa Luxemburg Stiftung. Retrieved from http://unionsforenergydemocracy.org/resist-reclaim-restructure-unions-and-the-struggle-for-energy-democracy/

Sweeney, S. (2014). Working Toward Energy Democracy. In *Governing for sustainability: state of the World 2014* (pp. 215–227). Washington, DC: Island Press.

Sweeney, S. (2015). *Energy Democracy in Greece: SYRIZA's Program and the Transition to Renewable Power (Working Paper #3)*. New York: Trade Unions for Energy Democracy. Retrieved from http://www.rosalux.eu/publications/

Sweeney, S., Benton-Connell, K., & Skinner, L. (2015). *Power to the People: Toward Democratic Control of Electricity Generation (Working Paper No. 4)*. New York: Trade Unions for Energy Democracy/Rosa Luxemburg Stiftung. Retrieved from http://unionsforenergydemocracy.org/power-to-the-people-toward-democratic-control-of-electricity-generation/

Szeman, I. (2014). Conclusion: On Energopolitics. *Anthropological Quarterly*, *87*(2), 453–464. https://doi.org/10.1353/anq.2014.0019

Szeman, I., & Diamanti, J. (2017). Beyond Petroculture: strategies for a Left energy transition. *Canadian Dimension*, *51*(1). Retrieved February 17, 2017 from

https://canadiandimension.com/articles/view/beyond-petroculture-strategies-for-a-left-energy-transition

Tarhan, M. D. (2017). Renewable Energy Co-operatives and Energy Democracy: A Critical Perspective. Presented at the Canadian Association for Studies in Co-operation, Toronto, ON. Retrieved from https://www.researchgate.net/publication/317369738_Renewable_Energy_Co-operatives_and_Energy_Democracy_A_Critical_Perspective

Thompson, G., & Bazilian, M. (2014). Democratization, Energy Poverty, and the Pursuit of Symmetry. *Global Policy*, *5*(1), 127–131. https://doi.org/10.1111/1758-5899.12103

Tokar, B. (2015). Democracy, Localism, and The Future of The Climate Movement. *World Futures*, *71*(3–4), 65–75. https://doi.org/10.1080/02604027.2015.1092785

Tozer, L., & Klenk, N. (2018). Discourses of carbon neutrality and imaginaries of urban futures. *Energy Research & Social Science*, *35*, 174–181. https://doi.org/10.1016/j.erss.2017.10.017

Tsebelis, G. (2002). *Veto players: How political institutions work*. Princeton University Press.

Van de Graaf, T., Sovacool, B. K., Ghosh, A., Kern, F., & Klare, M. T. (2016). *Palgrave handbook of the international political economy of energy*. London: Palgrave Macmillan.

Van der Schoor, T., Lente, H. van, Scholtens, B., & Peine, A. (2016). Challenging obduracy: How local communities transform the energy system. *Energy Research & Social Science*, *13*, 94–105. https://doi.org/10.1016/j.erss.2015.12.009

Walker, G. (2008). What are the barriers and incentives for community-owned means of energy production and use? *Energy Policy*, *36*(12), 4401–4405. https://doi.org/10.1016/j.enpol.2008.09.032

Watts, R. (2012). *Public meltdown: the story of the Vermont Yankee Nuclear Power Plant*. Amherst, Mass: White River Press.

Weber, M. (1978). *Economy and society: an outline of interpretive sociology.* Berkeley: University of California Press.

Weinberg, A. M. (1990). Technology and democracy. *Minerva*, *28*(1), 81–90.

Weinrub, A. (2014). *Expressions of Energy Democracy: Perspectives on an Emerging Movement*. Oakland, CA: Local Clean Energy Alliance. Retrieved from www.localcleanenergy.org

Weinrub, A., & Giancatarino, A. (2015). *Toward a climate justice energy platform: Democratizing our energy future*. Local Clean Energy Alliance / Center for Social Inclusion. Retrieved from localcleanenergy.org

Wesoff, E. (2017). Despite Headwinds, Big Capital Continues to Flow into Solar Projects, Processes and Startups. Retrieved February 16, 2017, from https://www.greentechmedia.com/articles/read/Despite-Headwinds-Big-Capital-Continues-to-Flow-Into-Solar-Projects-Proce?utm_source=EAN+Newsletter+-+February+2017&utm_campaign=Newsletter+2017+-+February&utm_medium=email

West, J., Bailey, I., & Winter, M. (2010). Renewable energy policy and public perceptions of renewable energy: A cultural theory approach. *Energy Policy*, *38*(10), 5739–5748. https://doi.org/10.1016/j.enpol.2010.05.024

Winner, L. (1980). Do artifacts have politics? *Daedalus*, 121–136.

Wiseman, H. (2011). Expanding regional renewable governance. *Harvard Environmental Law Review*, *35*(2), 477–540.

Wolsink, M. (2012). The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. *Renewable and Sustainable Energy Reviews*, *16*(1), 822–835. https://doi.org/10.1016/j.rser.2011.09.006

Wong, J. K. (2016). A Dilemma of Green Democracy. *Political Studies*, *64(IS)*, 136–155. https://doi.org/10.1111/1467-9248.12189

Wood, S. (2009). Energy Security, Normative Dilemmas, and Institutional Camouflage: Europe's Pragmatism. *Politics & Policy*, *37*(3), 611–635. https://doi.org/10.1111/j.1747-1346.2009.00187.x

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*(5), 2683–2691. https://doi.org/10.1016/j.enpol.2006.12.001

Yi, H., & Feiock, R. C. (2014). Renewable energy politics: Policy typologies, policy tools, and state deployment of renewables. *Policy Studies Journal*, *42*(3), 391–415.

York, R. (2012). Do alternative energy sources displace fossil fuels? *Nature Climate Change*, *2*(6), 441–443. https://doi.org/10.1038/nclimate1451

INTERCONNECTING TEXT TO CHAPTER 4

Chapter 4 has been published as Burke, M. J., & Stephens, J. C. (2017). Energy democracy: Goals and policy instruments for sociotechnical transitions. *Energy Research & Social Science*, *33*, 35–48. https://doi.org/10.1016/j.erss.2017.09.024

The research proceeds by examining energy democracy policy instruments to understand how renewable energy is currently put to work for social transformation. By integrating technological change with the potential for socioeconomic and political change, the movement links social justice and equity with energy innovation. As a set of rules for governing collective efforts toward renewable energy transition, policy instruments, including and in addition to institutional reforms and innovations of property-rights systems, are arguably the most evident changes to social systems governing energy transition. The previous chapter pulls together an underlying theory of energy democracy and transformative renewable energy transition, emphasizing possibilities, limits, and risks, and thus suggests the need for a programmatic approach. Chapter 4 goes on to consider the specific strategies being used for democratizing renewable energy and how they can be implemented effectively. More specifically, the following chapter examines the energy democracy agenda in the United States through a policy mix lens to understand how and to what extent the mix of policy instruments currently proposed among energy democracy advocates corresponds to the overarching goals of the movement.

CHAPTER 4: ENERGY DEMOCRACY: GOALS AND POLICY INSTRUMENTS FOR SOCIOTECHNICAL TRANSITIONS

4.1 Introduction

The concept of *energy democracy* is increasingly being used by grassroots activists in the United States, parts of Europe and elsewhere to call for and justify integrations of policies linking social justice and economic equity with renewable energy transitions. Energy democracy is thus both a novel concept and emergent social movement that connects energy infrastructural change with the possibilities for deep political, economic and social change. The term continues to spread throughout climate justice struggles, trade unions, academic communities, and political parties, while beginning to reach regional and national level discourse (Angel, 2016a).

Energy democracy emerges in the context of an increasing sense of urgency regarding global anthropogenic climate change. Despite growing recognition of the inherent unsustainability and injustice of fossil fuel civilization (Healy & Barry, 2017), an inability to adequately reduce fossil fuel dependency persists. The issue of and need for shifting away from fossil-fuel-dominant systems toward renewable-based energy has therefore become a central theme for science, politics, and public discourse worldwide (Araújo, 2014; Boyer, 2014; Brown, Larsen, Roney, & Adams, 2015; IRENA, 2017; Jacobson & Delucchi, 2011; Markard, Raven, & Truffer, 2012). How the decline in fossil fuel reliance plays out is likely to be among the most contested areas of policy and politics over the coming decades (Arent, Arndt, Miller, Tarp, & Zinaman, 2017; Boyer, 2014; Meadowcroft, 2009; REN21, 2017; Stirling, 2014).

Realizing opportunities for this restructuring of sociotechnical regimes (Stirling, 2014) requires a re-imagining of energy politics (Miller, Iles, & Jones, 2013), an effort that energy democracy advocates intend to inspire. The energy democracy movement seeks to create opportunities for destabilizing power relations (Angel, 2016a), reversing histories of dispossession, marginalization (Duda, 2015; Farrell, 2016a) and social and environmental injustices (EDANY, 2016), and replacing monopolized fossil fuel energy systems with democratic and renewable structures (Kunze, 2014). Above all, energy democracy offers a set of visionary organizing principles that provide guidance for democratically restructuring the energy and electricity sectors through the processes of shifting from fossil-fuel-based systems to renewable energy systems (Angel, 2016b; Sweeney, 2014).

Drawing from sociotechnical transition theory, the energy democracy movement represents an example of a de-alignment/re-alignment transition pathway, an ideal-type pathway for energy transition that develops in response to serious contextual pressures (Verbong & Geels, 2012). This transition pathway is characterized by a significant presence of actors who have lost faith in existing governing systems, the emergence of new guiding principles, beliefs and practices, the co-existence of multiple innovations and widespread experimentation, and a shift to more local or regional-based systems and decentralized technologies and management structures (Verbong & Geels, 2012). Such an agenda is intentionally incongruent with the governing systems in effect in most jurisdictions, thus deliberately lacking a goodness of fit with conventional energy regimes (Howlett & Rayner, 2013). Further, a strategy of de-alignment and re-alignment implies inherent uncertainties regarding the best path forward (Verbong & Geels, 2012), and may lead to ineffective combinations of policy instruments that fail to achieve the desired outcomes even if adopted (Kern & Howlett, 2009). In such a situation, policy tradeoffs and conflicting goals are arguably inevitable (Quitzow, 2015).

Recent scholarship on sociotechnical systems change acknowledges that the urgency for transitions to sustainability requires policy mixes that combine instruments that can destabilize existing regimes while creating space for innovative alternatives, described as processes of creative destruction or disruptive innovation (Kivimaa & Kern, 2016; Turnheim & Geels, 2012). In this sense, a comprehensive agenda for energy transition demands a combination of policy instruments that simultaneously seeks to resist dominant energy systems and support their replacement. Research has not yet given sufficient attention to such comprehensive agendas for sociotechnical change, however. For example, policies for resisting or destabilizing incumbent regimes have received less attention than policies for innovation (Turnheim & Geels, 2012), and combinations of policies for simultaneous innovation and disruption have also received minimal attention (Kivimaa & Kern, 2016). By explicitly linking moves to both destabilize incumbent systems and support new alternatives, energy democracy proposes a uniquely comprehensive and potentially effective agenda for driving deep sociotechnical change (Kivimaa & Kern, 2016; Quitzow, 2015). Given its integrated social change focus, the energy democracy approach may present better prospects for achieving the renewable energy transition than more traditional energy innovation and climate mitigation efforts that are often isolated from other social issues (Howlett, 2014; Howlett & Rayner, 2013).

This paper focuses on the energy democracy agenda in the United States and asks, how and to what extent does the set of policy instruments currently proposed among energy democracy advocates correspond to the overarching goals of the energy democracy movement? A policy mix lens offers a useful approach for drawing attention to sets of policies rather than individual policy tools, designed to achieve proposed societal outcomes (del Río, 2014). A policy mix lens further provides a framework for considering specific tradeoffs and potential conflicts within and between sets of policies, and for understanding how these different policies may interact to influence the achievement of goals and intended outcomes (Flanagan, Uyarra, & Laranja, 2011; Quitzow, 2015). Drawing from a review of both activist and academic literature on energy democracy, our aims include increasing the visibility of the energy democracy movement, clarifying and assessing the core claims and policies advanced by energy democracy advocates, and contributing to integrated policy designs for energy democracy.

In the following section, we describe our approach to assessing energy democracy goals and policies based on a review of recent sources on energy democracy. In section 4.3, we present the results of the review of goals and policy instruments for energy democracy. Here we synthesize and present the core energy democracy goals and summarize specific policy instruments associated with the energy democracy agenda for renewable energy transitions. Section 4.4 presents the results of this assessment comparing energy democracy goals and policy instruments. In section 4.5, we discuss the significance of the review and assessment in terms of the value of integrating a policy mix approach with an energy democracy agenda. This integration offers insights for understanding policy mixes in the context of urgently needed sociotechnical systems change, as well as for strengthening the energy democracy agenda. We address limitations of this research, suggesting areas for further research on the design of effective energy democracy policy mixes to advance renewable energy transitions. In section 4.6, we summarize our main conclusions and their implications for scholarship and practice.

4.2 Conceptual lens and methods

In this paper, we initiate an assessment of whether and how the mix of policy instruments proposed within the energy democracy movement advances the overarching goals of the movement. To conduct this assessment, we first undertook a conceptual review of energy democracy to identify the goals and policy instruments associated with this social movement.

This assessment requires some clarity on how the term energy democracy is used in practice. We then operationalized each broad energy democracy goal as a set of intended outcomes to enable a comparative assessment with each individual policy instrument.

This preliminary assessment of energy democracy policy instruments draws from a policy mix perspective, in which policy mixes are understood broadly as "complex arrangements of multiple goals and means which, in many cases, have developed incrementally over many years" (Kern & Howlett, 2009, p. 395). This basic definition differs from the more comprehensive policy mix concept as proposed by Rogge and Reichardt (2015, p. 24) but largely suits the purposes here by emphasizing the generalized notions of goals as desirable ends and policies as the means to achieve these ends over time. Nevertheless, we do follow Rogge and Reichardt (2015) to further specify our meaning of goals and policy instruments as applied here. In this work, the term *goal* refers to the set of intended effects or outcomes of policy instruments (2015, p. 9). The term *policy instrument* refers here to the specific tool or technique used to address policy problems, including programs and measures (2015, p. 9). The units of analysis for this initial assessment include each individual policy instrument and ultimately the constituting set of energy democracy policy instruments, described as an *instrument mix* (2015, p. 3).

The aim then is to contribute to understanding connections between goals and policy instruments. Conceptually, we assess the *congruence* of the relationship between goals and policy instruments as a means for evaluating the predicted success or failure of these efforts for energy transition (Kern & Howlett, 2009, p. 395). While much of the policy mix literature focuses on coherence of goals and consistency among existing policies, this assessment centers on the congruence of a set of existing and proposed policy instruments with a broad and emerging set of goals. We emphasize that the present assessment involves energy democracy goals as intended outcomes rather than actual impacts. An empirical assessment of impacts of specific policy instruments is beyond the scope of this paper due to the recent emergence of energy democracy and the complexity of both the policy instruments and the factors influencing the realization of their goals (Quitzow, 2015). Rather, this inquiry assumes that the large-scale sociotechnical transformation demanded by the energy democracy movement requires that the appropriate mix of policy instruments are actively and sufficiently proposed.

For the conceptual review, iterative searches were performed beginning in October 2015 using academic libraries and popular search engines publicly available in Canada and the United States. Search terms used included "energy democracy" and "energy AND democracy" and were directed at all source content, yielding an initial set of approximately thirty English-language reports, articles, websites and videos. This set of sources was expanded through November 2016 using searches of activist group websites, notifications from relevant listservs and participation in webinars, as well as inclusion of references frequently cited within source materials. These sources were coded first according to definitions of terms and concepts, findings and conclusions, and calls for further research. This process was followed by repeated topical sorting of coded material according to researcher-generated topics including origins and contextual factors, energy democracy actors, purposes and goals, guiding principles and values, core policy tools, and barriers. The sorted materials were organized within a conceptual outline that was used to guide the initial drafting of the review of energy democracy. This initial procedure to review the concept of energy democracy revealed a breadth of topical categories that inspired two supporting lines of inquiry, ultimately producing two research papers relating to the practice and theory of energy democracy. This paper examines the goals and policy instruments of the energy democracy movement through the lens of policy mixes, while the second review (see chapter 3) explores the theoretical relationships between renewable energy systems and democratic politics more broadly (Burke & Stephens, 2018).

For the comparative assessment of congruence of goals and instruments, the three broad energy democracy objectives of *resist*, *reclaim* and *restructure* (Sweeney, 2013, 2014) were used to organize a set of goals. For each of these three categories of goals, a list of intended outcomes was identified by first drawing from the review and then revisiting key sources that specifically addressed this three-pronged approach (Angel, 2016a; Speth, 2015; Sweeney, 2014; Weinrub & Giancatarino, 2015). The aim here was to identify a set of outcomes prioritized for each goal for energy democracy, at a level of specificity that could provide a clear statement of a desired outcome without specifying quantified targets, while further remaining applicable across various jurisdictions (e.g., U.S. states). This procedure resulted in a set of 26 statements of intended outcomes. Policy instruments were similarly identified through the review resulting in a set of 22 policy instruments that advocates for energy democracy have consistently identified as meaningful for advancing this agenda, mainly in the context of the U.S. as well as the UK and

EU. To facilitate the assessment, policy instruments were then organized into four categories including regulatory context, financial inclusion measures, economic institutions, and new energy system institutions (based on Duda, Hanna, & Burke, 2016). Once identified, each policy instrument was additionally summarized to provide definitions and examples in practice, drawing first from the above review and adding additional sources when clear definitions or current examples were lacking in the sources originally reviewed.

Having established the set of energy democracy policy instruments and intended outcomes, each instrument was paired and compared in a spreadsheet with each individual outcome statement. For each pairing, the aim was to assess whether the chosen instrument could reasonably be expected to contribute or not to the achievement of the specific outcome. In cases of uncertainty or ambiguity, it was assumed that an instrument could not be expected to contribute to the outcome. The comparisons were aggregated according to the three categories of energy democracy goals to consider whether and to what degree, modestly or strongly, each instrument related to the achievement of each goal. For a modest relationship to the goal, a selected instrument had to be assessed as related to at least half of the outcomes of that specific goal, whereas if an instrument was deemed relevant to at least 80% of the outcomes of a specific goal, the instrument was determined to relate strongly to the goal. Similarly, the individual outcomes were assessed according to the number of supporting policy instruments to determine the relative degree of attention given to each outcome from the set of instruments. Following Kivimaa and Kern (2016, p. 211), the objective of this exercise was to analyze how the combination of policy instruments for energy democracy may be expected to relate to and support outcomes considered to be constitutive of an energy democracy vision for renewable energy transitions, noting how the energy democracy instrument mix corresponded to combined goals of a resist-reclaim-restructure agenda.

4.3 Review of energy democracy goals and policy instruments

4.3.1 Energy democracy goals

Our review of the energy democracy literature reveals a core political agenda that includes a set of overarching goals with specific intended outcomes. These goals inspire a portfolio of different policy proposals and policy instruments which are reviewed in the next section. Energy democracy goals include a shift to 100% renewable energy sources in ways that resist the

dominant fossil-fuel energy agenda, reclaim social and public control over the energy sector, and restructure the energy sector to better support democratic processes, social justice and inclusion, and environmental sustainability.

With roots in resistance, the energy democracy movement arose from popular movements working to address climate and economic crises, resist fossil fuel expansion, and transition to renewable energy (Weinrub & Giancatarino, 2015). Since 2012, various groups and organizations have explicitly taken up the term energy democracy in the United States and Europe as a central theme of discourse on energy and climate change.[5] Within the German climate justice movement, the Lausitz Climate Camp saw a number of groups work to define the term in 2012 (Angel, 2016a). That same year, in the United States, Cornell University's Global Labor Institute hosted an international roundtable of unionists who used energy democracy to frame the struggle for energy transition (Weinrub, 2014), out of which emerged a new organization, Trade Unions for Energy Democracy (Trade Unions for Energy Democracy, 2015). The roots of the energy democracy movement go back further, however, and can be understood as contemporary expressions of earlier social and environmental movements within and beyond the energy sector, including grassroots anti-nuclear and peace movements in Europe and the United States and the associated interest in local, participatory and direct democracy (Tokar, 2015). In Germany, for example, the movement for energy transition known as the *Energiewende* is associated with the nuclear phaseout agreements in 2002, the Feed-in Tariff Act of 1990, as well as with earlier movements against the industrialization of farming (Morris & Jungjohann, 2016). Elsewhere in the world, particularly in the global south, social groups have taken up related terms such as energy justice (Jenkins, McCauley, Heffron, Stephan, & Rehner, 2016) and energy sovereignty. Advocates of energy democracy wish to see these related terms become meaningful among a diverse set of actors and activists unified in their pursuit of a more equitable distribution of political and economic power and of greater social and community control of energy, as well as food, water and land (Angel, 2016a; Chavez & Dove, 2015).

[5] A representative sample of these groups includes Community Power Network, Local Clean Energy Alliance, Trade Unions for Energy Democracy, Institute for Local Self Reliance, Center for Social Inclusion, the Climate Justice Alliance, Rosa Luxemburg Foundation, Platform London, Switched on London, Berlin Energy Roundtable, the Alternative Information and Development Centre, Public Services International, the Emerald Cities Collaborative, and the Energy Democracy Alliance of New York (Angel, 2016b; EDANY, 2016; Energy Democracy Project, 2015; Weinrub, 2014).

To improve outcomes and to democratically legitimate consent, advocates and scholars argue that all of society need to participate in and engage with the processes of energy transition (Giancatarino, 2013; Kunze, 2014). Different groups of people who hold different sets of motives and interests may make different choices regarding the distribution of benefits and risks (Miller, Iles, & Jones, 2013; Moss, 2014), resulting in very different energy systems. Within an energy democracy perspective, ordinary citizens and communities would exert far greater control over energy decisions than is currently realized (Weinrub, 2014). Indeed, the energy transition is linked to a broader project of expanding political democracy (Weinrub, 2014), where the reforms of the energy sector serve to re-inspire a politically-engaged citizenry (Thompson & Bazilian, 2014) who participate as citizens before consumers (Jenkins et al., 2016). Energy democracy activists therefore recognize the importance of broadening the inclusion of actors within energy politics. This aim includes finding ways to draw in historically marginalized groups, individuals and communities, including communities of color, Indigenous communities, low-income communities (Angel, 2016a; Duda, 2015; Weinrub & Giancatarino, 2015) and others who bring a fresh set of priorities and values to the debate over energy futures. Energy democracy demands that the key decisions be made not by a few large corporations but rather by communities and citizens (Jenkins, McCauley, Heffron, Stephan, & Rehner, 2016). Those communities who have been most adversely impacted by the current energy system would be prioritized to receive tangible and direct benefits from community-based energy projects (e.g., good local jobs, ownership opportunities) (Farrell, 2016a; Weinrub & Giancatarino, 2015).

The energy democracy movement advances a vision that includes communities powered by 100% renewable energy (Angel, 2016b; EDANY, 2016), with the majority of energy coming from decentralized systems (Sweeney, 2013, 2014; Weinrub & Giancatarino, 2015). Energy democracy aggressively promotes energy conservation and the functioning of ecosystems (CSI, 2010; Sweeney, 2013, 2014). Ecological interdependence is respected and a project or policy is not to be pursued if the risks to humans and environment are high or poorly understood (Weinrub & Giancatarino, 2015). Energy is considered a public good or commons before a commodity (Angel, 2016a; Lohmann & Hildyard, 2014), requiring informed and conscientious communities that strive to conserve and protect all material resources (Weinrub & Giancatarino, 2015). Energy democracy further provides a new model of economic development and key elements of a new economy. Electricity represents a multi-billion-dollar industry (Farrell, 2014). Energy

democracy works to keep these financial resources within the communities (Van der Schoor, Lente, Scholtens, & Peine, 2016) by establishing a clear link between local generation and local use (Hoffman & High-Pippert, 2005), potentially transforming poor and neglected communities into energy producers (CSI, 2010). Host communities, including citizens acting as *prosumers* (in Toffler's term (Morris, 2001)) and energy citizens (Byrne & Taminiau, 2016), are to realize substantially greater economic opportunity and benefit (CSI, 2010; Farrell, 2014, 2016a). Energy finance builds shared ownership and community-based resources rather than facilitating wealth accumulation (Lohmann & Hildyard, 2014; Weinrub & Giancatarino, 2015). Relatedly, energy democracy aims to create green jobs and supports union leadership. Energy democracy seeks to protect workers' rights and generate secure and meaningful work. Achieving this objective requires that workers co-lead the energy transition and that jobs in the renewable energy sector be primarily unionized (Angel, 2016b; Sweeney, 2013).

Central to an energy democracy agenda is a shift of power through democratic public and social ownership of the energy sector and a reversal of privatization and corporate control (Sweeney, 2014; Weinrub & Giancatarino, 2015). Energy democracy seeks to shift control over all stages of the energy sector, from production to distribution, and extending to infrastructure, finance, technology and knowledge (Angel, 2016b) while reducing the concentration of political and economic power of the energy sector, particularly within the electricity industry (Farrell, 2016a). While governance of renewable energy assets would favor public or community ownership and control (Farrell, 2014), diverse forms of ownership are needed (Farrell, 2016a) that respect the political, economic and social requirements, diversity, and challenges of specific locations or communities (CSI, 2013; Thompson & Bazilian, 2014). Decision-making procedures would give primacy to values as expressed by local communities over conventional approaches (e.g. cost-benefit analysis) (Agustoni & Maretti, 2012). Mechanisms for widespread, meaningful, inclusive democratic participation would be ensured and receive the necessary support (EDANY, 2016; Weinrub & Giancatarino, 2015). Energy policies would therefore support community-scale innovations (CSI, 2013) that serve to increase community capacity (Duda, Hanna, & Burke, 2016).

These broad pursuits to *resist*, *reclaim* and *restructure* energy systems (Sweeney, 2013, 2014) together shape the unique approach of the energy democracy movement for achieving renewable

energy transitions (Table 4.1). This energy democracy movement therefore offers a type of systemic and comprehensive agenda needed for renewable energy transitions. Structuring the types of democratic relationships necessary for allowing community-based decision-making authority over decentralized energy systems presents formidable and insufficiently considered challenges (Hoffman & High-Pippert, 2005; Weinrub & Giancatarino, 2015). The sets of policies proposed by energy democracy advocates and scholars offer an emerging response to this challenge.

Table 4.1. Energy democracy goals and intended outcomes (based on Angel, 2016a; Speth, 2015; Sweeney, 2014; Weinrub and Giancatarino, 2015)

Goals for energy democracy	Intended outcomes
Resist the dominant energy agenda	• Fossil fuels remain in the ground. • Expansion of fossil fuel infrastructure and development of extreme forms of energy and extraction stops. • Land grabbing for large-scale renewables ceases. • Fossil fuel subsidies end. • Privatization and marketization of energy sector halts. • Undermining of climate protection stops. • The most dependent on fossil fuel industries protected, especially labor. • Public resources shift away from fossil fuels. • Public legitimacy of the fossil fuel industry is reduced. • New social alliances are created (e.g., unions, environmental groups, municipalities).
Reclaim the energy sector	• Energy corporations democratize and localize. • Social/public control of energy production and consumption normalizes. • Parts of the energy sector that have been privatized or marketized return to public control. • Principles of public interest within and democratic control over publicly-owned energy companies is restored. • New energy companies, ownership models and financial investment systems under social and public control develop.
Restructure the energy sector	• Energy sector moves away from the profit motive. • Energy access and assets are shared broadly and community wealth-building is supported. • Energy systems are governed as a commons. • Community power and capacity to control energy systems strengthen. • Emphasis shifts from growth to wellbeing, sufficiency and environmental quality. • Economic and political power is decentralized and distributed. • Capacity for energy planning increases. • Geopolitics of energy supports global cooperation and peace over competition and conflict. • Solidarity, inclusion and open, democratic participation advances. • Workers, low-income communities and communities of color hold central positions within energy systems. • An understanding of the energy sector as interdependent within the natural environment pervades.

4.3.2 Policy instruments

Our review of the energy democracy literature identifies multiple policy tools having the potential to advance energy democracy goals. Here we provide a brief description of each policy measure, primarily with an orientation toward the potential for implementation within the United States context. Individually, each policy offers potential benefits and drawbacks yet collectively these policies offer the possibility to provide synergies and enhance effectiveness for achieving integrated energy democracy goals and outcomes. This section characterizes policies within four categories: regulatory context, financial inclusion measures, economic institutions, and new energy system institutions (Duda et al., 2016).

4.3.2.1 Regulatory context

Among the four categories of policy instruments for energy democracy, policies categorized as regulatory context provide a contextual foundation for the pursuit of additional policy reforms for energy systems change.

Statutory priority for demand reduction and distributed generation. The energy democracy movement intends to shift toward an energy system in which the total demand for energy is reduced over time, and where distributed generation supplies a majority of the electricity supply within a 100% renewable energy system. According to Weinrub and Giancatarino, two leading voices within the U.S. energy democracy movement, demand reduction is possibly the most important component of a decentralized renewable energy system (Weinrub & Giancatarino, 2015). Whether measuring costs monetarily or otherwise, reduced demand provides cost savings and eases the transition to renewable sources. Distributed (or on-site) generation refers to small-scale generation of electricity in distributed locations, typically involving a shortened distance between points of generation and use. Such systems often include the generating technologies such as solar photovoltaics and wind turbines, load fluctuation controls, monitoring equipment, and possibly on-site storage. Greater reliance on distributed generation can introduce increased variability into grid operations, which may require diverse strategies including improved grid management and increased transmission and storage. Distributed generation may interconnect with the grid or operate off-grid (Bronin, 2010), and requires some right to self-generate electricity within conditions necessary for protecting public health and safety (Wellinghoff & Weissman, 2015). State and local governments, often through public utility commissions, may

have greater expertise with the regulation of distributed generation than federal entities such as the Federal Energy Regulatory Commission (Bronin, 2010). Centralized systems still may serve an important role in a democratized energy system, but this system prioritizes distributed energy supply for serving an overall reduced demand.

Net metering and virtual net metering. Net metering and virtual (or group) net metering are widely considered as key policies for energy democracy, enabling various other inclusive community-based generation and ownership models such as shared or community solar (Farrell, 2014, 2016a; Weinrub & Giancatarino, 2015). Net metering allows owners of on-site generation systems to feed electricity back into the grid, typically selling excess power back to the utility or receiving credits. Virtual net metering programs allow people and organizations to own or share in ownership of off-site facilities. Virtual net metering broadens the sharing of benefits from renewable energy projects by allowing those lacking access to a suitable generating site to participate in sharing the output from a single facility. Most states have adopted net metering laws, while only sixteen states have adopted virtual net metering policies with varying restrictions (Farrell, 2016b).

Renewable energy standards. A Renewable Energy Standard or Renewable Portfolio Standard (RES/RPS) requires that utilities supply a targeted proportion of electricity from renewable sources by a specified point in time, typically within decades (Sweeney, 2015). By attaching a set-aside for distributed generation, the RPS can additionally stipulate that a portion of the renewable electricity be generated through these distributed technologies as described above. In the United States, RPS programs have typically been adopted at the state level but the federal government could also adopt a national standard (Duda et al., 2016). Efforts to comply with RPS obligations may have contributed to more than half of new renewable energy generation since 2000 (Wiser et al., 2016). RPS programs help to ensure that renewables replace fossil fuel use rather than simply adding new capacity. RPS policies have also shown a redistributive effect, shifting benefits through shifts in employment from fossil fuel to renewable energy sectors. Currently, RPS programs have been adopted in 29 states and Washington, D.C., while an increase in RPS-driven demand is anticipated (Wiser et al., 2016).

Participatory energy planning and deliberation. Participatory energy planning processes offer the opportunity for communities to become educated and engaged on key issues, creating

precedents and capacities for long-term, meaningful public participation in energy system decision-making (Duda et al., 2016). Public participation is widely acknowledged as an important means for bringing forward perspectives other than those of incumbents with vested interests in the status quo, potentially shifting the political and institutional context within which decisions about future energy choices are made (Calland & Nakhooda, 2012). However, current efforts tend to focus on individual projects and technologies and involve relatively minor levels of engagement rather than building the capacity for deeper participation (Miller et al., 2013; Peterson, Stephens, & Wilson, 2015). Weaker levels of participation, for example, as end users or simple proponents or opponents to a siting decision, fail to support the context needed for democratizing the energy system. Energy democracy requires levels of engagement that guarantee sustained participation and citizen control (Arnstein, 1969) as ensured through ownership, for example. A community renewable project should involve the community at the earliest stages (Agustoni & Maretti, 2012; CSI, 2010). Participation also includes education and technical assistance (CSI, 2010). Deliberative democratic practices can be used to improve the quality of engagement and help participants develop opinions informed by relevant facts, expert information, and multiple perspectives (Canfield, Klima, & Dawson, 2015). Energy governance structures are highly context specific and the ideal procedures for participatory community engagement vary dramatically across communities in different locations. Therefore, the design of planning processes and participation, including ownership models, benefits from negotiation with and within specific communities (Shaw et al., 2015), and are likely to require time and experience to improve practices.

Community choice aggregation. Community Choice (Energy) Aggregation (CCA) programs allow communities to choose the source of electricity supply. A CCA functions by designating a public agency such as a municipality, county or other jurisdictions as the aggregator, to procure electricity on behalf of ratepayers, for example, through targeted purchasing or through local renewable energy development, while the utility continues to deliver electricity and services (Weinrub, 2014; Weinrub & Giancatarino, 2015). CCA programs thus enable community control over purchasing of electricity, increasing democratic oversight and involvement while avoiding or facilitating deliberation over the option for full municipalization (Duda et al., 2016). Following California's energy crisis of 2001, widely attributed to abuse of utility monopoly power, the state adopted legislation allowing CCA programs. Cities and counties were granted

the authority to procure electrical power for their residents, established through local ordinance and designed as opt-out programs (LEAN Energy US, 2017). Currently eight CCA programs have formed statewide, with four more anticipated and as many as 20 in planning stages. In addition to concerns with cost and local control, CCA programs have been shown to enable deployment of renewable energy, allowing communities to achieve renewable energy goals and facilitating the adoption of a more ambitious statewide RPS of 50% renewable power by 2030 (Clean Power Exchange, 2017; Local Government Commission, 2016; Willdan/EnerNex, 2017).

Community benefit agreements. Community benefit agreements (CBAs) are legal measures designed to distribute the benefits of projects or programs among a community. For renewable energy projects, CBAs are typically set up as contractual agreements between large developers and communities hosting a project that specify required tangible benefits to the communities. CBAs can be required for projects that receive some form of public support such as subsidies or tax reductions or through state or local programs that promote renewable energy. Various benefits may be specified in CBAs including standards for wages or union jobs, local hiring, shared community and minority ownership, rights of participation and public engagement, environmental restoration, greenhouse gas emissions reduction strategies or direct payments made to communities or the state (Barrera-Hernández, Barton, Godden, Lucas, & Rønne, 2016; Duda et al., 2016). States or community-based organizations can set the standards for approved contractors and enforce agreements (Duda et al., 2016). Because of their versatility, CBAs are ideally negotiated between a coalition of community groups and the developer to emphasize local needs. When properly negotiated, CBAs can lower transactions costs by reducing conflicts, improve participation in public processes, and protect taxpayers (De Barbieri, 2016). While CBAs are widely implemented for largescale developments in the United States, their use for renewable energy projects remains limited. Meanwhile, the UK has seen a significant number of CBA policies specifically adopted for renewables, primarily wind energy projects.

4.3.3.2 Financial inclusion measures

In addition to the regulatory context, financial inclusion measures provide financial opportunities and monetary incentives for broadening and advancing energy systems change.

Feed-in tariffs. One of the most popular approaches to supporting decentralized and democratized renewable energy systems worldwide is a feed-in tariff (FIT), typically established

through utility contracts (CSI, 2013; Weinrub, 2014). Rather than a subsidy, FITs typically set a long-term guaranteed minimum fixed price for the purchase of generated renewable energy (i.e., fixed-price payment models), although premium-price models, which tie payments to market prices, are also common (Couture, Cory, Kreycik, & Williams, 2010). Community-scale electricity producers can then compete with large-scale power producers and receive financial benefit from renewable energy generation (Morris & Jungjohann, 2016; Weinrub, 2014). While FITs have been adopted globally (with Germany's FIT being highly influential) and have been shown to be one of the most effective instruments for advancing renewable energy and creating jobs, they do require good policy design, for example, appropriate and transparent pricing schemes (Mendonça, Jacobs, & Sovacool, 2010). On their own, FITs have been found to be regressive, placing more financial burden on lower income households while providing more benefit to upper incomes who account for most of the installations (Grösche & Schröder, 2014). Experiments with FIT payment models are ongoing, and include introducing payment caps to keep payments from rising significantly as in Spain (Couture et al., 2010), while more recently model variants based on auctions have gained popularity. The municipally-owned utility serving Gainesville, Florida was the first in the U.S. to adopt a solar FIT in 2009, and currently six U.S. states use FITs or related policies, including California, Hawaii, Maine, Oregon, Vermont, and Washington (NREL, 2016).

Green subsidies. Green energy subsidies include various grants and funding mechanisms implementable across levels of government that direct resources to targeted communities for specific needs. Energy efficiency and weatherization programs target what many consider the most cost-effective first steps for supporting a renewable energy system. Low-income renewable energy grants provide direct funding to people who typically cannot afford renewable energy systems, including low-income households and multifamily affordable housing developments, to partially or fully offset the costs installation. Grants for financial or technical assistance to community-based organizations such as places of worship or childcare and senior centers can raise the visibility and sense of inclusiveness of renewable energy projects, building trust and encouraging greater community awareness and involvement. Although green subsidies are politically unstable and not necessarily innovative, they nonetheless remain useful to an energy democracy policy mix (Duda et al., 2016). Numerous examples of green subsidies have been deployed across the U.S., including the Department of Energy Weatherization Assistance

Program, which since 1976 has provided locally-administered grants for energy efficiency improvements for more than seven million low-income families (US DOE, 2017b).

On-bill financing and repayment programs. On-bill financing and on-bill repayment or recovery programs are mechanisms that allow low-income households lacking the upfront capital or access to credit needed for renewable energy installations to purchase and finance these systems through payments made on their utility bills (Duda et al., 2016). Depending on the program, public sector entities may also be able to take advantage of on-bill programs to finance renewable energy projects. Typically, either the utility or a third party will incur the upfront costs, and the savings or credits are paired with the repayments on the same bill. Similarly, for Property Assessed Clean Energy (PACE) programs, the local government serves as the lender to homeowners who repay through their property taxes. On-bill programs work best with a supportive utility that targets billing neutrality, and when the repayment obligation stays with the meter rather than the customer if the system is sold (US DOE, 2017b). In cooperation with New York utilities, New York State implemented an on-bill program in 2012 through the New York State Energy Research and Development Authority, while additionally targeting low- to moderate-income communities through its Green Jobs – Green New York program (NYSERDA, 2017).

Revolving loan funds. Revolving loan funds establish a long-term source of credit for renewable energy system installations rather than one-time subsidies. When loans are repaid, all or a portion of the repayment is used to sustain and grow the fund for additional projects. The loan fund can be administered through community-based financial institutions such as a green public service bank or through other entities of state and local governments, and can be linked to technical assistance and additional supporting resources (Duda et al., 2016; US DOE, 2017b). Government-sponsored loan funds typically offer lower interest rates and/or more flexible terms than commercial capital markets, with terms ending within 10 years, and can also be used to leverage private investment. More than 30 U.S. states have implemented revolving loan fund programs for energy efficiency and renewable energy projects (US DOE, 2017b). Created by the Iowa Legislature in 1996 and managed by the Iowa Energy Center, the Alternate Energy Revolving Loan Program provides zero-interest loans for various technologies including solar,

biomass, small hydro and small and large wind turbine facilities for up to half of the cost of the project (IEC, 2017).

Public bonds. The use of public bonds as a financial energy democracy policy approach is worth mentioning although they are discussed only minimally among energy democracy advocates (Weinrub & Giancatarino, 2015). We include public bonds in this review due to their widespread use by state and local governments in the United States, the common requirement for voter approval, and the recent adoption of the use of federally-subsidized tax credit bonds. Governments, public utilities and community members may consider debt-financing of renewable energy projects as a worthwhile approach to control of energy supplies given that costs of these technologies tend to drop over time and the operation costs are low. Municipal bonds are one such financing tool that has been used successfully for financing largescale infrastructural projects for over a century. The large municipal bond market accounts for $3.7 trillion of U.S. municipal debt, with individuals accounting for the majority of investments as bonds are typically tax exempt (Climate Bonds Initiative, 2015). Administered by the U.S. Internal Revenue Service, Clean Renewable Energy Bonds are issued by electric cooperatives and government entities to bondholders who receive federal tax credits rather than the typical bond interest (US DOE, 2017b). The City of Burlington, Vermont issued a $12 million, 20-year bond with 79% voter approval allowing its municipally-owned electric utility to purchase a 7.4 MW hydroelectric facility in 2014, which in addition to earlier acquisitions and contracts, currently allows the city to cover the equivalent of 100% of its electricity use with renewable energy (BED, 2016).

Carbon tax-and-invest. A carbon tax is a fee for the use of fossil fuels implemented in proportion to the content of carbon within the fuel source. Based on the polluter-pays principle, a carbon tax is intended to create a financial incentive for the reduction of carbon dioxide emissions while generating needed public revenues (Parry, Morris, & Williams, 2015). A carbon tax may be implemented at any level of government that has taxation authority, and is facilitated by the presence of these tax collection mechanisms. Ideally such taxes would be assessed as far upstream as possible in the fossil fuel supply chain, for example, on the extractive or wholesale industries. To overcome political resistance while also realizing emissions reductions, a carbon tax is thought best to be introduced at lower rates with a clear commitment to steadily and

predictably increasing the rate to a point adequate for reducing fossil fuel consumption. Fuel suppliers and processors can be expected to pass along the cost of the tax to the extent that fuel markets allow (Carbon Tax Center, 2017). Carbon pricing has been criticized for its regressive quality, as lower income households spend a higher proportion of their income on energy, and thus will be impacted to a greater extent than wealthier households. This issue can be addressed through a variety of mechanisms, for example, by dedicating the revenues to public investments such as education, healthcare, energy efficiency and community renewable energy, by issuing dividend payments to tax payers, or by integrating within the carbon tax policy additional tax shifts to achieve revenue neutrality for vulnerable groups. British Columbia's revenue-neutral carbon tax, despite not directly targeting public investments, has nonetheless proven effective for driving local investment in renewables and energy efficiency at the local level. As a flexible instrument, policymakers have the option to use these revenues for public investments as the tax rate increases over time (Duda et al., 2016; Shah & Beckstead, 2012). The states of Washington, Massachusetts, Vermont and New York have all demonstrated some interest in getting carbon tax proposals on the political agenda.

Cap-and-dividend. A cap on fossil fuel use or greenhouse gas emissions sets a specified reduction target that decreases over time. The emissions allowances are auctioned, yet unlike cap-and-trade, cap-and-dividend ensures that fees collected are shared widely and transparently, for example, returning revenues as guaranteed basic income on a per capita basis or as a targeted green subsidy. Thus, the policy treats the atmosphere as a commons, with members of the public as shared owners (Duda et al., 2016; Kunkel & Kammen, 2011). If distributed on a per capita basis, those people with greater emissions reductions stand to gain. Dividend payments can therefore counter the regressive impacts of carbon reductions on lower income groups and make them progressive, even in cases when public entities retain some portion of the revenue. Cap-and-dividend policies can be developed based on existing cap-and-trade initiatives in the United States (Kunkel & Kammen, 2011). Following a period of considerable interest across various states including California, cap-based systems appear to have lost prominence as carbon tax proposals have gained renewed attention. Cap-and-dividend may again become politically popular if suspicions regarding trading schemes increase, or if a carbon tax fails to achieve the necessary emissions reductions or sustain the needed political constituency.

Cooperative financing. Cooperative financing is an umbrella term for various financing innovations such a crowdfunding or direct public offerings that pool funds from a potentially large number of individual and community investors. Crowdfunding campaigns for example have been promoted as a means to democratize energy as well as finance (Gilpin, 2014). In many cases, payback or discounts are offered rather than returns on investment due to limitations of securities laws. Specific terms must be designed to allow smaller non-institutional investors to participate or to direct the benefits of such projects toward serving the public good or communities in need. Operating as a Benefit (B-) Corporation, Mosaic is among the largest such lending platforms in the United States, having raised millions for solar electricity projects, although less emphasis has been placed on the crowdfunding platform recently. Funds are loaned to third-party investors who own the project and repay investors through payments made for the electricity generated by the project (Mishra, 2014).

4.3.3.3 Economic institutions

This category of policy instruments provides a set of reforms that seek to provide community economic development opportunities and create new socioeconomic institutions.

Community energy. Various models of community or publicly-owned and operated utilities exist, including the more than 2,000 public power systems serving approximately 15% of electricity customers in the United States (APPA, 2015). Community renewable energy programs, also known as shared solar, shared wind and solar gardens, represent an innovative grassroots model that allows people who do not own homes, who cannot individually afford the investment of renewable energy systems, or who do not have sufficient resources, to pool their resources with other community members. Members purchase or lease a share of a renewable system developed in the local community and receive the benefits of the energy that is produced by their share. The member's share of the electricity generated by the project is credited to their electricity bill. The renewable energy facility achieves greater economies of scale than with single family installations (Duda et al., 2016; US DOE, 2017a). The state of Colorado requires that solar gardens allocate a minimum of 5% of each shared solar array to low-income subscribers (US DOE, 2017a), although this proportion could be increased to improve accessibility to renewables.

Renewable energy cooperatives. Non-profit consumer-owned electric cooperatives, including distribution cooperatives and generation and transmission cooperatives, provide renewable energy or related services to consumer-members. In the United States, more than 800 electric cooperatives provide electricity from various sources to roughly 42 million people (NRECA, 2016). Worker-owned cooperatives provide employment and financial benefits of ownership to worker-owners in addition to various renewable energy services to customers (CPN, 2017). Like cooperatives worldwide, electric cooperatives operate according to a set of seven cooperative principles, including democratic control by members and cooperation among cooperatives (CPN, 2017; NRECA, 2016). The Energy Solidarity Cooperative, based in Oakland, California, presents a hybrid model, cooperatively owned by workers, consumers and community investors, and builds cooperatively-owned solar energy projects and political educational programs with groups in communities of color and low-income communities (CPN, 2017). Evergreen Energy Solutions provides solar electric installations and energy efficiency, weatherization and remodeling services as part of the group of Evergreen Cooperatives of Cleveland, which was started in 2008 by various city institutions and municipal government to create livable wage employment in low income neighborhoods in Cleveland, Ohio (Evergreen Cooperative, 2016). Emerging more recently, prosumer-to-prosumer models support cooperative renewable energy management and ownership among clusters of prosumers operating on an islanded microgrid, increasing the reliability and usage of the local power system (Luna, Diaz, Graells, Vasquez, & Guerrero, 2016).

Remunicipalization. The widespread privatization of municipally-owned public assets since the 1980s, especially water, sewage and electricity systems, now confronts the prospect of remunicipalization as municipalities worldwide and especially in Europe and Latin America, re-purchase privatized companies, cancel or decline to renew private contracts and establish new municipal projects. Remunicipalization is typically motivated by dissatisfaction with the outcomes of privatization, desire for greater transparency and accountability, and an interest to achieve better environmental and labor standards (Becker, Beveridge, & Naumann, 2015). Activists and scholars agree that public ownership provides no guarantee of improved outcomes; however, voices from the energy democracy movement assert that public sector models, including the "public works" approach of the last century and contemporary experimentation within the public sector, are key to energy democracy (Chavez & Dove, 2015; Sweeney, 2015).

Recognizing potential and historic flaws of public ownership, advocates realize that remunicipalization, as a decentralized form of collective action, must be grounded in economic democracy and public participation and must allow a wide variety of models of public ownership as relevant to particular locations (Cumbers, 2012). Diverse public ownership models exist that may be explored during remunicipalization, including hybrid cooperatives, joint private-public companies and public-to-public partnerships. Through a 2011 voter ballot initiative, the City of Boulder, Colorado formally launched a process of remunicipalization that continues today, as part of the city's broader effort to achieve 100% clean energy by 2050 while providing a replicable model for local authority over energy infrastructure investment decisions (Stephens, Wilson, & Peterson, 2015). The City recently received approval from the Colorado Public Utilities Commission for the schedule of transfer of assets, and intends to begin operations in 2017 (City of Boulder, 2017).

Green public service banks. Green public service banks and related community development financial institutions are designed to target community-based renewable energy projects and supporting initiatives while offering greater accountability to local communities for decisions over public financing (Sweeney, 2015; Weinrub & Giancatarino, 2015). Financing from globally mobile capital often remains disconnected and disembedded from local communities (Lohmann & Hildyard, 2014). Non-profit public service banks on the other hand not only provide loans to support place-based projects and organizations, but the decisions regarding these investments are made with and through the communities. Green public service banks can be legally required to provide inexpensive, accessible credit to cooperatives and other community-based projects (Lohmann & Hildyard, 2014). These approaches to financing can then stimulate additional circulation locally and regionally, known as a multiplier effect (Goerner, 2013). The Connecticut Green Bank was established by the Connecticut Legislature in 2011. As the nation's first full-scale green bank, the bank is now widely viewed as a leader in the clean energy finance and green bank movement in the United States. The green bank draws together both public and private funds to support investment in renewable energy and energy efficiency projects while creating employment opportunities in Connecticut (CT Green Bank, 2017; Duda et al., 2016).

4.3.3.4 New energy system institutions

The fourth category of energy democracy policy instruments includes those instruments that support or facilitate institutional reforms within the energy sector.

Energy investment districts. Known by various terms including Just Transition Zones, Energy Investment Districts or Energy Improvement Districts (EIDs), these policies provide economic development models that target specific geographic zones such as economically depressed communities or locations suffering environmental injustices such as toxic pollution (Weinrub & Giancatarino, 2015). The designation of an EID provides the means to combine public bonds or other funding sources with a focused commitment to assisting underserved communities (Duda et al., 2016). For example, the EID model championed by the Center for Social Inclusion (CSI) specifically seeks to target marginalized low-income communities and communities of color for renewable energy projects. A community-based organization can convene community members, some of whom may serve on an associated energy trust and local council, to identify, select and implement projects within a district, using democratic planning and decision-making processes (Giancatarino, 2014). Various related models exist, for example, in Ohio, Connecticut and Arkansas, allowing communities to apply for designation of energy investment districts that then typically allows property owners within the district to participate in PACE programs (DSIRE, 2016; Giancatarino, 2014). To increase the benefits beyond property owners and target specific communities, as in the CSI model, would require improvements to the design of EID policy, including criteria for community designation and commitment to participatory processes (Giancatarino, 2014).

Microgrids and democratized grid management. Energy democracy advocates increasingly view centralized grid management, favoring large utilities, as a key barrier to democratizing renewable electricity sectors and thus the microgrid and democratized models of grid management are widely recognized as critical sites of contest for energy democracy. Grid management that allows fair access for any potential provider is seen as the "structural center of a democratized electricity system" (Farrell, 2014, p. 39). In this model, independent grid managers would ensure equal access to the grid, coordinating resources from decentralized renewable generation under distributed ownership (Duda et al., 2016; Farrell, 2011). The microgrid, which connects and integrates multiple forms of distributed renewable generation capacity, storage, transmission

facilities, and interconnected loads and smart devices within clearly defined electrical boundaries, would be owned and managed locally by members of the microgrid community (Duda et al., 2016; Grimley & Farrell, 2016; Wolsink, 2012). Microgrids are flexible and adaptable, vary in size to match levels of demand, potentially reduce the need for long distance transmission and distribution capacity and the land required, and offer the possibility for operation in both grid-connected or disconnected islanded mode to increase grid resilience (Bronin, 2010; Grimley & Farrell, 2016). Model standards for microgrids are needed that among other objectives serve to ensure grid access and fair pricing (Bronin, 2010). Coordinated by the nonprofit Clean Coalition in collaboration with Pacific Gas & Electric, the Hunters Point Community Microgrid Project is intended to support higher levels of local renewables and provide economic, energy, and environmental benefits such as local employment and reductions of greenhouse gas emissions for the Bayview and Hunters Point areas of San Francisco (Clean Coalition, 2017). Hawai'i is also seen as a leader in the deployment of renewable energy and microgrid technologies (Grimley & Farrell, 2016).

Energy regions. Energy regions and related institutions, including regional energy districts, transmission corridor districts, regional transmission agencies, and cooperative energy networks, all seek to broaden the scale of renewable energy planning and supply from the local to the regional scale. These new governing arrangements assemble and coordinate localized initiatives and projects into regional networks, thereby encouraging transition at the regime level while attempting to respect the autonomy of local energy initiatives (Späth & Rohracher, 2010; Van der Schoor et al., 2016). An example is the scaling up of local energy cooperatives into regional networks organized around cooperative principles (Van der Schoor et al., 2016). Working in communities in Southern Vermont and Massachusetts, Co-op Power has organized a regional network of six Community Energy Cooperatives (Green, 2016). Energy regions such as those working in the Netherlands differ from existing models such as the independent system operators set up in the United States, governed instead by democratic and decentralized processes. Revenues, finances, and technical knowledge systems are also cooperatively managed to support renewable energy projects (Van der Schoor et al., 2016). Austria has been developing a model of energy regions since the early 1990s that uses participatory processes for envisioning energy futures and determining pathways and targets (Duda et al., 2016; Späth & Rohracher, 2010). A Transmission Corridor District is a specific model intended to coordinate decision making and

planning of property owners and other stakeholders regarding the development of local-to-regional transmission corridors (Gerstle, 2014).

Sustainable energy utilities. A Sustainable Energy Utility (SEU) is an independent and financially self-sufficient entity formed to coordinate and deliver comprehensive energy efficiency, conservation and renewable energy services. Operating as a community utility, the SEU model can be organized by communities of almost any scale (towns, cities, or regions) to gain governing authority over their energy future (Byrne & Taminiau, 2016). The model has been developed in part due to the recognition that conventional utilities are organized for provision of energy supplies through commodity sales rather than self-generation and energy use reduction services. Unlike many energy services or energy efficiency utilities, SEUs serve all community members and target all sectors and fuel types (Houck & Rickerson, 2009). Modeled as a nonprofit clearinghouse under publicly-accountable third-party management, an SEU streamlines energy service delivery by serving as the point-of-contact for all energy service needs, including energy efficiency and conservation as well as renewable energy self-generation, connecting residents and institutions at the municipal or state-level to information, technical and financial resources and subsidies for energy efficiency and renewable energy generation and involving end users in the development of the energy system (Duda et al., 2016; Houck & Rickerson, 2009). Initially funded through public bonds, SEUs seek self-sufficient financing through revenue generated activities and the authority to access a range of funding sources (Houck & Rickerson, 2009). More ambitiously, an SEU aims to change the energy economy, redirecting energy systems away from commodity-based energy and towards decentralized commons-based sustainability based on genuine needs, and directly involving the community in decision-making (Hoffman & High-Pippert, 2005). Created in 2007 by the state of Delaware, the Delaware Sustainable Energy Utility is the first SEU of its kind to be established in the United States, and is being replicated in several other communities around the world (Energize Delaware, 2017).

4.4 Comparing energy democracy policy instruments with goals of the movement

The results of the review indicate an intention to advance a broad political program centered around a shift to 100% renewable energy sources by resisting the dominant corporate energy agenda, reclaiming social and public control over the energy sector, and restructuring the energy

sector to better support democratic processes, social justice and environmental sustainability. These three broad goals inspire a set of 26 intended outcomes that shape an energy democracy agenda (Table 4.1). Sources concerned with advocating this agenda have emphasized a set of at least 22 policy instruments currently under implementation in the United States as well as the EU and UK. This policy instrument mix includes regulatory, financial and institutional reforms.

The results of the assessment comparing the policy instruments to the energy democracy goals are summarized in Table 4.2. We find that the mix of instruments proposed for energy democracy has the potential to contribute to the advancement of renewable energy transitions based on the combined agenda of resist-reclaim-restructure. While recognizing that the number of instruments per goal is less relevant than the influence of the instruments in practice (Kivimaa & Kern, 2016), we note that as a group, the policy instrument mix gives more attention to the goal of reclaiming the energy sector and less attention to the goal of resisting dominant energy regimes. Policy instruments typically correspond to one or two goals rather than all three, and often only modestly rather than strongly. Several specific instruments relate across all three goals: cap-and-dividend, green public service banks, and sustainable energy utilities. Each of the four categories of instruments relate across the three energy democracy goals at least to some degree, and institutional reforms tend to relate more strongly to goals for reclaiming and restructuring.

Table 4.2. Comparing policy instruments and goals for energy democracy

Policy instruments	Goals		
	Resist	Reclaim	Restructure
Regulatory context			
Statutory demand reductions and distributed generation	••		•
Net metering and virtual net metering		•	
Renewable energy standards	•		
Participatory energy planning and deliberation		•	•
Community choice aggregation		•	
Community benefit agreements			•
Financial inclusion measures			
Feed -in tariffs		•	
Green subsidies		•	
On-bill financing and repayment programs		•	
Revolving loan funds		•	•
Public bonds		••	•
Carbon tax-and-invest	•	•	
Cap-and-dividend	•	•	•
Cooperative financing		•	•
Economic institutions			
Community energy		••	••
Renewable energy cooperatives		••	••
Remunicipalization		••	•
Green public service banks	•	•	•
New energy system institutions			
Energy investment districts		•	•
Microgrids and democratized grid management		••	•
Energy regions		•	•
Sustainable energy utilities	•	•	••

Note. •policy instrument relates modestly to goal. ••policy instrument relates strongly to goal.

Unpacking the specific outcome statements within each of the three energy democracy goals, we find that the set of energy democracy policy instruments included in this review are more likely to contribute to some outcomes while other intended outcomes have limited supporting policies. For the goal of resisting the dominant energy agenda, policy instruments clustered around the outcome of "New social alliances are created" with minimal connection to the outcome of "Land grabbing for large-scale renewables ceases." For the goal of reclaiming the energy sector, the outcome of "Social/public control of energy production and consumption normalizes" most frequently connected to the policy instruments while "Energy corporations democratize and localize" had the fewest connections. And for restructuring the energy sector, the outcome of "Economic and political power is decentralized and distributed" received the most attention among the policy instruments and "Geopolitics of energy supports global cooperation and peace over competition and conflict" received the least.

Across all three goals, the outcomes most addressed by energy democracy policy instruments include the following:

• Economic and political power is decentralized and distributed.

• New social alliances are created (e.g., unions, environmental groups, municipalities).

• Social/public control of energy production and consumption normalizes.

• Energy access and assets are shared broadly and community wealth-building is supported.

• New energy companies, ownership models and financial investment systems under social and public control develop.

• Community power and capacity to control energy systems strengthen.

Conversely, the outcomes least addressed across all energy democracy goals include:

• Land grabbing for large-scale renewables ceases.

• Expansion of fossil fuel infrastructure and development of extreme forms of energy and extraction stops.

• Fossil fuel subsidies end.

• Geopolitics of energy supports global cooperation and peace over competition and conflict.

• Fossil fuels remain in the ground.

• Energy corporations democratize and localize.

• An understanding of the energy sector as interdependent within the natural environment pervades.

• Undermining of climate protection stops.

• Public legitimacy of the fossil fuel industry is reduced.

Overall, this assessment finds that the energy democracy policy instrument mix provides policies to address all three goals but relates unevenly across the specific intended outcomes. A small set of instruments relate across all three goals and none relate strongly across the three goals. More attention is given to the goals and outcomes for reclaiming and restructuring the energy sector, and less attention is given to the goal and outcomes for resisting the dominant fossil-fuel-based energy agenda.

4.5 Discussion: implications, lessons and next steps

4.5.1 Implications for energy democracy

This review and assessment characterize the emerging energy democracy social movement in terms of goals and outcomes and their corresponding policy instruments. Energy democracy initiatives in practice may be effectively identified not only, or even necessarily, by the use of the concept (i.e., some energy democracy initiatives may not employ the term explicitly), but by their commitment to three broad goals to resist the dominant energy agenda and reclaim and restructure the energy sector, while pursuing high levels of renewable energy deployment. The priority outcomes defining an energy democracy agenda include: decentralizing and distributing economic and political power; creating new alliances of social groups; normalizing the social and public control of energy production and consumption; strengthening the power and capacity for communities to control energy systems; and developing new organizations, ownership models and financial investment systems under such control.

Several policy instruments appear to constitute the core policy instruments (Rogge & Reichardt, 2015) for energy democracy. This assessment suggests two ways to identify core policy instruments: those instruments simultaneously corresponding to each of the three goals, and

those instruments that strongly relate to any of the three goals. As such, core instruments currently include: statutory demand reductions and distributed generation; public bond instruments; cap-and-dividends; and a set of economic and new energy system institutional reforms including community energy, renewable energy cooperatives, remunicipalization, green public service banks, microgrids and democratized grid management, and sustainable energy utilities. Other instruments can be considered as complementary to this set of core instruments (Rogge & Reichardt, 2015).

The large-scale transformation demanded by the energy democracy movement, however, appears likely to require strengthening of existing policy instruments as well as the development or adoption of other policy instruments beyond those described here. In line with this assessment, strengthening existing instruments could involve finding ways to better relate a given instrument to a broadened set of intended outcomes, thereby shifting from a modest to a strong relationship to the associated energy democracy goal. A meaningful example might be the improvement of capacity for participatory planning and deliberation within the public sector and among unions, low-income communities and communities of color. The necessity to innovate policy instruments is also likely, especially to enhance the effectiveness of efforts to resist incumbent regimes. More direct instruments may be developed or brought into the core set of policies to address additional outcomes, for example, regulating the fossil fuel trade, eliminating fossil fuel subsidies or democratizing energy companies in the private sector through employee-ownership options or joint public-private enterprises.

4.5.2 Value of a policy mix approach

Thinking in terms of policy mixes (Rogge & Reichardt, 2015) opens opportunities for supporting an energy democracy agenda by improving design and evaluation of policy instrument mixes. The policy mix lens emphasizes the necessity for advocates, communities, and other decision makers to give attention to combinations of instruments and the ways they may or may not correspond with the desired outcomes. Recognizing gaps and insufficiencies within the mix of instruments and systematically assessing the implications for each goal and intended outcome suggests ways to innovate and strengthen the energy democracy mix as a step toward developing a more effective instrument mix.

The policy mix lens also urges greater consideration of potential tradeoffs among policy instruments (Quitzow, 2015). Temporal tradeoffs among different energy democracy policy instruments intended to address the three different overarching goals represent one kind of important tradeoff, i.e., some policy instruments emphasize more immediate effects while others are designed for more long-term system change. Given a growing sense of urgency in responding to climate change, the push to resist expansion of fossil fuel extraction may need to take precedence and deserve more immediate action, whereas achieving outcomes for reclaiming the energy sector may extend over many years to decades. Restructuring the energy sector may extend over many decades and longer. Presently it also appears that the goal of reclaiming the energy sector takes priority with regard to supporting policy instruments. This situation may reflect differences among members of the energy democracy movement, suggesting an additional potential tradeoff between the emphasis given to each of the goals. Reclaiming energy systems may have broader appeal in the U.S. context, at least initially, because the rationale aligns more readily with prominent political rhetoric of independence, local control and economic advantage. Given the need for pursuing all three energy democracy goals simultaneously, this assessment supports the view that at some point tensions within the movement will need to be addressed (Tarhan, 2017).

A policy mix approach also urges consideration of how goals of energy democracy may be temporally extended for periods following implementation of the resist-reclaim-restructure agenda. The notion of an *energy commons* (Byrne, Martinez, & Ruggero, 2009; Byrne & Taminiau, 2016; Melville, Christie, Burningham, Way, & Hampshire, 2017; Wolsink, 2012) opens the possibility for energy democracy goals that extend over greater periods of time. Energy commons reconceptualizes energy as a common pool resource rather than a commodity, owned and managed by communities deploying systems of rules for energy production and consumption (Melville, Christie, Burningham, Way, & Hampshire, 2017).

The knowledge gained from the growing body of research on the management of common pool resources is relevant for considering renewable energy and energy system transitions from the perspective of energy commons (Melville et al., 2017; Wolsink, 2012). Ostrom's work on long-enduring resource regimes (Ostrom, 2010) draws from empirical research completed over many decades to distill the set of practices used successfully by collective users of common pool

resources (typically at the local and regional scale). These experiences could inspire the addition of the goal of *endure* and/or *restore* to those of resist-reclaim-restructure. Corresponding policy instruments might involve mechanisms for building trust among communities, procedures for clearly defining boundaries of energy commons, systems for monitoring levels of use and production and resolving conflicts, new ways of scaling up systems of governance, and so on (Ostrom, 2010). Research for energy commons could draw from scholarship on socio-ecological-technical systems (SETS) (Berkes, Folke, & Colding, 1998; Geels & Schot, 2007; McGinnis & Ostrom, 2014; Ostrom, 2009). In the context of renewable energy transitions the SETS framework may further benefit policy mix scholarship by broadening the scope of relevant elements and interactions and thus better accounting for non-technological elements of transitions as well as broader contextual factors influencing these interacting systems.

4.5.3 Policy mixes and renewable energy transitions

Energy democracy in turn offers insights on policy mixes in the context of renewable energy transitions. In view of the claim that ideal policy mixes for transitions would include instruments (and other policy mix elements) for both creating innovations and destabilizing currently dominant regimes (Kivimaa & Kern, 2016), the energy democracy agenda appears to exemplify and extend this ideal. From this perspective, instruments designed to resist the dominant energy agenda provide a potentially destabilizing function, while the instruments intended to reclaim and restructure the energy sector offer the means for innovation.

The resist-reclaim-restructure agenda of energy democracy seems to provide an approach for both creative destruction and disruptive innovation. The resist-reclaim-restructure goals also complicate these notions in the context of renewable energy transition. These ideas of innovation have typically emphasized technological innovations as advanced through market mechanisms and elite agents of change. Conversely, the outcomes for reclaiming and restructuring the energy sector, while including technological innovation (i.e., the adoption of renewable energy technologies), place significant emphasis on non-technological, social structural innovations as advanced through public and social arenas involving a broadened set of change agents including communities, social movements, unions and energy citizens. Additionally, to reclaim and restructure existing systems requires re-engagement with existing social structures as well as innovation. In this way, reclaim and restructure differs from creative destruction by offering an

agenda for replacing rather than solely adding to or layering upon (Howlett & Rayner, 2007) current regimes.

Similarly, the concept of resistance does not necessarily relate to the concepts of destruction or destabilization. Drawing from historical social movements, resistance may be better understood as defense against forces of creative destruction. Although both resistance and destabilization may share similar approaches such as delegitimization of existing regimes, the outcomes involved with resistance as identified here place much more emphasis on the cessation of action as a means for sociotechnical change rather than action itself. In an historical context, the energy democracy movement may be understood as a contemporary expression of efforts to protect communities and energy commons from the presently destabilizing forces of the market (Polanyi, 2001). This view holds resistance as a form of re-stabilization in the face of historical trends of creative destruction rather than destabilization as such. We therefore remain cautious about overstating the similarities between notions of creative destruction and the resist-reclaim-restructure agenda of energy democracy.

Energy democracy may then offer a fresh approach to advancing a timely transition to renewable energy, by combining efforts and strategies to end fossil fuel energy systems with those to democratically and inclusively advance renewable energy systems. To focus solely on one part of this interconnected agenda may lead to missed opportunities for synergies and ultimately less effective strategies. The movement building to be done therefore requires that more direct connections be made between, for example, anti-fracking protests, divestment initiatives, First Nations protectors, and related resistance movements with community solar projects, remunicipalization efforts, renewable energy co-ops and so on. Simultaneous attention needs to be given to the integration of all three goals, their associated outcomes, and corresponding policy instruments.

4.5.4 Limitations and future work

While generating important insights, we recognize limitations of this research. The assessment depends upon the process of the review to establish outcome statements and policy instruments. The outcomes were compiled from various sources and may in some cases hold less relevance for an energy democracy agenda or to current interpretations of this agenda. An additional limitation of our approach is the potential redundancy of outcomes as well as the choice of

groupings of outcomes within each energy democracy goal; this redundancy and organization may skew the results. We also recognize that the energy democracy movement is not necessarily unified across all actors adopting the term; differences in framing and emphasis exist within the energy democracy movement (Tarhan, 2017). Our articulation and categorization of intended outcomes could be refined and adjusted because we do not expect the emergence of a singular energy democracy agenda or set of goals. Rather, we acknowledge a diversity of approaches within the energy democracy, as appropriate for different locations and communities.

For the instrument mix, we expect that the set of policy instruments may have underrepresented instruments for resistance. For example, policies to divest from fossil fuel companies or policies banning hydraulic fracturing did not show up through the review, although we would expect that these and other instruments would be viewed supportively within the energy democracy movement. This omission may reflect both a limitation of the review as well as a shortcoming of the current instrument mix. Also, the emphasis here on congruence among goals and instruments does not address consistency or effectiveness of policy instruments in practice. Other elements of an energy democracy policy mix also deserve attention (e.g., targets, plans).

Determining the degree to which any single instrument corresponds to a specific outcome requires a more robust method of assessment than the preliminary approach developed here. Future research could aim to develop an index to be used to assess the strength of relationships with greater specificity, drawing from third-party assessments and expert opinion to compare outcomes to instruments. Also, assessing whether a given instrument could reasonably be expected to influence the achievement of an outcome requires making an assumption regarding whether a reform could be expected to either add to or replace the existing regime. This problem is fundamental to much of the efforts to advance renewable energy systems, and in fact few instruments offer any clear mechanisms to avoid being solely additive. The assumption that replacement would not occur may have led to an underestimation of the potential for the energy democracy movement. Empirical work on the capacity for individual policy instruments to replace rather than add to existing energy systems would be valuable in this regard.

Additional work is needed to more precisely characterize what energy democracy looks like in practice. More attention is needed to understand the application and effectiveness of various instrument mixes for energy democracy within specific communities and across regions. Future

research could build on this work through direct engagement with energy democracy advocates, practitioners and organizations. The resist-reclaim-restructure framing and the outcomes and instruments identified through this review may be used to guide the identification of energy democracy initiatives through a typology of this emerging social movement (Tables 4.1 and 4.2). These tools for research could then support improved ex-ante design and evaluation and examination of their effectiveness in practice, and offer a basis for participatory policy development and visioning. The three broad goals of the energy democracy movement and their associated outcomes thus provide the basis for an evaluative framework for energy planning and policy, serving to guide the selection and implementation of specific policy instruments.

4.6 Conclusions

The transition from fossil-fuel-dominated energy systems to more renewable-based energy opens an opportunity for shifting technologies as well shifting social and political dynamics through democratic realignment of these sociotechnical systems. Energy democracy provides a set of goals and policy instruments for resisting the dominant energy regime while reclaiming and democratically restructuring energy systems, sectors and institutions. In the United States and elsewhere, groups advancing energy democracy and related visions for renewable energy transitions may be recognized by their support for a set of core and complementary policy instruments and intended outcomes that promote the three overarching energy democracy goals of resist, reclaim and restructure. Resistance here may be understood not simply as destabilization but as a form of re-stabilization of community wellbeing and protection of energy commons following an extended period of creative destruction. This combined energy democracy agenda offers a comprehensive approach and a valuable framing to characterize current and future practical actions for renewable energy transitions.

A policy mix approach to understanding connections among combinations of goals and policy instruments offers insights for improving energy policy design and evaluation. No single policy instrument can advance the energy democracy agenda in isolation; rather, a combination of policy instruments is required. Bolstering the energy democracy agenda will likely require development of new policy instruments, strengthening of existing policy instruments in relation to the intended outcomes of the movement, and more directly linking efforts to end fossil fuel reliance and advance renewable energy. The research presented here offers a foundation for

increasing the visibility of the energy democracy movement and clarifying and assessing the core claims and policy instruments advanced by its advocates, contributing to policy design for renewable energy transitions and energy democracy.

Acknowledgements

The authors thank the editors of this special issue and two anonymous reviewers for constructive recommendations that significantly improved this paper. We wish to gratefully acknowledge two anonymous energy democracy activists for helpful discussions on the energy democracy movement from the advocate perspective. We further acknowledge multiple colleagues in Vermont, Massachusetts, and at The Democracy Collaborative, for efforts and valuable insights that informed this research.

This work was supported by the Social Sciences and Humanities Research Council of Canada, the Department of Natural Resource Sciences at McGill University, the Blittersdorf Professorship at the University of Vermont, the College of Social Sciences and Humanities at Northeastern University, and the Global Resilience Institute at Northeastern University.

References

Agustoni, A., & Maretti, M. (2012). Energy and social change: an introduction. *International Review of Sociology*, *22*(3), 391–404. https://doi.org/10.1080/03906701.2012.730820

Angel, J. (2016a). *Strategies of Energy Democracy*. Brussels, Belgium: Rosa-Luxemburg-Stiftung. Retrieved from http://www.rosalux.eu/publications/strategies-of-energy-democracy-a-report/

Angel, J. (2016b). *Towards energy democracy: Discussions and outcomes from an international workshop* (Workshop report). Amsterdam: Transnational Institute.

APPA. (2015). Public Power: Shining a light on public service. American Public Power Association. Retrieved from https://www.publicpower.org/

Araújo, K. (2014). The emerging field of energy transitions: Progress, challenges, and opportunities. *Energy Research & Social Science*, *1*, 112–121. https://doi.org/10.1016/j.erss.2014.03.002

Arent, D., Arndt, C., Miller, M., Tarp, F., & Zinaman, O. (Eds.). (2017). *The political economy of clean energy transitions*. New York, NY: Oxford University Press.

Arnstein, S. R. (1969). A Ladder of Citizen Participation. *Journal of the American Institute of Planners*, *35*(4), 216–224. https://doi.org/10.1080/01944366908977225

Barrera-Hernández, L. K., Barton, B., Godden, L., Lucas, A. R., & Rønne, A. (Eds.). (2016). *Sharing the costs and benefits of energy and resource activity: legal change and impact on communities* (First edition). Oxford, United Kingdom: Oxford University Press.

Becker, S., Beveridge, R., & Naumann, M. (2015). Remunicipalization in German cities: contesting neo-liberalism and reimagining urban governance? *Space and Polity*, *19*(1), 76–90. https://doi.org/10.1080/13562576.2014.991119

BED. (2016). Burlington Electric Department. Retrieved July 15, 2017, from https://www.burlingtonelectric.com/

Berkes, F., Folke, C., & Colding, J. (1998). *Linking social and ecological systems: management practices and social mechanisms for building resilience*. Cambridge, U.K.; New York, NY, USA: Cambridge University Press.

Boyer, D. (2014). Energopower: An Introduction. *Anthropological Quarterly*, *87*(2), 309–333. https://doi.org/10.1353/anq.2014.0020

Bronin, S. C. (2010). Curbing Energy Sprawl with Microgrids. *Connecticut Law Review*, *43*(2). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1594515

Brown, L. R., Larsen, J., Roney, J. M., & Adams, E. E. (2015). *The great transition: shifting from fossil fuels to solar and wind energy* (First edition). New York: W.W. Norton & Company.

Burke, M. J., & Stephens, J. C. (2018). Political power and renewable energy futures: A critical review. *Energy Research & Social Science*, *35*, 78–93. https://doi.org/10.1016/j.erss.2017.10.018

Byrne, J., Martinez, C., & Ruggero, C. (2009). Relocating Energy in the Social Commons: Ideas for a Sustainable Energy Utility. *Bulletin of Science, Technology & Society*, *29*(2), 81–94. https://doi.org/10.1177/0270467609332315

Byrne, J., & Taminiau, J. (2016). A review of sustainable energy utility and energy service utility concepts and applications: realizing ecological and social sustainability with a community utility: Review of SEU and Energy Service Utility Concepts and Applications. *Wiley Interdisciplinary Reviews: Energy and Environment*, *5*(2), 136–154. https://doi.org/10.1002/wene.171

Calland, R., & Nakhooda, S. (2012). Participatory democracy meets the hard rock of energy policy: South Africa's national integrated resource plan. *Democratization*, *19*(5), 912–931. https://doi.org/10.1080/13510347.2012.709688

Canfield, C., Klima, K., & Dawson, T. (2015). Using deliberative democracy to identify energy policy priorities in the United States. *Energy Research & Social Science*, *8*, 184–189. https://doi.org/10.1016/j.erss.2015.05.008

Carbon Tax Center. (2017). Carbon Tax Center – Pricing carbon efficiently and equitably. Retrieved July 15, 2017, from https://www.carbontax.org/

Chavez, D., & Dove, F. (2015). The meaning, relevance and scope of energy democracy. Retrieved June 27, 2016, from https://www.tni.org/en/article/the-meaning-relevance-and-scope-of-energy-democracy

City of Boulder. (2017). Energy Future. Retrieved July 15, 2017, from https://bouldercolorado.gov/energy-future

Clean Coalition. (2017). Clean Coalition. Retrieved July 15, 2017, from http://www.clean-coalition.org/

Clean Power Exchange. (2017). Clean Power Exchange. Retrieved July 15, 2017, from http://cleanpowerexchange.org/

Climate Bonds Initiative. (2015). US Green City Bonds Coalition. Retrieved July 15, 2017, from https://www.climatebonds.net/get-involved/green-city-bond-campaign/US

Couture, T. D., Cory, K., Kreycik, C., & Williams, E. (2010). *A Policymaker's Guide to Feed-in Tariff Policy Design* (Technical Report No. NREL/TP-6A2-44849). National Renewable Energy Laboratory. Retrieved from http://www.nrel.gov/docs/fy10osti/44849.pdf

CPN. (2017). Working Together for Local, Renewable Energy | Community Power Network. Retrieved July 15, 2017, from http://communitypowernetwork.com/

CSI. (2010). *Energy democracy: community-scale green energy solutions*. New York, N.Y.: Center for Social Inclusion. Retrieved from centerforsocialinclusion.org

CSI. (2013). *Energy democracy: community-led solutions - three case studies*. New York, N.Y.: Center for Social Inclusion. Retrieved from centerforsocialinclusion.org

CT Green Bank. (2017). Accelerating Green Energy Adoption in CT | CT Green Bank. Retrieved July 15, 2017, from http://ctgreenbank.com/

Cumbers, A. (2012). *Reclaiming public ownership: making space for economic democracy*. London; New York, NY: Zed Books.

De Barbieri, E. W. (2016). Do Community Benefits Agreements Benefit Communities? *Cardozo Law Review*, *37*. Retrieved from https://ssrn.com/abstract=2802409

del Río, P. (2014). On evaluating success in complex policy mixes: the case of renewable energy support schemes. *Policy Sciences*, *47*(3), 267–287. https://doi.org/10.1007/s11077-013-9189-7

DSIRE. (2016). Database of State Incentives for Renewables & Efficiency®. Retrieved July 15, 2017, from http://www.dsireusa.org/

Duda, J. (2015). Energy, democracy, community. Retrieved June 27, 2016, from https://medium.com/@JohnDuda/energy-democracy-community-320660711cf4#.jtxijr47s

Duda, J., Hanna, T., & Burke, M. (2016). *Building community capacity for energy democracy: A deck of strategies* (p. 23). Democracy Collaborative. Retrieved from http://www.thenextsystem.org/building-community-capacity-for-energy-democracy/?mc_cid=2ce36b4895&mc_eid=13ffb04686

EDANY. (2016). *New York State Energy Democracy Alliance - Formation, organization, and moving our agenda: A report from our first 18 months*. New York, N.Y.: Energy Democracy Alliance. Retrieved from www.energydemocracyny.org

Energize Delaware. (2017). Energize Delaware - Home Page - DESEU Information. Retrieved July 15, 2017, from https://www.energizedelaware.org/

Energy Democracy Project. (2015). What is the Energy Democracy Project? Local Clean Energy Alliance. Retrieved from http://www.localcleanenergy.org/EnergyDemocracy

Evergreen Cooperative. (2016). Evergreen Cooperatives. Retrieved July 15, 2017, from http://www.evgoh.com/

Farrell, J. (2011). Democratizing the Electricity System. *New Rules Project*, *23*. Retrieved from http://atcscam.homestead.com/democratizing-electricity-system.pdf

Farrell, J. (2014). *Beyond Utility 2.0 to Energy Democracy* (Democratic Energy Initiative). Minneapolis; Portland; Washington, DC: Institute for Local Self-Reliance. Retrieved from https://ilsr.org/report-energy-democracy/

Farrell, J. (2016a). *Beyond sharing: How communities can take ownership of renewable power* (Energy Democracy Initiative). Institute for Local Self-Reliance. Retrieved from https://ilsr.org/report-beyond-sharing/

Farrell, J. (2016b). Virtual net metering. Retrieved from https://ilsr.org/virtual-net-metering/

Flanagan, K., Uyarra, E., & Laranja, M. (2011). Reconceptualising the 'policy mix' for innovation. *Research Policy*, *40*(5), 702–713. https://doi.org/10.1016/j.respol.2011.02.005

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Gerstle, B. (2014). Giving Landowners the Power: A Democratic Approach for Assembling Transmission Corridors. *J. Envtl. L. & Litig.*, *29*, 535.

Giancatarino, A. (2013). *Community-Scale Energy: Models, Strategies and Racial Equity - A Scan of Community Innovation around Efficiency and Renewable Energy*. New York, N.Y.: Center for Social Inclusion.

Giancatarino, A. (2014). *Energy Investment District (EIDs): Policy Concept Paper*. New York, New York: Center for Social Inclusion. Retrieved from http://www.centerforsocialinclusion.org/energy-investment-districts-a-racially-equitable-solution/

Gilpin, L. (2014). How crowdfunding solar power is democratizing the way we finance clean energy. *TechRepublic*. Retrieved from http://www.techrepublic.com/article/how-crowdfunding-solar-power-is-democratizing-the-way-we-finance-clean-energy/

Goerner, S. (2013). Corrective Lenses: How the Laws of Energy Networks Improve our Economic Vision. *World Futures*, *69*(7–8), 402–449. https://doi.org/10.1080/02604027.2013.835962

Green, J. (2016). *Energy democracy: Co-op Power - A profile in cooperative ownership*. New York, N.Y.: Center for Social Inclusion. Retrieved from http://www.centerforsocialinclusion.org/category/publications/

Grimley, M., & Farrell, J. (2016). *Mighty microgrids* (Energy Democracy Initiative). Institute for Local Self-Reliance. Retrieved from https://ilsr.org

Grösche, P., & Schröder, C. (2014). On the redistributive effects of Germany's feed-in tariff. *Empirical Economics*, *46*(4), 1339–1383. https://doi.org/10.1007/s00181-013-0728-z

Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition." *Energy Policy*, *108*, 451–459. https://doi.org/10.1016/j.enpol.2017.06.014

Hoffman, S. M., & High-Pippert, A. (2005). Community Energy: A Social Architecture for an Alternative Energy Future. *Bulletin of Science, Technology & Society*, *25*(5), 387–401. https://doi.org/10.1177/0270467605278880

Houck, J., & Rickerson, W. (2009). The Sustainable Energy Utility (SEU) Model for Energy Service Delivery. *Bulletin of Science, Technology & Society*, *29*(2), 95–107. https://doi.org/10.1177/0270467608330023

Howlett, M. (2014). From the 'old' to the 'new' policy design: design thinking beyond markets and collaborative governance. *Policy Sciences*, *47*(3), 187–207. https://doi.org/10.1007/s11077-014-9199-0

Howlett, M., & Rayner, J. (2007). Design Principles for Policy Mixes: Cohesion and Coherence in 'New Governance Arrangements.' *Policy and Society*, *26*(4), 1–18. https://doi.org/10.1016/S1449-4035(07)70118-2

Howlett, M., & Rayner, J. (2013). *Patching vs Packaging in Policy Formulation: Assessing Policy Portfolio Design* (No. 170–182). https://doi.org/10.12924/pag2013.01020170

IEC. (2017). Iowa Energy Center. Retrieved July 15, 2017, from http://www.iowaenergycenter.org/

IRENA. (2017). *REthinking Energy 2017: Accelerating the global energy transformation*. Abu Dhabi: International Renewable Energy Agency. Retrieved from www.irena.org/publications

Jacobson, M. Z., & Delucchi, M. A. (2011). Providing all global energy with wind, water, and solar power, Part I: Technologies, energy resources, quantities and areas of infrastructure, and materials. *Energy Policy*, *39*(3), 1154–1169. https://doi.org/10.1016/j.enpol.2010.11.040

Jenkins, K., McCauley, D., Heffron, R., Stephan, H., & Rehner, R. (2016). Energy justice: A conceptual review. *Energy Research & Social Science*, *11*, 174–182. https://doi.org/10.1016/j.erss.2015.10.004

Kern, F., & Howlett, M. (2009). Implementing transition management as policy reforms: a case study of the Dutch energy sector. *Policy Sciences*, *42*(4), 391–408. https://doi.org/10.1007/s11077-009-9099-x

Kivimaa, P., & Kern, F. (2016). Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Research Policy*, *45*(1), 205–217. https://doi.org/10.1016/j.respol.2015.09.008

Kunkel, C. M., & Kammen, D. M. (2011). Design and implementation of carbon cap and dividend policies. *Energy Policy*, *39*(1), 477–486. https://doi.org/10.1016/j.enpol.2010.08.046

Kunze, C. (2014). What is Energy Democracy? Retrieved June 27, 2016, from http://energie-demokratie.de/what-is-energy-democracy/

LEAN Energy US. (2017). Lean Energy U.S. – California. Retrieved July 15, 2017, from http://www.leanenergyus.org/cca-by-state/california/

Local Government Commission. (2016). *Community Choice Aggregation Fact Sheet*. Sacramento, CA. Retrieved from https://www.lgc.org

Lohmann, L., & Hildyard, N. (2014). *Energy, Work and Finance*. Dorset, UK: Corner House. Retrieved from http://www.thecornerhouse.org.uk

Luna, A. C., Diaz, N. L., Graells, M., Vasquez, J. C., & Guerrero, J. M. (2016). Cooperative energy management for a cluster of households prosumers. *IEEE Transactions on Consumer Electronics*, *62*(3), 235–242. https://doi.org/10.1109/TCE.2016.7613189

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy*, *41*(6), 955–967. https://doi.org/10.1016/j.respol.2012.02.013

McGinnis, M. D., & Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society*, *19*(2). https://doi.org/10.5751/ES-06387-190230

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, *42*(4), 323–340. https://doi.org/10.1007/s11077-009-9097-z

Melville, E., Christie, I., Burningham, K., Way, C., & Hampshire, P. (2017). The electric commons: A qualitative study of community accountability. *Energy Policy*, *106*, 12–21. https://doi.org/10.1016/j.enpol.2017.03.035

Mendonça, M., Jacobs, D., & Sovacool, B. K. (2010). *Powering the green economy: the feed-in tariff handbook*. London; Sterling, VA: Earthscan.

Miller, C. A., Iles, A., & Jones, C. F. (2013). The Social Dimensions of Energy Transitions. *Science as Culture*, *22*(2), 135–148. https://doi.org/10.1080/09505431.2013.786989

Mishra, A. (2014, July 18). Top 5 Renewable Energy Crowdfunding Platforms. *Renewable Energy World*. Retrieved from http://www.renewableenergyworld.com/ugc/articles/2014/07/top-5-renewable-energy-crowdfunding-platforms.html

Morris, D. (2001). Seeing the Light. *Institute for Local Self-Reliance*. Retrieved from https://www.pharosproject.net/uploads/files/sources/1/1349813941.pdf

Morris, & Jungjohann, A. (2016). *Energy democracy: Germanys Energiewende to renewables*. Basingstoke: Palgrave Macmillan.

Moss, T. (2014). Socio-technical Change and the Politics of Urban Infrastructure: Managing Energy in Berlin between Dictatorship and Democracy. *Urban Studies*, *51*(7), 1432–1448. https://doi.org/10.1177/0042098013500086

NRECA. (2016). America's Electric Cooperatives. Retrieved July 15, 2017, from https://www.electric.coop/

NREL. (2016). State and Local Governments - Clean Energy Policy Basics. Retrieved January 22, 2017, from http://www.nrel.gov/tech_deployment/state_local_governments/policy_basics.html

NYSERDA. (2017). NYSERDA - New York State Energy Research & Development Authority. Retrieved July 15, 2017, from https://www.nyserda.ny.gov/

Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, *325*(5939), 419–422. https://doi.org/10.1126/science.1172133

Ostrom, E. (2010). Beyond Markets and States: Polycentric Governance of Complex Economic Systems. *American Economic Review*, *100*(3), 641–672. https://doi.org/10.1257/aer.100.3.641

Parry, I. W. H., Morris, A. C., & Williams, R. C. (Eds.). (2015). *Implementing a US carbon tax: challenges and debates*. Hoboken, N.J. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=955695

Peterson, T. R., Stephens, J. C., & Wilson, E. J. (2015). Public perception of and engagement with emerging low-carbon energy technologies: A literature review. *MRS Energy & Sustainability*, *2*(E11). https://doi.org/10.1557/mre.2015.12

Polanyi, K. (2001). *The great transformation: the political and economic origins of our time* (2nd Beacon Paperback ed). Boston, MA: Beacon Press.

Quitzow, R. (2015). Assessing policy strategies for the promotion of environmental technologies: A review of India's National Solar Mission. *Research Policy*, *44*(1), 233–243. https://doi.org/10.1016/j.respol.2014.09.003

REN21. (2017). *Renewables Global Futures Report: Great debates towards 100% renewable energy*. Paris: REN21 Secretariat.

Rogge, K. S., & Reichardt, K. (2015). Going beyond instrument interactions: towards a more comprehensive policy mix conceptualization for environmental technological change, SWPS 2015-12 (April), Science Policy Research Unit, 2015, pp. 1–47.

Shah, T., & Beckstead, C. (2012). *Local Climate Action in British Columbia: motivations and policy implications*. Pembina Institute. Retrieved from http://www.pembina.org/pub/2373

Shaw, K., Hill, S. D., Boyd, A. D., Monk, L., Reid, J., & Einsiedel, E. F. (2015). Conflicted or constructive? Exploring community responses to new energy developments in Canada. *Energy Research & Social Science*, *8*, 41–51. https://doi.org/10.1016/j.erss.2015.04.003

Späth, P., & Rohracher, H. (2010). 'Energy regions': The transformative power of regional discourses on socio-technical futures. *Research Policy*, *39*(4), 449–458. https://doi.org/10.1016/j.respol.2010.01.017

Speth, J. G. (2015). *Getting to the next system: Guideposts on the way to a new political economy* (NSP Report 2). The Next System Project. Retrieved from http://thenextsystem.org/gettowhatsnext/

Stephens, J., Wilson, E. J., & Peterson, T. R. (2015). *Smart Grid (R)Evolution: Electric Power Struggles*. New York: Cambridge University Press. https://doi.org/10.1017/CBO9781107239029

Stirling, A. (2014). Transforming power: Social science and the politics of energy choices. *Energy Research & Social Science*, *1*, 83–95. https://doi.org/10.1016/j.erss.2014.02.001

Sweeney, S. (2013). Resist, Reclaim, Restructure: Unions and the Struggle for Energy Democracy. Trade Unions for Energy Democracy/Rosa Luxemburg Stiftung. Retrieved from http://unionsforenergydemocracy.org/resist-reclaim-restructure-unions-and-the-struggle-for-energy-democracy/

Sweeney, S. (2014). Working Toward Energy Democracy. In *Governing for Sustainability: State of the World 2014* (pp. 215–227). Washington, DC: Island Press.

Sweeney, S. (2015). *Energy Democracy in Greece: SYRIZA's Program and the Transition to Renewable Power (Working Paper #3)*. Trade Unions for Energy Democracy. Retrieved from http://www.rosalux.eu/publications/

Tarhan, M. D. (2017). Renewable Energy Co-operatives and Energy Democracy: A Critical Perspective. Presented at the Canadian Association for Studies in Co-operation, Toronto, ON. Retrieved from https://www.researchgate.net/publication/317369738_Renewable_Energy_Co-operatives_and_Energy_Democracy_A_Critical_Perspective

Thompson, G., & Bazilian, M. (2014). Democratization, Energy Poverty, and the Pursuit of Symmetry. *Global Policy*, *5*(1), 127–131. https://doi.org/10.1111/1758-5899.12103

Tokar, B. (2015). Democracy, localism, and the future of the climate movement. *World Futures*, *71*(3–4), 65–75. https://doi.org/10.1080/02604027.2015.1092785

Trade Unions for Energy Democracy. (2015). Our History. Retrieved June 27, 2016, from http://unionsforenergydemocracy.org/about/our-history/

Turnheim, B., & Geels, F. W. (2012). Regime destabilisation as the flipside of energy transitions: Lessons from the history of the British coal industry (1913-1997). *Energy Policy*, *50*, 35–49. https://doi.org/10.1016/j.enpol.2012.04.060

US DOE. (2017a). Community Renewable Energy. Retrieved January 18, 2017, from http://apps3.eere.energy.gov/greenpower/community_development/

US DOE. (2017b). State and Local Solution Center. Retrieved January 22, 2017, from https://energy.gov/eere/slsc/state-and-local-solution-center

Van der Schoor, T., Lente, H. van, Scholtens, B., & Peine, A. (2016). Challenging obduracy: How local communities transform the energy system. *Energy Research & Social Science*, *13*, 94–105. https://doi.org/10.1016/j.erss.2015.12.009

Verbong, G., & Geels, F. (2012). Future electricity systems: visions, scenarios and transition pathways. In G. Verbong & D. Loorbach (Eds.), *Governing the energy transition: reality, illusion or necessity?* (pp. 203–219). New York: Routledge.

Weinrub, A. (2014). *Expressions of Energy Democracy: Perspectives on an Emerging Movement*. Oakland, CA: Local Clean Energy Alliance. Retrieved from www.localcleanenergy.org

Weinrub, A., & Giancatarino, A. (2015). *Toward a climate justice energy platform: Democratizing our energy future*. Local Clean Energy Alliance / Center for Social Inclusion. Retrieved from localcleanenergy.org

Wellinghoff, J., & Weissman, S. (2015). The right to self-generate as a grid-connected customer. *Energy LJ*, *36*, 305.

Willdan/EnerNex. (2017). *City of San Diego Feasibility Study for a Community Choice Aggregate*.

Wiser, R., Barbose, G., Heeter, J., Mai, T., Bird, L., Bolinger, M., … others. (2016). A retrospective analysis of the benefits and impacts of US renewable portfolio standards. *Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory*. Retrieved from http://climate-xchange.org/wp-content/uploads/2015/11/Renewable-Energy-Standards-Study.pdf

Wolsink, M. (2012). The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. *Renewable and Sustainable Energy Reviews*, *16*(1), 822–835. https://doi.org/10.1016/j.rser.2011.09.006

INTERCONNECTING TEXT TO CHAPTER 5

Chapter 5 has been published as Burke, M. J. (2018). Shared yet contested: Energy democracy counter-narratives. *Frontiers in Communication*, *3*(22). https://doi.org/10.3389/fcomm.2018.00022

Transformations of the type envisioned here involve more than changes to rules and policies. Realizing this transformative energy vision will depend upon the capacity for groups working towards energy democracy to influence the direction of transition through both practice and persuasion. Examining organizations and programs working to advance energy democracy and their public narratives of energy transition provides a way to explore this question. The previous chapter finds a set of energy democracy goals and policy instruments and an uneven congruence among them, and develops a broader understanding of the movement, its aspirations and limitations. Chapter 5 turns attention to a set of these social initiatives for energy democracy. Specifically, the chapter aims to understand and demonstrate the transformative performance of renewable energy by examining energy democracy narratives in practice across the region of northeastern North America. Conventional ways of communicating about the transition to renewable energy in North America presuppose that energy systems can be changed while sustaining existing social, political and economic relations. While energy democracy counters such ostensibly apolitical narratives by emphasizing the socially-transformative potential of this transition, as both organizing principle and social movement, it is itself increasingly recognized as flexible and contested. This research seeks to better discern and understand the practices and implications of energy democracy and its variants through synthesis and qualitative analysis of transition 'counter-narratives' drawn from public communications of energy democracy initiatives actively working in northeastern North America.

CHAPTER 5: SHARED YET CONTESTED: ENERGY DEMOCRACY COUNTER-NARRATIVES

5.1 Introduction: energy democracy and transition narratives

The project of shifting from fossil fuels to renewable energy sources is now widely recognized for its political rather than strictly technological or economic dimensions (Cherp, Vinichenko, Jewell, Brutschin, & Sovacool, 2018). A broad political movement organized around renewable energy transition has not yet been clearly articulated, however. Energy democracy, as an organizing principle and social movement, offers the opportunity for groups promoting renewable energy to mobilize around an overtly re-politicized project for energy transition (Angel, 2016; Becker & Naumann, 2017). Advocates of energy democracy see in the renewable energy transition the possibility and even the necessity for achieving multiple social and ecological goals and outcomes through the process of ending fossil fuels and developing their renewable replacement (Burke & Stephens, 2017; Szulecki, 2018). In this way, energy democracy provides a socio-political counter-narrative (Davis, 2002, p. 25; Lieberman & Kline, 2017, p. 3; Nye, 2003, p. 14) to mainstream post-political transition narratives that position renewable energy transitions within a broadly dominant neoliberal hegemony (Mouffe, 2014a, p. 66). These dominant narratives, increasingly criticized for their inability to compel the desired level of action (Bushell, Buisson, Workman, & Colley, 2017; Sweeney & Treat, 2017), tend to approach the transition to renewables primarily as a matter of changing technologies and fuel sources, while taking as given a need to renew and sustain processes of accumulation (McCarthy, 2015) under a banner of the green economy (Gibbs & O'Neill, 2017, p. 162; Luederitz, Abson, Audet, & Lang, 2017, p. 396).

As with the democratic paradigm more broadly, energy democracy would therefore appear to hold as a central concern not only technological change but also a creative transformation of social relations (Montgomery, 2016, p. 1992). Indeed, energy democracy has been described in terms of a political demand for just, democratic, and sustainable energy systems as well as a corresponding effort to institutionalize democratic energy governance through diverse and socially transformative forms of organization (Becker & Naumann, 2017). Yet energy democracy is also politically flexible and contested, involving divergent approaches, some of which may serve to justify and advance established notions of green capitalism and extend market relations (Angel, 2016; Tarhan, 2017). Energy democracy appears to move beyond

reformist approaches to sustainability that emphasize technological or behavioral change but may be flexible in whether it takes a reconfiguration position, working to reconfigure modern energy systems, or a revolutionary position, working toward deeply structural societal shifts through processes of energy transitions (Geels, McMeekin, Mylan, & Southerton, 2015, p. 9).

This current moment of transitions in the making (Turnheim et al., 2015, p. 240) opens an opportunity for energy democracy activists to disrupt and expand political imaginations and develop and implement tangible and targeted initiatives. This opportunity can be enabled through simultaneous processes of disarticulating the existing hegemony and re-articulating old and new elements into more democratic configurations (Mouffe, 2014a, pp. 67–68) as pre-figurations of alternative socio-ecological-technical systems (Turnheim et al., 2015, p. 249). Realizing this transformative energy vision will therefore largely depend upon the capacity for groups working towards energy democracy to influence the direction of transition through both practice and persuasion (Bushell et al., 2017; Davis, 2002). To better understand and recognize energy democracy as part of a contemporary socio-political struggle, research can seek to uncover and analyze the central characters of this struggle, the contending mobilized counterpublics (Hess, 2017), their core political claims and arguments (Montgomery, 2016), and their motives and strategies on the ground (Turnheim et al., 2015, p. 244) as embedded within and publicly performed through particular locations and diverse social institutions and modes of organization (Becker & Naumann, 2017; Gibbs & O'Neill, 2017; Hess, 2017; Jasanoff, 2015).

This original research examines energy democracy initiatives and their transition narratives in northeastern North America to understand 1) how energy democracy works as a counter-narrative to mainstream energy transition narratives, and 2) whether and how a diversity of counter-narratives for energy democracy are presently communicated publicly and how they compare across this region. Transition narratives include and extend beyond stories about political life to serves as collective justification for actions to create sustainability transition pathways (Luederitz et al., 2017, p. 394; Wesley, 2014, p. 138). Such narratives of change, describing context, actors and plots of transformation (Wittmayer et al., 2015), may interact with social and systems-wide innovations and macrolevel phenomena to produce transformative social innovations that challenge, alter or replace dominant institutions (Avelino et al., 2017). Narratives can support the efforts of communities of energy and climate change researchers and

activists by collectively imagining, integrating, and expressing broad yet detailed possibilities, rather limiting the focus of transition to narrowly-prescribed institutional or political reforms (Moezzi, Janda, & Rotmann, 2017, p. 6). As communicative strategies and practices for energy transition, narratives offer to communities of people an accessible, meaningful, and culturally- and historically-grounded approach to expand participation, diversify and anchor challenging deliberation, articulate and legitimate community values, and increase capacity for rethinking energy futures (Miller, O'Leary, Graffy, Stechel, & Dirks, 2015, p. 67). Like their constituent elements, transition narratives are stabilized through diverse social institutions including governments, businesses, sciences, the media, and civil society, and in turn seek to influence and give rise to institutionalized change (Becker & Naumann, 2017; Hess, 2017; Jasanoff, 2015). The paper broadly contributes to research on sustainability transitions by examining and comparing cross-regional transition narratives at trans-national and sub-national levels (Jasanoff, 2015, p. 18), clarifying emergent ideal-type transition counter-narratives, and initiating a data set for future research on regional social-ecological-technical systems to strengthen initiative-based learning and support diverse and participatory analytical approaches (Turnheim et al., 2015, p. 244).

The following section on materials and methods summarizes the procedures used for defining and selecting cases of energy democracy, collecting data, and analyzing and synthesizing transition narratives. The paper goes on to present the results of this research, describing attributes of cases, a general energy democracy narrative, and diverse types of energy democracy and transition narratives for the region, and offers a preliminary set of factors related to this diversity. In the discussion section, the paper considers energy democracy counter-narratives in terms of their convergence and divergence, and their performative and transformative potential. These differences, it is argued, can and perhaps must activate a productive tension among multiple energy democracies available for guiding democratized renewable energy futures. A final section concludes by reviewing the contributions and limitations of this research and proposing ways to improve upon and extend this work.

5.2 Materials and methods

This section briefly summarizes the materials and methods used for this research. To investigate transitions in their particular spatial contexts (Gibbs & O'Neill, 2017, p. 169), the units of analysis include energy democracy initiatives and their transition narratives presently operating in eastern Canada and the northeastern United States. An *energy democracy initiative* (EDI) is defined as an organization or program that actively makes use of the term "energy democracy" to guide actions (Hess, 2018) or works to advance energy democracy goals and outcomes or policy instruments to achieve a renewable energy transition (Burke & Stephens, 2017). For this research, a *transition narrative* is defined by a set of elements used for ongoing public communications of an initiative, whether originating in an official source or used less formally by non-experts (Tidwell & Tidwell, 2018). Informed by Miller et al. (2015) and Wittmayer et al. (2015), these elements of transition narratives include 1) *collective-action frames* that define problems, solutions, and motivations for sociotechnical change (Eaton, Gasteyer, & Busch, 2014, pp. 232–233), 2) *discourses* that describe values and norms of members of the communities of interest (Wesley, 2014, p. 137), 3) *sociotechnical imaginaries* that describe and prescribe collective visions of desirable futures to be attained in a given context (Eaton et al., 2014, p. 230; Jasanoff, 2015, p. 4; Jasanoff & Kim, 2009, p. 123), and 4) *stories* that connect past, present, and future and identify specific human agents and adversaries of change (Moezzi et al., 2017, p. 2; Wesley, 2014, p. 138). This definition avoids presuming any specific social group as agent or adversary (Tidwell & Tidwell, 2018). Similarly, the "institutionalist dimension of energy democracy," involving the issue of who should own and control energy infrastructure (Becker & Naumann, 2017, pp. 4–5), is addressed within transition narratives in terms of new or existing organizational forms proposed as solutions for democratization.

An iterative process of online searches and evaluation of evidence yielded text source data and attribute values for a set of nine EDIs working within northeastern North America, as well as a broader data base of initiatives within this region available for scholarly research through a publicly accessible repository (Burke, 2018). Analysis and synthesis of transition narratives for the EDIs were performed through qualitative document analysis (Wesley, 2014), coding text data by categories of elements of transition narratives (Table 5.1), clustering similar organizational narratives, and constructing a transition narrative for each cluster of organizations. This process uncovered a set of attribute values useful for characterizing energy democracy initiatives, a generalized energy democracy transition narrative, three distinct types of energy democracy and

their associated variants of transition narratives, and an exploration of possible relationships between attributes and types of energy democracy. Further details on case selection, data collection, and analysis and synthesis of transition narratives are described within the Supplementary Material to this manuscript (see appendix to this chapter).

Table 5.1. Coding topics and descriptions of elements of a transition narrative

Coding topic	Description
Collective-action frames	Problems, solutions, and motivations for collective action toward sociotechnical change.
Motivations for collective action	Specific events or phenomena that have occurred or are occurring at an identified point in time, which have inspired or sustain a sense of need for collective action.
Problems	Issues of collective concern (e.g., global warming, income inequality) that the group identifies as requiring action to address and improve.
Solutions	General types of responses (e.g., organizational forms, policies, strikes, demonstrations) promoted to address problems through collective action.
Discourses	Values and norms of members of the communities of interest, including the initiative, partners, and communities served.
Values and norms of members	Ideological commitments or normative positions that guide the collective behaviour of members of an initiative.
Sociotechnical imaginaries	Desirable futures collectively described or prescribed in a given context.
Futures described or prescribed	Collective visions of a future that the initiative works to create and attain.
Stories	Periods of time and events connecting past, present, and future, and specific agents of and adversaries to the desired change.
Adversaries for change	Groups identified as preventing the attainment of a desired future.
Agents for change	Groups identified as holding the capacity for controlling the direction of change or occupying a central role for making change toward a desirable future.
Connecting past, present, and future	Selective descriptions of events and timelines that temporally position the work of the initiative and its members.

5.3 Results

5.3.1 Attribute values for energy democracy initiatives

The search and selection process identified a set of nine energy democracy initiatives as defined here, including: Canadian Union of Public Employees (CUPE); Confédération des syndicats nationaux, Québec (CSN); Co-op Power; Coule Pas Chez Nous; New England Grassroots Environment Fund (NEGEF); New York Energy Democracy Alliance (EDA); The Leap; 350.org; and Trade Unions for Energy Democracy (TUED). The researcher-completed surveys of primary sources yielded values for attributes relevant to sustainability initiatives within social-ecological-technical systems at the regional scale. Energy democracy as an organizing principle has been taken up by this set of organizations and programs operating within the region at local, regional, national, global, or some combination of scales. Both long-standing and recent initiatives, representing a range of organizational types, have taken to using the term. The initiatives examined here demonstrate a leadership approach described as either bottom-up or a combination of top-down and bottom-up, emphasizing social or a combination of social and ecological dimensions, often taking a holistic perspective to their analysis of problems and their proposed solutions, and organizing around available renewable energy technologies generally. Examples of evidence of these values as identified in the primary sources are presented here for the attributes “organization type,” “initiation or leadership approach,” “social-ecological emphasis,” “breadth of focus,” “geographic range/spatial scale,” and “available technologies.” The number of EDIs for each key attribute value is presented in Table 5.2.

Table 5.2. Number of Energy Democracy Initiatives (EDIs) by attribute value (n=9)

Attribute and attribute value	Number of EDIs
Province or state	
Massachusetts	1
New Hampshire	1
New York	3
Ontario	2
Québec	2
Year of initiation	
Pre-1970	2
1970-2007	2
2008-2017	5
Organization type	
Nongovernmental/nonprofit	4
Private	0
Public	0
Community-based	2
Cooperative	1
Hybrid (mix of types)	2
Initiation/management or leadership	
Bottom-up	5
Hybrid (bottom-up and top-down)	4
Top-down	0
Social-ecological emphasis	
Ecological	0

Social	3
Social-ecological	6
Breadth of focus	
Holistic	7
Specific issues	2
Geographic range or spatial scale	
Local	0
Regional	4
National	0
Global	1
Cross-scalar	4
Available technologies	
All renewables	5
All renewables with specifics indicated	2
Specific renewables	1
Unspecified	1

McGinnis and Ostrom (2014) identify a broad set of organizational types used to characterize social groups including public, private, nonprofit, community-based, and hybrid organizations (p. 9). These general categories were used here to characterize the selected EDIs based on differences found within the text documents. For example, for an organizational type of cooperative, Co-op Power self-described as "a consumer-owned sustainable energy cooperative,"[6] for EDA, a community-based organization, "a statewide alliance of community-based organizations, grassroots groups, and policy experts working together to advance a just and participatory transition to a resilient, localized, and democratically controlled clean energy economy,"[7] and for TUED, a hybrid organization, "a multi-partner initiative"[8] coordinated by nonprofits as part of a partnership between a public university and labor unions. These examples demonstrate differences in the language used for self-description of the EDIs, useful for understanding whether and how different forms of organizations publicly present transition narratives. Aside from cooperatives, no private sector initiatives or their hybrids were identified among this set.

Orenstein and Shach-Pinsley (2017) propose a set of characteristics of sustainability initiatives that may allow achievement of successful outcomes, including approach to initiation and leadership of initiatives (bottom-up and top-down) (p. 250). Interpreting the diversity of approaches across these categories and their hybrid can provide insight as to the potential for success both individually and as a group. Evidence suggested bottom-up and hybrid organizations within this set. For example, for a bottom-up leadership approach, NEGEF made the following statement: "Focused on all things local, the Grassroots Fund is the only organization of its kind dedicated to inspire, connect, and support community-based environmental projects throughout New England. Grassroot Fund's niche is to help those on-the-ground, everyday people for whom grassroots work is a passion and whose volunteer time is a priceless contribution to the common good."[9] In contrast, a hybrid approach values both bottom-up and top-down, for example: "Trade unionism at CSN is based on the organization of autonomous trade unions. They choose the rules that drive their union life. Our unions are

[6] http://www.cooppower.coop/about-us (Accessed 24 September, 2017)
[7] https://edatestsite2.wordpress.com/ (Accessed 23 September, 2017)
[8] http://unionsforenergydemocracy.org/about/about-the-initiative/ (Accessed 23 September, 2017)
[9] https://grassrootsfund.org/about-us (Accessed 24 September, 2017)

masters of their decisions."[10] "In our democracy, it is imperative that the State assume its responsibilities in implementing the measures guaranteeing social solidarity and the best possible sharing of wealth produced. The State must act through laws, agreements and treaties, through taxation, supporting by all necessary means the public networks of health, education and social services and taking measures capable of ensuring income security to all citizens."[11] No exclusively top-down leadership approaches were identified.

Differences in relative emphasis on ecological and/or social systems may also influence effectiveness (Orenstein & Shach-Pinsley, 2017, p. 250). Evidence from the text data suggests social and combined social-ecological emphases among these organizations. For a social emphasis, EDA stated that "We envision a renewable energy system that is led by and prioritizes solutions for low- and moderate-income communities and communities of color who are most impacted by our current energy and economic system. We transform our communities' relationship to power through advocacy, organizing, job creation, coalition-building, policy research, and public education for an equitable, sustainable energy future."[12] Rather than a general statement on the value of sustainability, a social-ecological emphasis gives explicit attention to combined social and ecological concerns: according to 350.org, "Climate change is not just an environmental issue, or a social justice issue, or an economic issue — it's all of those at once."[13] No organization appeared to emphasize only ecological dimensions.

Outcomes are also understood to be affected by an organization's breadth of focus, seeking to address a more narrowly-defined issue or taking a more holistic approach (Orenstein & Shach-Pinsley, 2017, pp. 250–251), where both approaches offer advantages. As evidence of a breadth of focus on specific issues, 350.org stated that "All of our work leverages people power to dismantle the influence and infrastructure of the fossil fuel industry,"[14] and "Keeping fossil fuels in the ground is the most important step we can take to prevent further climate change."[15] Conversely, NEGEF, an organization demonstrating a holistic breadth of focus, stated that "Just

[10] https://www.csn.qc.ca/mouvement/patrimoine/nos-valeurs/ (Accessed 21 September, 2017) (Translated from French)
[11] https://www.csn.qc.ca/mouvement/patrimoine/notre-declaration-de-principe/ (Accessed 21 September, 2017) (Translated from French)
[12] https://edatestsite2.wordpress.com/mission/ (Accessed 23 September, 2017)
[13] https://350.org/about/#principles (Accessed 23 September, 2017)
[14] https://350.org/about/#history (Accessed 23 September, 2017)
[15] https://350.org/science/#causes (Accessed 23 September, 2017)

Transition means shifting from dirty energy to energy democracy, from funding highways to expanding public transit, from incinerators and landfills to zero waste, from industrial food systems to regional food sovereignty, from gentrification to community land rights, and from rampant development to ecosystem restoration."[16]

Geographic range or spatial scale provide both a means for characterizing organizations by location and spatial extent of activity (McGinnis & Ostrom, 2014, pp. 8–9) as well as an additional factor proposed to influence their success when working in a specific context (Orenstein & Shach-Pinsley, 2017, p. 251). Here categories included local, regional, national, global, and cross-scalar. As evidence for a regional geographic range or spatial scale, Co-op Power described its scope of work as a "regional structure, organizing our cooperative as a decentralized network of [cooperatives],"[17] while for a global range, TUED includes "58 trade union bodies, including 4 Global Union Federations, 3 regional organizations, and 7 national centers…10 allied organizations from the policy and academic communities…Unions presently participating in TUED come from 20 countries."[18] As an example of a cross-scalar range, 350.org states, "With the growth in local groups, we've been busy organizing around the world and training the climate movement."[19] None of these nine EDIs were found to orient their work strictly at the local or national levels.

Organizations are also characterized by the types of renewable technologies they articulate and emphasize within their efforts to transition, described here as available technologies (McGinnis & Ostrom, 2014, p. 5), suggesting both the form and the degree of engagement with technology as key components of social transformation. This category includes either specific renewable energy technologies or renewables in general. For example, Coule Pas Chez Nous, an initiative focusing on specific available technologies, listed the technologies as "biomethane… biogas…geothermal…wind turbines…solar photovoltaic…passive solar…active thermal solar…hydroelectricity,"[20] whereas the more frequently stated category of "all renewables" was indicated by CUPE as "We will support renewable energy that has a less harmful impact on the

[16] https://grassrootsfund.org/dollars/guiding-values (Accessed 24 September, 2017)
[17] https://www.cooppower.coop/what-is-a-community-energy-co-op/ (Accessed 24 September, 2017)
[18] http://unionsforenergydemocracy.org/about/partners/ (Accessed 23 September, 2017)
[19] https://350.org/2016-annual-report/ (Accessed 23 September, 2017)
[20] https://www.coulepascheznous.com/alternatives#tabbed-content (Accessed 22 September, 2017) (Translated from French)

climate and the environment" (CUPE, 2013, p. 14), and by TUED in terms of "the need to restructure the global energy system in order to massively scale up renewable energy and other safe low–carbon options" (Sweeney, 2013, p. ii).

Additionally, organizations can be characterized and distinguished by the outcomes used to measure and communicate success for transition. McGinnis and Ostrom (2014) describe such indicators as social and ecological performance measures (p. 5), which can vary depending on the context. Accordingly, the specific outcomes varied across these initiatives, yet taken together they reveal a set of general priorities or performance measures for energy democracy in this region. Social outcomes include accountability, community resilience/adaptation, community sustainability, efficiency, employment, energy conservation, equity/justice, health/wellbeing/quality of life, participation/democracy/inclusivity, public/community ownership, public safety, reduced energy poverty, and sense of place. Ecological outcomes identified include clean air/clean soils/clean water, ecological resilience, environmental/ecosystem sustainability, reduced greenhouse gas emissions, and regeneration. Overall, the work of these EDIs is oriented toward achieving a broad set of both ecological and especially social outcomes, including mainstream outcomes such as community and environmental sustainability and energy efficiency and conservation, with additional emphasis on issues of equity and social justice, participation and democracy, and public and community ownership of energy technologies and infrastructures.

5.3.2 A shared energy democracy transition narrative for the region

The analysis revealed a set of topics or themes that indicate a convergence among the selected EDIs around a shared transition narrative. Events that have motivated collective action of these EDIs include: ongoing trends of social and environmental deterioration including especially global warming; a corresponding increase in awareness, activism, and sense of urgency; actual and potential risks of impacts to local environments and communities; and specific changes in energy policies and politics at all levels. The EDIs seek to address systemic problems of climate change and greenhouse gas emissions, fossil fuels, privatization and the primacy of the market; risks associated with fossil fuel projects and environmental degradation; and institutionalized economic, social, and environmental injustices. Members of these EDIs bring the values and norms of equity and justice, broadened public and community participation, concern for the well-

being and resilience of social and ecological communities, and a perspective that connects deep social transformation with efforts to advance renewable energy and conservation. Overarching solutions center on increasing and innovating forms of public and community ownership and control over renewable energy systems, community development and public investments, low-carbon jobs, renewal of democracy and reorientation of government policy, sanctioning of the fossil fuel industry, and various other local and public solutions.

These efforts are temporally positioned in response to a continuation of historic harms, injustices and global inequities; the current moment of crisis, change, growing inequality, public scarcity and urgency for economic transformation; and a future of lasting struggle for true sustainability while stewarding enduring energy sources. Key agents of change include citizens and communities, governments, elected officials and the public sector, activists and social movements, Indigenous groups, trade unions and workers, cooperatives and businesses. The key adversaries to change include the fossil fuel industry, governments, public agencies, political leadership and political parties, private companies and corporations, financial institutions, and corporate and centralized state utilities. Sociotechnical imaginaries are generally described in terms of renewable, sustainable futures, and public communities and economies, envisioning a just and participatory transition to a diverse, resilient, democratically-controlled renewable energy economy in balance with the Earth's limits, and allowing citizens, workers, and communities access to real decision-making power, ownership, and control of the means of sustainable energy production.

5.3.3 Types of energy democracy within the region

Based on the coded content identified through the coding queries, the process of identifying patterns and themes for each element of transition narratives per EDI pointed to three plausible generalized types or models of energy democracy. These types are described as 1) Local and regional communities, 2) Public partnerships, and 3) Social movements. Two additional subtypes appeared important to articulate. Within "Local and regional communities," there was an emphasis on cooperatives, and within "Public partnerships," an emphasis on labor and trade unions. The relationships among these types of energy democracy are graphically demonstrated in Figure 5.1. Of the nine EDIs assessed, two (Co-op Power and NEGEF) were grouped under "Local and regional communities," three (CUPE, CSN, and TUED) under "Public partnerships,"

and two (Coule Pas Chez Nous and 350.org) under the “Social movements” group. The remaining two (EDA and the Leap) were not easily characterized according to these recognizable societal division, did not demonstrate the same degree of particularity as the other groupings, and their patterns and themes of transition narratives indicated an intermediate tendency relative to the three types described. Rather than force a tenuous relationship or overemphasize similarities, the choice was made to address these initiatives within the overall energy democracy transition narrative presented in the previous subsection, while recognizing that the synergies of these models may inspire over time not only a blend of types but rather an emergence of unique and differentiated approaches to energy democracy.

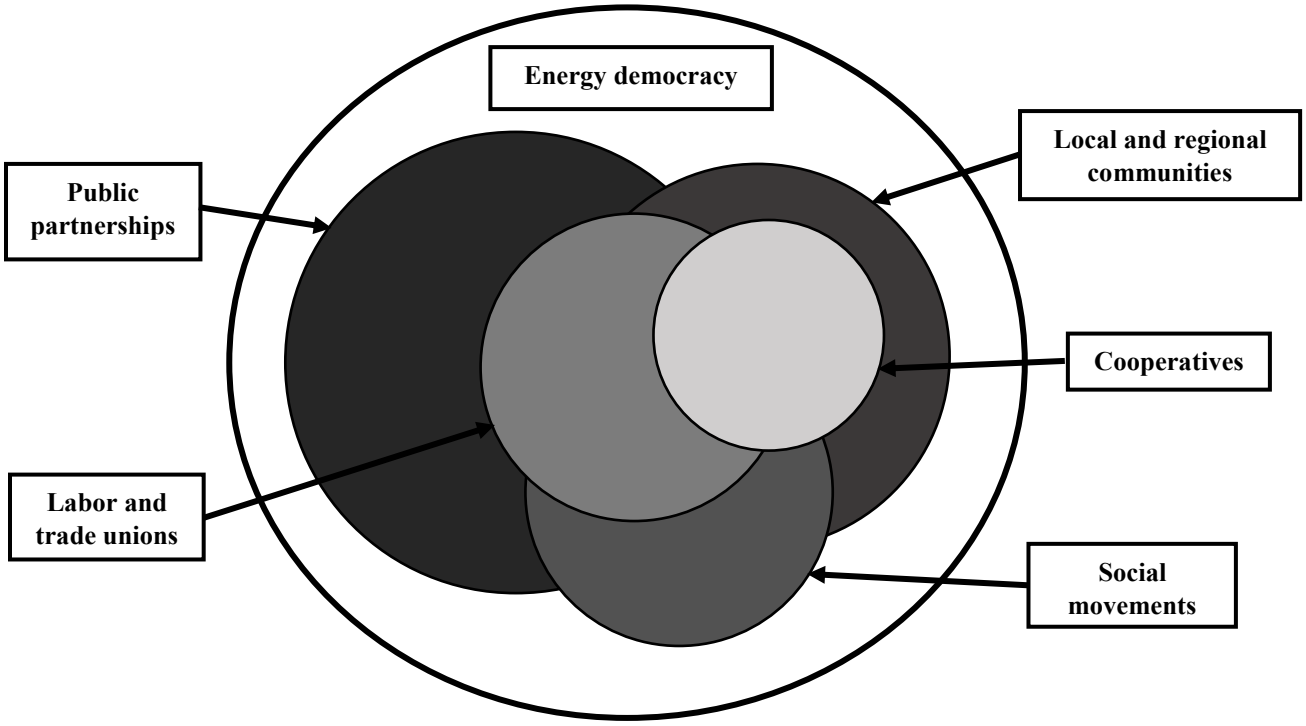

Figure 5.1. Visualizing diverse types of energy democracy across the region

As a descriptive tool resulting from the analysis of elements of narratives, the Venn diagram was used in combination with pairwise comparison diagrams to confirm the relationships based on the relative positioning of each EDI within the graphic. The comparisons largely confirmed the Venn diagram with only minor adjustments, with one exception being that the grouping of Coule Pas Chez Nous under "Social movements" demonstrated uncertainty in relation to the three "Public partnerships" initiatives, meaning that the coding comparisons between these EDIs could not be reliably represented. Thus, there is a degree of uncertainty regarding the positioning of this EDI with respect to the "Public partnerships" group. Revisiting the coding for this EDI revealed a consistent focus on local government, municipalities, and related solutions. Because the relationships were more readily confirmed with the remaining five EDIs, the choice was made to retain this EDI within the group for "Social movements" for the purpose of developing distinct transition narratives. The three variants of transition narratives are presented in the following section and summarized in Table 5.3 with emphasis on their divergence where relevant. Although these narratives include some of the same dimensions as identified by Becker and Naumann (2017, p. 6) (e.g., political objectives, modes of organization, technologies and resources involved, and spatial dimensions), the resulting typology of energy democracy differs here because the narratives were constructed based on elements expressed by initiatives themselves.

5.3.4 Variants of transition narratives[21]

5.3.4.1 Local and regional communities

Local and regional communities are motivated toward collective action for energy transition in response to a general awareness of "political and social trends that compromise the [local and global] environment and economy"[22] and the inability for local communities to "consistently meet the social and ecological needs"[23] of their members. Communities presently face multiple and overlapping problems that weaken their resilience including climate change and environmental degradation, dependence on polluting energy sources that undermine public health, a fossil-fuel-driven economy, consumerism, militarism, and a legacy of exploitation of land, labor, and resources. The transition to community-scale, local renewable energy resources

[21] This section has been modified from the published version per suggestions of thesis examiners.
[22] http://www.cooppower.coop/why-we-exist (Accessed 4 October, 2017)
[23] https://grassrootsfund.org/about-us/community-resilience (Accessed 4 October 2017)

is one element of building healthy and resilient communities, yet the complexity and expense of these systems create barriers for communities. Overcoming these barriers while creating secure jobs and livelihoods requires new energy policies, support of innovative community and place-based projects and initiatives, grassroots work, local activism, civic engagement, and direct democratic decision-making and participatory energy planning within the context of a "multiclass, multi-racial movement."[24]

Community-based and regionally-produced renewable energy requires the development and advancement of new organizational and democratically-owned group-based business models including community-owned sustainable energy businesses and networks of community energy cooperatives that design and implement projects for and permanently anchor capital within local communities and the region. As one organization describes, "Co-op Power plans to address the energy needs of this region, root capital in area towns and cities and build environmentally and economically sustainable communities."[25] This networked and community-based approach is the work of "everyday people"[26] operating within and across communities of the region, finding creative ways toward a sustainable future. Workers, community members, grassroots organizations and community activists, cooperatives, legislators, and cities and towns are to lead the way to clean energy economies, while corporations, large financial interests, and energy industries pose the greatest obstacles. "Community energy cooperatives"[27], guided by principles of democracy, autonomy, open membership, and mutual support, serve as key drivers of community and regional energy transitions.

Change begins at the local level, allowing those people closest to and most affected by current economic and environmental trends to determine their own solutions. This approach is legitimated and sustained by the deeply-rooted sense of place among neighbors, and their interests in their homes and communities defined both socially and ecologically. Social movements and grassroots organizations serve to educate, organize, inspire, and provide the resources for community-led change. Solutions imposed outside of communities and the region will surely fail. Community members themselves are empowered to access, own, and control

[24] http://www.cooppower.coop/about-us (Accessed 4 October, 2017)
[25] http://www.cooppower.coop/why-we-exist (Accessed 4 October, 2017)
[26] https://grassrootsfund.org/collaborations/partner-resources/100-renewable-new-england-fund (Accessed 4 October, 2017)
[27] http://www.cooppower.coop/about-us (Accessed 4 October, 2017)

locally- and regionally-generated energy and become effective practitioners of grassroots democracy, stepping up to co-create the long-term resilience of neighborhoods and towns through the development of all components of resilience, including energy, food, water, and livelihoods. From this perspective, "(c)ommunity resilience is not a dire scaling back nor a fearful preparatory measure, but rather a positive movement towards a brighter future where natural and social systems inherently support health, wellness, equity, and justice."[28]

The organizing vision of the future includes a safer and healthier economy powered by 100% clean, renewable sources for all end uses based on maximized efficiencies, reduced demand, expanded storage, responsible siting of facilities, and a democratized power grid. This approach ensures a just transition for workers and communities and opens up the benefits of the green economy to low-income people and people of color. The transition must stay on track to drastically reduce global warming pollution by mid-century. Rather than an economy of scarcity, this is a "local, living, loving economy" of abundance, "grounded in ecological and social well-being, cooperation and regeneration."[29]

5.3.4.2 Public partnerships

The motivation for a comprehensive, public partnership approach to energy transition stems from: a recognition of substantial gaps between actions needed to confront global warming and other social and ecological crises and targets as established by the scientific community; current impacts and the likely trajectory towards planetary catastrophe of current models of energy and economic development under a "green growth" pathway[30]; failure to establish firm sustainability commitments at global conferences including Rio+20 in 2012; and possibilities opened by recent events, including the Paris Agreement and the rise of global movements for climate justice and a just transition. Because economic unsustainability, global inequality, and environmental calamity share the same systemic roots, these crises must be addressed together, requiring movements to "embrace the unavoidable truth that deep structural change in the global economy is needed."[31] This work requires directly confronting the power of corporate control over energy resources,

[28] https://grassrootsfund.org/about-us/community-resilience (Accessed 4 October 2017)
[29] https://grassrootsfund.org/dollars/guiding-values (Accessed 4 October, 2017)
[30] http://unionsforenergydemocracy.org/resources/tued-publications/tued-working-paper-9-energy-transition-are-we-winning/ (Accessed 4 October, 2017)
[31] http://unionsforenergydemocracy.org/resources/tued-publications/tued-working-paper-4-power-to-the-people/ (Accessed 4 October, 2017)

infrastructures, markets, and our collective political imagination, leading to a change not only of energy sources but also to the full spectrum of unsustainable and unjust features of the dominant political economy. Representative of this perspective, TUED argues that "in common with other social movements, unions have in recent years begun to engage in a deeper questioning of the political economy of capitalism from both a climate and environmental standpoint and from a socioeconomic perspective."[32]

Mainstream narratives of green growth and ecological modernization are grounded in destructive neoliberal ideologies that prioritize profit, commodification, extractivism, deregulation, corporatization, privatization and marketization, support ongoing use of fossil fuels and increasing use of energy, and sustain patterns of economic precarity, financial insecurity, global austerity, and systematic "dismantling"[33] of the social welfare state. Future renewables-based energy systems are not achieved by making capitalism green and sustainable, or shifting economic and political power of fossil fuel corporations to large, for-profit renewable energy multinationals. This approach is an extension of existing unsustainability. A focus on maximizing short-term profit, making market conditions work for renewables, and creating incentives for private ownership of renewable generation fails to protect workers and vulnerable communities and effectively places the fate of humanity and the planet in the hands of private corporations and bankers. The logic of the market is not compatible with the basic survival of the human species and other life forms, and must be replaced by logics of non-market, needs-based approaches that bring economic life into alignment with social and ecological necessity.

Solutions are to be found primarily through a reassertion of public and social ownership of energy and other key economic sectors, central to a deep, democratic restructuring of the global political economy. This approach is the most and possibly only effective path toward decisively ending fossil fuels and deploying diverse (decentralized and centralized) renewable-based energy systems rapidly, equitably, and efficiently, while simultaneously protecting workers and communities, providing quality, stable employment, respecting ecosystems, and ensuring universal energy access. A public partnership approach requires democratization of public

[32] http://unionsforenergydemocracy.org/resources/tued-publications/tued-working-paper-2-climate-change-and-the-great-inaction-landing/ (Accessed 4 October, 2017)
[33] https://www.csn.qc.ca/actualites/a-la-recherche-dune-transition-juste/ (Accessed 6 October, 2017) (Translated from French)

renewable power systems and services in cooperation with communities and social movements, strategic regional and national energy planning and community development, revival of the manufacturing and transport sectors, and complete transformations of production and consumption patterns. As stated by CUPE, "Fighting for working people now and in the future is deeply interconnected with fighting to protect our planet from the disastrous effects of climate change. There is no radically new direction or simple solution for working people to achieve our goals."[34] Rather, this work builds on and revitalizes core principles of sustainable development and its combined economic, social, and environmental agenda, emphasizing access to decent work, economic development as social development, and respect for human rights and planetary limits. These efforts form part of long-term struggle for the common good led by working people, building on historical experience over the last century with responding to societal crises and advancing public works. This model now regains importance following decades of neoliberal policies and logics, including privatization of public assets and services, that have weakened the capacity of the public sector to address existing and future crises worldwide. Ensuring the survival of life on our planet is a moral and ethical responsibility.

Working in a spirit of solidarity, key agents include progressive trade unions and labor movements, energy sector workers, citizens, local community groups and civil society, governments at all levels, public agencies and municipal utilities, environmental, Indigenous, and racial justice movements, as well as left and progressive political parties. New technologies are the impetus for change, the public sector remains the central driver of change, and work remains a key defining activity of the human experience. Thus, "(i)t is clear that governments at all levels must lead and provide public investments to ensure that the public sector is front and centre in the new green economy."[35]Households and cooperatives may play an important role over time, but presently there are not enough localized initiatives in practice to significantly alter present trends, nor does a narrow focus on distributed generation address the pace and scale of change required to transform energy and economic systems, particularly the manufacturing sectors. Adversaries include groups advocating or aligning with mainstream green growth agendas, including wealthy federal, provincial, and state governments, current political leadership, corporatized and conservative political parties, traditional unions, private and

[34] https://cupe.ca/strategic-directions-2015-2017 (Accessed 5 October, 2017)
[35] https://cupe.ca/cupe-and-coalition-partners-rally-around-green-jobs (Accessed 5 October, 2017)

marketized state-owned fossil fuel corporations and investor-owned utilities, business interest groups, chambers of commerce and for-profit firms, well-established environmental groups, and mainstream global economic and political entities including the United Nations, the World Bank, the International Monetary Fund, and the World Trade Organization. Energy, water, transportation, and other critical public services are basic human rights and public goods, to be supported largely through public systems, including for example, "renewable public energy systems that are fully unionized."[36] Such systems are best controlled by ordinary people through partnerships with well-run and accountable public agencies and governmental leadership, using public works programs and diverse ownership models that provide decent, meaningful work and public-sector jobs, devolving power and decentralizing technologies as much as possible to workers, communities, and municipalities. Generation and transmission of renewable-based energy is returned to public control and ownership for meeting essential social and environmental priorities. This energy system will form the core of a new political economy grounded in social justice, equity, democracy, universality, and genuine sustainability.

5.3.4.3 Social movements

With the Paris Agreement and related international accords as impetus, local and global networks of social movements advance energy democracy, following systematic targeting of communities and regions for extreme or risky energy extraction and transport projects, and due to a growing recognition of global warming trends and associated impacts across the planet. As noted by 350.org, for example, "2016 was the hottest, most extreme year on record, causing misery for hundreds of millions around the world."[37]This lived experience, of large-scale fossil fuel projects, new coal and gas developments, fracking, pipelines, spills, contamination of water sources and arable land, and general expansions of the fossil fuel industry on one hand, and on the other, extreme weather events, deadly heat waves, severe droughts, loss of biodiversity, ocean acidification, melting glaciers, displacement of populations, and human misery stemming from a global climate crisis, compels widespread action to end fossil fuels and advance renewable energy. Climate change is real and impacting the global community now. Justice demands courageous action to avoid further climate and environmental catastrophe. All can and

[36] https://cupe.ca/sites/cupe/files/field_publication_past_issues/global_justice_winter_2017_e.pdf (Accessed 5 October, 2017)
[37] https://350.org/2016-annual-report/ (Accessed 5 October, 2017)

must contribute to this collective effort, as the issues are pressing and immense, requiring new ways of thinking, new modes of living, and diverse ways of learning among allies.

The most critical and urgent strategy is to "keep carbon in the ground."[38] Fossil fuel projects must be delayed and cancelled, bans and moratoria on all new projects and infrastructure must be adopted, and credible and coherent plans for transitioning to 100% renewable energy must be made and implemented rapidly. Within a global grassroots movement, direct actions, mass demonstrations, and civil disobedience are key elements of this agenda. Yet this approach goes beyond resisting fossil fuels. As asserted by Coule Pas Chez Nous, "Alternatives to fossil fuels already exist. They are numerous and diverse."[39] At the local level, this energy transition will therefore require rethinking ways of living, reducing consumerism, supporting low-carbon jobs, shifting to organic agriculture and permaculture, developing public transport, improving urban and community planning, and so on to reverse patterns of unsustainability, particularly in Western societies. This unsustainability is evidenced in the historical increase of atmospheric carbon dioxide. Civilization developed under specific and stable climatic conditions, yet as the use of fossil fuels increased and spread, the amount of carbon in the world's atmosphere and oceans has skyrocketed, now above 400 parts per million. Knowledge of global warming dates back more than a century. Since at least the 1970s, however, vested interests concerned with their bottom line have sought to create a sense of uncertainty regarding the science, contributing to a false debate that has prevented action and discouraged political leadership for decades.

Organizers, community groups, and regular people have therefore stepped up and mobilized to protect homes and livelihoods from the impacts of the fossil fuel industry and climate change. This mobilization of activists and citizens unites diverse peoples and institutions locally and globally working at all levels of society, including citizens, landowners, Indigenous and environmental organizations, local authorities, farmers, artists, students, researchers, religious leaders, labor unions, institutional investors, and especially frontline communities who are suffering the worst impacts. Together these groups directly confront the power of the fossil fuel industry and their allies in government and finance and apply pressure on government agencies and elected officials to take bold action toward a 100% renewable energy future for all. This shift

[38] https://350.org/about/ (Accessed 5 October, 2017)
[39] https://www.coulepascheznous.com/alternatives/ (Accessed 8 October, 2017)

to a renewable economy based around sharing, mutual help and solidarity will help create viable livelihoods across the globe and contribute to "a just, prosperous, and equitable world built with the power of ordinary people."[40]

[40] https://350.org/about/ (Accessed 5 October, 2017)

Table 5.3. Comparative summary of variants of energy democracy transition narratives

Elements of transition narratives	Local and regional communities	Public partnerships	Social movements
Collective-action frames	Ongoing trends at the local and global levels and an inability to meet community needs have inspired groups to work together on problems of insufficient community resilience, fossil fuel dependence, and complexity and expense of energy systems by advancing community-based initiatives, including cooperatives and community-owned energy businesses, grassroots and local activism, and citizen engagement and decision-making.	Failures of mainstream efforts and global agreements to achieve the change required have motivated action targeting the systemic roots of social, environmental, and economic problems, by shifting energy and other economic sectors to public and social control, democratically restructuring and reprioritizing governments, and increasing community planning and development, public investments, and public works programs.	Experienced local impacts, risks of energy extraction and transport, growing social movements, and policy changes at all levels has stirred direct action to confront the global climate crisis, fossil fuel expansion, and global inequities, by mobilizing to keep fossil fuels in the ground, stop industry expansion, and experiment with local sustainable livelihoods and new modes of living.
Discourses	Community health and resilience; secure jobs; participation and ownership; citizen and community control.	Rejection of green growth agenda and other neoliberal ideologies; just transition and empowerment of workers and communities; global solidarity; genuine sustainability.	Urgency of climate change; shared responsibility and shared benefits of transition; grassroots action; strategic alliances; energy and environmental justice.
Sociotechnical imaginaries	Localized, efficient, decentralized and democratically-controlled renewable energy powering local living economies and healthy, resilient, just, and environmentally sustainable communities.	Just, equitable and democratic societies and new political economies providing meaningful work, renewable energy, and other services as public goods and human rights while respecting planetary limits.	Strengthened local and global communities built by ordinary people using renewable energy to support viable livelihoods and a just, prosperous, and equitable world for all.

Stories	Everyday people working within and across local communities, grounded in a strong sense of place and empowered to overcome large financial interests and energy utilities, work toward long-term community resilience and economic and civic renewal.	Alliances of progressive labor movements, energy sector workers, citizens, and governments at all levels, building on a history of collective struggle and past accomplishments, confront established centers of economic and political power and restructure political economies.	Networks of community groups, social movements and frontline communities, resolved to resist the fossil fuel industry and their allies and expose their misinformation campaigns, reverse historic global inequities and end the fossil fuel era.

5.3.5 Relating attribute values by type of energy democracy

Charting EDI cases by selected attributes suggests similarities and differences of attribute values for each type of energy democracy. Within the "Local and regional communities" group, the two EDIs are located within the U.S. in relatively smaller towns. The organizations were initiated in 1996 and 2002. These EDIs include a cooperative and a hybrid community-based/non-governmental organization. Both indicated a bottom-up leadership approach and included a regional focus. These EDIs differed in their social-ecological emphasis and their breadth of focus. Both looked to renewable energy generally with a focus on solar photovoltaics.

The three EDIs within the "Public partnerships" type are located in major metropolitan areas in Canada and the U.S. This group includes the two organizations in operation for the longest period of time. The three EDIs include non-governmental trade unions and hybrid (non-governmental/public) organizations partnering with trade union organizations. All were characterized as a hybrid top-down/bottom-up leadership approach and a holistic breadth of focus. These organizations differed in their social-ecological emphasis and their geographic scope, and described renewable energy generally or did not specify favored technologies.

For EDIs of "Social movements," initiated in 2008 and 2014 in Canada and the U.S., both are bottom-up, nongovernmental/non-profit organizations emphasizing social and ecological dimensions, and differing in breadth of focus and geographic scope. One EDI indicated specific renewable technologies while the other indicated all renewables. The two remaining organizations relating more broadly across all types are located in metropolitan areas in Canada and the U.S. Both are community-based organizations initiated in 2015 with a holistic breadth of focus. These EDIs differed in their leadership model, social-ecological emphasis, geographic range, and both looked to renewable energy technologies generally.

5.4 Discussion

In contrast to conventional narratives of energy transition, this research finds a set of long-standing as well as recently emerging organizations and programs across the region organizing around the term and/or goals of energy democracy, in effort to advance a transformative shift from fossil fuels to renewable energy. The energy democracy initiatives take a variety of organizational forms, embrace bottom-up and in some cases combine top-down leadership models, emphasize ecological and especially social dimensions and outcomes, and often bring a

holistic lens to the work. The EDIs work across geographic scales and often organize around renewable energy systems generally rather than specific technologies. Broadly, the evidence suggests that these initiatives can reasonably be characterized as critical (rather than liberal) (Tarhan, 2017, p. 17), democratic (rather than technocratic) (Montgomery, 2016, pp. 1982–1983), reconfiguration or revolutionary (rather than reformist) (Geels et al., 2015, p. 9) and potentially transformative (Avelino et al., 2017, p. 4) positions of energy democracy, social innovation, and sustainability transition. They thus do represent counter-narratives and the mobilization of counter-publics (Hess, 2017) engaged in efforts to articulate and serve a broad and reimagined public interest. Together these efforts demonstrate a clear example of diverse publics actively engaging in energy transition (Miller et al., 2015) and re-politicizing narratives of energy transition (Meadowcroft, 2009; Stirling, 2014).

The study uncovers a distinct set of archetypical transition narratives for this region (Luederitz et al., 2017, p. 404), finding both a convergence and divergence among them. Similar to the three energy democracy approaches described by Becker and Naumann (2017), these regional narratives converge around a shared commitment to high levels of renewables, a preference for public and local control over energy systems, and a view of energy change as inseparable from broader changes to communities, politics, and economies. In this view, social, economic, ecological, and energic crises are fundamentally intertwined; all will change together and all must be addressed together. Framings for collective actions demonstrate a shared set of motivating events that link impacts to communities and global trends, agreements, and failures. Action is largely directed toward addressing climate change and fossil fuel dependence. In proposing solutions, these transition narratives shift away from market-based energy systems. Rather, this set of EDIs, "united in championing new modes of organisation that break with international regimes of accumulation in the energy sector" (Becker & Naumann, 2017, p. 9), emphasize a broad set of organizational solutions centered on communities and the public sector and based on alliances and integration among diverse social movements. This integrated stance regarding technological change is further evidenced by the tendency among these narratives to seek solutions in renewable energy technologies in a general rather than specific sense, suggesting that energy democracy as expressed here considers the non-technological dimensions of energy systems change at least as important if not more so than the technological dimensions. Likewise, among these groups, less attention has been given to critically assessing specific

renewable energy technologies and the degree to which different technical systems may support an energy democracy agenda, which may indicate either a gap in knowledge, an unexamined belief, or an implicit rejection of technological determinism. The narratives each express values of responsibility and capacity to act, participation, cooperation, equity, and sustainability, envisioning shared engagement with energy systems that support a prosperous and just future, emphasizing meaningful work and sustainable livelihoods. Perhaps most notably, these narratives identify a shared set of adversaries, while emphasizing the interconnected roles of public partnerships and trade unions, local and regional communities and cooperatives, diverse groups of social movements, and similar to Szulecki (2018), the importance of citizens in steering the energy transition and owning and controlling renewable energy futures.

This shared energy democracy counter-narrative draws from the voices of groups presently active across this region who utilize and self-define this notion of energy democracy through their public communications, rather than drawing upon theoretically-derived concepts (Hess, 2018). The shared regional narrative suggests an available and potentially effective alternative to dominant narratives, their positioning of the private sector and for-profit corporations as the key agents of change, and their scope of available energy policies and politics that are increasingly viewed as insufficient to the task of transition. The findings suggest transformative potential of this set of initiatives by linking transition narratives with innovation of energy systems and broader macro-level trends and events to produce social transformation (Avelino et al., 2017). The regional energy democracy narrative may prove more effective by providing a shared and inclusive statement of what, why, how, and for whom members of these organizations and their associated communities across political jurisdictions and sectors of society are taking action (Bushell et al., 2017). The practical implication then is that the functions of these initiatives and their narratives are not mutually exclusive and may facilitate joint policy-making and activism (Becker & Naumann, 2017). Employed flexibly and strategically as a co-productive synthesis, a shared narrative may serve to complement, integrate, and tie together diverse initiatives, organizations, and campaigns for energy systems change, increasing their collective prominence and motivating action toward a positive and comprehensive vision of the future (Avelino et al., 2017; Becker & Naumann, 2017; Bushell et al., 2017; Hess, 2018; Jasanoff, 2015; Moezzi et al., 2017).

Differences across all elements of transition narratives also suggest the possibility for a diversity of counter-narratives for the region. For collective-action frames, there is difference in the degree of focus on local lived experiences, with social movements especially motivated by experiences with specific risks and events impacting local communities. The framings of problems overlap, yet as with the associated attributes, a more holistic breadth of focus was found within the narratives of public partnerships and social movements, which place greater emphasis on systemic problems. This problem framing then points to differences in proposed solutions, with the narrative of local and regional communities proposing positive, community-oriented, and often policy-based solutions while saying little about struggle or opposition. The narrative of public partnerships and social movements are fundamentally organized around struggle and conflict, with the former emphasizing more targeted political change and comprehensive planning and the latter emphasizing broad but arguably less defined cultural change. The narratives also diverge in their emphasis regarding which modes of social organization, e.g., local businesses, cooperatives, municipalities, and other governments, should be supported, developed, and reformed. The social movement narrative appears to offer relatively less specificity on organizational reforms as solutions, whereas the local and regional narrative emphasizes local organizations as solutions and public partnerships emphasizes multi-scalar public restructuring.

Beyond general convergence around a core set of values and future visions, the findings suggest that the public partnership and social movement narratives express a stronger critical or oppositional positioning and commitment to global solidarity. The imaginaries of the local and regional, public partnership, and social movement narratives are respectively constructed to work primarily at the local, trans-local, and national/transnational levels. While the narratives converge around the element of stories, important differences are found with respect to the key agents of change within broadly shared alliances, the degree of specificity of adversaries, and the set of historical experiences that the current work is understood to extend. The main agents of change are identified by the names given to each narrative of energy democracy, with public partnerships underscoring the role of state and local governments relative to the positioning of groups of citizens as change agents in the other two narratives. The local and regional narrative refers to adversaries in vague terms and lacks a depth of engagement with the core issue of social power, while public partnership and social movement narratives generally name specific

individuals or entities as a way to target key loci of power, albeit emphasizing different levels of governance. Convergence around futures interestingly stem from diverse historical experiences, where once again the public partnership and social movement narratives include a greater emphasis on historical conflict (extended or more recent) while the local and regional narrative seems to connect past and future not through conflict but as recovery, suggesting a yearning for a lost ideal of self-determined communities. Overall, these findings imply differences regarding the possibility for energy democracy to connect, empower, or disempower specific social groups, to include robust theories of change and obduracy, to focus on specific institutional change, to resist negative as well as promote positive agendas, and to work across scales.

Minding these potential differences among this set of energy democracy narratives allows for speculation regarding their potential value as counter-narratives for social transformation. While collectively an energy democracy narrative serves to bridge differences across social groups (Hess, 2018, p. 180), the narrative of local and regional communities may offer less capacity for bridging groups or influencing policy changes or technological solutions at larger scales (i.e., energy system regime) as compared to the other narratives. Likewise, given their greater emphasis on historical episodes, specific adversaries, imbalances of social power, and negative as well as positive dimensions of the future, public partnership and social movement narratives may prove more useful for helping agents make sense of and respond to past, present, and future events or trends and better appreciate what is at stake. These narratives do not focus narrowly on political targets but rather offer broad and detailed visions that may lead to more integrated approaches and a wider set of solutions for renewable energy transitions (Moezzi et al., 2017). On the other hand, the local and regional narrative, and the social movement narrative to some degree, may serve to inspire concrete actions by emphasizing direct benefits of renewable energy to people's everyday lives and by stressing local community identity, thus appealing to psychological and sociological drivers of behavior change (Bushell et al., 2017). Further, an emphasis on the role of marginalized or vulnerable communities, as articulated in the social movement narrative, may more effectively change who speaks and whose voice is heard in the process of energy transitions. Of course, this assessment can only point toward transformative potential. Ultimately the effectiveness of any narrative requires evaluation with respect to its ability to lead to action toward and achievement of a desirable future (Bushell et al., 2017).

These transition narratives may likewise vary in the degree to which they can be considered as counter-narratives to the neoliberal hegemony (Geels et al., 2015, p. 9). The narratives of public partnerships and social movements appear firmly positioned within the reconfiguration or revolutionary positions, whereas the narrative of local and regional communities appears flexible regarding the reformist position, in line with the analyses of Luederitz et al. (2017, p. 397) and Tarhan (2017, p. 17), and thus potentially more vulnerable to cooptation (Angel, 2016, p. 11). This claim has less to do with the solutions, visions, or futures that this narrative describes, and more to do with a lack of breadth and depth of analysis of historical context, problems, and adversaries. In other words, the concern involves not so much what is in but rather what is left out of the narrative, perhaps overemphasizing the opportunities of renewables while neglecting engagement with the realities of current energy systems. There is similarly an important difference in terms of the stance on the future of fossil fuels across narrative types; what role fossil fuels will serve going forward, and how, if at all, energy democracy will engage, and even democratize, these currently dominant energy systems while concurrently developing systems based on renewables. Does a democratized energy system largely ignore hydrocarbons, fight to keep them in the ground, or use them strategically to support energy transition and protect the most vulnerable? Each narrative appears to take a different position on this question.

Following Geels et al. (2015), the more revolutionary narratives face threats of another sort, possibly limiting their potential for affecting deep social change through energy transition. Rather than broad societal change, a more targeted or subject-specific focus (Orenstein & Shach-Pinsley, 2017, pp. 250–251) limited to overhauling and democratizing modern energy systems (Geels et al., 2015; Szulecki, 2018), still far from simple, may yield greater gains. In other words, there may be benefit for these initiatives to further reflect on the necessary balance between a holistic and issue- or sectoral-specific focus to successfully achieve outcomes, in the same way that they appear to have presently found a balance, as a group, between top-down and bottom-up leadership, social and ecological emphasis, and diversity of spatial scales (Orenstein & Shach-Pinsley, 2017). Targeted projects focusing on changing the energy sector offer the additional benefit of learning-by-doing, blending testable approaches, small-scale yet networked experimentation, and use of both top-down and bottom-up leadership (Mason, 2015, p. 265)

This analysis therefore tentatively proposes three different approaches or layers of energy democracy across the region, with degrees of difference related to the problem framings, the form and specificity of solutions, the critical stance, the historical positioning, and importantly, the scale, agency and mode of social organization. From another point of view, we could describe these narratives as representing rather multiple *energy democracies* (Hess, 2018, pp. 185–186), due to their varied meanings, emphases, implications, and transformative potential (Avelino et al., 2017; Rivera-Ferre, 2018). Theoretically, these multi-layered differences complicate efforts to characterize or position energy democracies along typical binary divisions (e.g., centralized-decentralized, reformative-transformative) although such distinctions may be usefully applied in further analysis. In their performance, these multiple energy democracies and their narratives will likely vary in who they bring together, at what scale they operate, and in how they effectively empower, confront, or constrain social groups, provide sense of meaning and explanation of events, and justify targeted policy, organizational, and behavioral changes.

These perceived differences across narratives are not necessarily a disadvantage for advancing energy democracy. Firstly, the narratives are correctly understood as plausible rather than definitive interpretations or representations of the perspectives of these initiatives and their members. Likewise, as illustrated in Figure 5.1, this research finds considerable overlap among transition narratives, so the distinctions drawn should in themselves be considered flexible both theoretically and practically. This flexibility across counter-narratives may prove an advantage in targeting or bridging specific audiences while retaining a fundamental distinction and meaning (Bushell et al., 2017). Additionally, the priorities of one narrative can be used to broaden or shift the emphasis of another. For example, the public partnership narrative arguably holds the broadest formulation of the issue of social power, the social movement narrative focuses sharply on the issue of ending fossil fuels, while the local and regional community narrative carries a strong commitment to involving everyday people working in places of meaning.

Lastly, given a democratic agenda, such differences may not only be unavoidable but also desirable (Hansen & Sonnichsen, 2014; Mouffe, 2014b), as diverse groups struggle to develop and implement a new form of hegemony based on a values and norms centered on justice and sustainability. This suggests the emergence of what democratic theorist Chantal Mouffe describes as a *conflictual consensus*, a situation in which social agents share a commitment to a

set of ethical and political principles yet disagree about their interpretation (Hansen & Sonnichsen, 2014, p. 268). While currently offering a counterhegemonic approach, these diverse counter-narratives of energy democracy within this region may offer the basis for engagement as political contestants, rather than political enemies, through ongoing democratic argument *within* a democratized energy future, in the endless quest to achieve outcomes such as justice and sustainability. This view of energy democracies suggests multiple and competing energy transition pathways and political projects that engage through processes of political conflict as well as continuous dialogue and co-learning (Bushell et al., 2017; Luederitz et al., 2017). In this way, the presence of a variety of positions as and within energy democracy at this moment of pre-figuration is a potential strength, offering both a shared opposing stance as well as multiple interpretations for defining and refining visions and imaginations of new energy politics, new energy cultures, and new energy futures.

5.5 Conclusion

This analysis of public narratives finds and compares energy democracy counter-narratives that have emerged through use and promotion among organizations active across eastern Canada and the northeast United States. Across this region, energy democracy as a narrative for energy transition converges not only around a shared commitment to shifting to renewable energy systems, but crucially using collective control and in a transformative manner for communities, politics, and economies. A comparison across four elements of transition narratives identifies difference in themes and emphases, suggesting three plausible, distinct, and potentially competing approaches to energy democracy, or multiple energy democracies, described as local and regional communities, public partnerships, and social movements. The intention here is not to propose these narratives as factual representation of energy democracy, rather to offer them and their principle elements as useful means for thinking about differences within an emerging phenomenon, open to further analysis, verification, and revision. As such, the value of this typology is both descriptive, in identifying and sharpening differences, and analytical, in drawing out implications of these differences.

This research has taken a step toward allowing these diverse groups to hear and learn from one another. Recognizing that actors can project but never fully control transition narratives (Bushell et al., 2017), the practice of energy democracy may take into consideration these dynamics of

convergence and divergence when communicating with different groups of people, mapping out alliances, and considering their strategic integration and experimentation. There may be benefit in networking across differences, to leverage the diversity of attributes across complimentary initiatives, adapt to changing circumstances, resist dominant agendas, and increase capacities and resilience across the region. For example, governments and the public sector could prioritize development of capacities at the community level, communities could give more attention to the wide ranging and holistic demands and perspectives of a broadly defined public, while social movements could benefit from strong partnerships with governments and communities.

Further research could build on this work in several ways. Although this research offers an approach to standardizing search methods, online research may miss important instances of energy democracy initiatives, and therefore the procedure for discovering and selecting these cases could be further tested and refined. More broadly, methods can be advanced for reconstructing and analyzing transition narratives in terms of their production and role as well as their content (Wittmayer et al., 2015). Expanding the set of initiatives included for analysis and providing greater empirical substantiation would clearly be an important next step to confirm or modify the groupings and narratives as suggested here. The data set provides a basis for this expansion (Burke, 2018), including at the time of this research an additional 44 organizations or programs across the region for which further inquiry may yield sufficient evidence for analysis (see Supplementary Material in appendix to this chapter). A systematic assessment of differences would benefit from such an engagement with a broader set of initiatives. Connecting more directly with French-language scholarship on sustainability transitions would also be worthwhile for this region (e.g., Audet, 2015).

Conversely, while this work takes a high-level, regional perspective, a targeted approach with individual cases and narratives is also strongly encouraged. Leveraging the strengths of initiative-based learning for sustainability transitions (Turnheim et al., 2015), more direct engagement with members of these initiatives, through surveys based on the attributes, case study analysis, and ethnographic and participatory methods would serve to strengthen and sharpen these findings while changing the voices, shifting the logics, opening new solution space, and contributing to coherent yet transformative proposals for political and cultural change. The understanding of transition narratives and supporting organizations could benefit from a

deeper exploration of the degree and importance of differences for core analytical concepts including especially social power, social movements, and processes of sociotechnical change. While this research cannot offer explanatory power for the differences in transition narratives, it does suggest lines of inquiry, for example, exploring the influence of organizational history and type, and physical location. A variety of analytical, comparative and reflective approaches and uses for narratives are available (Avelino et al., 2017; Becker & Naumann, 2017; Jasanoff, 2015; Moezzi et al., 2017; Paschen & Ison, 2014) as well as complementary approaches such as modeling and historical research on regional transitions, which could help to overcome limitations of initiative-based learning (Turnheim et al., 2015). Likewise, energy futures research based on these narratives may help build capacity among relevant social groups to understand and transform energy systems and inform democratic debate and technological development (Grunwald, 2011; Miller et al., 2015). To get at actual performance of initiatives and further contribute to transition studies involving social-ecological-technical systems, research could further develop the data base of attributes and specifically the set of outcomes expressed here, into workable indicators and measures of both social and ecological performance (Cherp et al., 2018; McGinnis & Ostrom, 2014).

Overall, this research contributes to practice and scholarship of sustainability transitions by clarifying and amplifying an emergent transition narrative and diverse yet complementary counter-narratives, examining and comparing transition narratives at the regional level, and initiating a data set for future research on regional social-ecological-technical systems to strengthen initiative-based practice and learning and support diverse and participatory analytical approaches.

Author contributions

The author confirms being the sole contributor of this work, is fully responsible for its content, and approved its publication.

Funding

This research was supported by the Social Sciences and Humanities Research Council of Canada and the Economics for the Anthropocene program at McGill University.

Acknowledgments

This research has benefited from the efforts and insights of colleagues at the Energy Democracy Symposium at The University of Utah, July 2017. The author acknowledges the many helpful suggestions and comments of the three reviewers and the topic editor, resulting in a substantially improved manuscript. The author expresses gratitude for the support of library staff at McGill University including Jane Burpee, Emily MacKenzie, and Berenica Vejvoda, Dessislava Kirilova at QDR, and comments from Conrad Kunze, Derya Tarhan, David Hess, and Jennie Stephens, among others. This work is dedicated to the many people across this region working to advance a just and sustainable renewable energy future.

References

Angel, J. (2016). *Strategies of Energy Democracy*. Brussels, Belgium: Rosa-Luxemburg-Stiftung. Retrieved from http://www.rosalux.eu/publications/strategies-of-energy-democracy-a-report/

Audet, R. (2015). Le champ des sustainability transitions: origines, analyses et pratiques de recherche. *Cahiers de recherche sociologique*, (58), 73–93. https://doi.org/10.7202/1036207ar

Avelino, F., Wittmayer, J. M., Pel, B., Weaver, P., Dumitru, A., Haxeltine, A., … O'Riordan, T. (2017). Transformative social innovation and (dis)empowerment. *Technological Forecasting and Social Change*. https://doi.org/10.1016/j.techfore.2017.05.002

Becker, S., & Naumann, M. (2017). Energy democracy: Mapping the debate on energy alternatives. *Geography Compass*, *11*(8), e12321. https://doi.org/10.1111/gec3.12321

Burke, M. (2018). *Energy democracy in northeastern North America*. Qualitative Data Repository. [QDR Main Collection]. https://doi.org/10.5064/F6BUAX58

Burke, M. J., & Stephens, J. C. (2017). Energy democracy: Goals and policy instruments for sociotechnical transitions. *Energy Research & Social Science*, *33*, 35–48. https://doi.org/10.1016/j.erss.2017.09.024

Bushell, S., Buisson, G. S., Workman, M., & Colley, T. (2017). Strategic narratives in climate change: Towards a unifying narrative to address the action gap on climate change. *Energy Research & Social Science*, *28*, 39–49. https://doi.org/10.1016/j.erss.2017.04.001

Cherp, A., Vinichenko, V., Jewell, J., Brutschin, E., & Sovacool, B. (2018). Integrating techno-economic, socio-technical and political perspectives on national energy transitions: A meta-theoretical framework. *Energy Research & Social Science*, *37*, 175–190. https://doi.org/10.1016/j.erss.2017.09.015

Davis, J. E. (2002). Narrative and social movements: The power of stories. In J. E. Davis (Ed.), *Stories of Change: Narrative and social movements* (pp. 3–30). Albany, NY: State University of New York Press.

Eaton, W. M., Gasteyer, S. P., & Busch, L. (2014). Bioenergy Futures: Framing Sociotechnical Imaginaries in Local Places. *Rural Sociology*, *79*(2), 227–256. https://doi.org/10.1111/ruso.12027

Geels, F. W., McMeekin, A., Mylan, J., & Southerton, D. (2015). A critical appraisal of Sustainable Consumption and Production research: The reformist, revolutionary and reconfiguration positions. *Global Environmental Change*, *34*, 1–12. https://doi.org/10.1016/j.gloenvcha.2015.04.013

Gibbs, D., & O'Neill, K. (2017). Future green economies and regional development: a research agenda. *Regional Studies*, *51*(1), 161–173. https://doi.org/10.1080/00343404.2016.1255719

Grunwald, A. (2011). Energy futures: Diversity and the need for assessment. *Futures*, *43*(8), 820–830. https://doi.org/10.1016/j.futures.2011.05.024

Hansen, A. D., & Sonnichsen, A. (2014). Radical democracy, agonism and the limits of pluralism: an interview with Chantal Mouffe. *Distinktion: Scandinavian Journal of Social Theory*, *15*(3), 263–270. https://doi.org/10.1080/1600910X.2014.941888

Hess, D. J. (2017). *Undone Science: Social Movements, Mobilized Publics, and Industrial Transitions*. Cambridge, MA: The MIT Press.

Hess, D. J. (2018). Energy democracy and social movements: A multi-coalition perspective on the politics of sustainability transitions. *Energy Research & Social Science*, *40*, 177–189. https://doi.org/10.1016/j.erss.2018.01.003

Jasanoff, S. (2015). Future Imperfect: Science, Technology, and the Imaginations of Modernity. In S. Jasanoff & S.-H. Kim (Eds.), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (pp. 1–33). Chicago; London: University of Chicago Press.

Jasanoff, S., & Kim, S.-H. (2009). Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea. *Minerva*, *47*(2), 119–146. https://doi.org/10.1007/s11024-009-9124-4

Kunze, C., & Becker, S. (2015). Collective ownership in renewable energy and opportunities for sustainable degrowth. *Sustainability Science*, *10*(3), 425–437. https://doi.org/10.1007/s11625-015-0301-0

Lieberman, J. L., & Kline, R. R. (2017). Dream of an Unfettered Electrical Future: Nikola Tesla, the Electrical Utopian Novel, and an Alternative American Sociotechnical Imaginary. *Configurations*, *25*(1), 1–27. https://doi.org/10.1353/con.2017.0000

Luederitz, C., Abson, D. J., Audet, R., & Lang, D. J. (2017). Many pathways toward sustainability: not conflict but co-learning between transition narratives. *Sustainability Science*, *12*(3), 393–407. https://doi.org/10.1007/s11625-016-0414-0

Mason, P. (2015). *Postcapitalism: a guide to our future* (1st American Edition). New York: Farrar, Straus and Giroux.

McCarthy, J. (2015). A socioecological fix to capitalist crisis and climate change? The possibilities and limits of renewable energy. *Environment and Planning A*, *47*(12), 2485–2502. https://doi.org/10.1177/0308518X15602491

McGinnis, M. D., & Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society*, *19*(2). https://doi.org/10.5751/ES-06387-190230

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, *42*(4), 323–340. https://doi.org/10.1007/s11077-009-9097-z

Miller, C. A., O'Leary, J., Graffy, E., Stechel, E. B., & Dirks, G. (2015). Narrative futures and the governance of energy transitions. *Futures*, *70*, 65–74. https://doi.org/10.1016/j.futures.2014.12.001

Moezzi, M., Janda, K. B., & Rotmann, S. (2017). Using stories, narratives, and storytelling in energy and climate change research. *Energy Research & Social Science*, *31*, 1–10. https://doi.org/10.1016/j.erss.2017.06.034

Montgomery, T. (2016). Are Social Innovation Paradigms Incommensurable? *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, *27*(4), 1979–2000. https://doi.org/10.1007/s11266-016-9688-1

Mouffe, C. (2014a). Democratic Politics in the Age of Post-Fordism. *Pavilion: Journal for Politics and Culture*, *17*, 62–69.

Mouffe, C. (2014b). Agonistic Democracy and Radical Politics. Retrieved November 10, 2017, from http://pavilionmagazine.org/chantal-mouffe-agonistic-democracy-and-radical-politics/

Nye, D. E. (2003). *America as second creation: technology and narratives of new beginnings*. Cambridge, Mass.: MIT Press.

Orenstein, D. E., & Shach-Pinsley, D. (2017). A Comparative Framework for Assessing Sustainability Initiatives at the Regional Scale. *World Development*, *98*, 245–256. https://doi.org/10.1016/j.worlddev.2017.04.030

Paschen, J.-A., & Ison, R. (2014). Narrative research in climate change adaptation—Exploring a complementary paradigm for research and governance. *Research Policy*, *43*(6), 1083–1092. https://doi.org/10.1016/j.respol.2013.12.006

Rivera-Ferre, M. G. (2018). The resignification process of Agroecology: Competing narratives from governments, civil society and intergovernmental organizations. *Agroecology and*

Sustainable Food Systems, *42*(6), 666–685. https://doi.org/10.1080/21683565.2018.1437498

Stirling, A. (2014). Transforming power: Social science and the politics of energy choices. *Energy Research & Social Science*, *1*, 83–95. https://doi.org/10.1016/j.erss.2014.02.001

Sweeney, S., & Treat, J. (2017). *Energy transition: Are we winning?* (Working Paper No. 9). New York, New York: Trade Unions for Energy Democracy. Retrieved from unionsforenergydemocracy.org

Szulecki, K. (2018). Conceptualizing energy democracy. *Environmental Politics*, *27*(1), 21–41. https://doi.org/10.1080/09644016.2017.1387294

Tarhan, M. D. (2017). Renewable Energy Co-operatives and Energy Democracy: A Critical Perspective. Presented at the Canadian Association for Studies in Co-operation, Toronto, ON. Retrieved from https://www.researchgate.net/publication/317369738_Renewable_Energy_Co-operatives_and_Energy_Democracy_A_Critical_Perspective

Tidwell, J. H., & Tidwell, A. S. D. (2018). Energy ideals, visions, narratives, and rhetoric: Examining sociotechnical imaginaries theory and methodology in energy research. *Energy Research & Social Science*, *39*, 103–107. https://doi.org/10.1016/j.erss.2017.11.005

Turnheim, B., Berkhout, F., Geels, F., Hof, A., McMeekin, A., Nykvist, B., & van Vuuren, D. (2015). Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges. *Global Environmental Change*, *35*, 239–253. https://doi.org/10.1016/j.gloenvcha.2015.08.010

Wesley, J. J. (2014). The qualitative analysis of political documents. In B. Kaal, I. Maks, & A. V. Elfrinkhof (Eds.), *From text to political positions: Text analysis across disciplines* (Vol. 55, pp. 135–159). Amsterdam; Philadelphia: John Benjamins Publishing Company.

Wittmayer, J. M., Backhaus, J., Avelino, F., Pel, B., Strasser, T., & Kunze, I. (2015). *Narratives of change: How Social Innovation Initiatives engage with their transformative ambitions* (working paper #4). Rotterdam: TRANSIT.

Conflict of Interest Statement: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix to chapter 5: detailed description of materials and methods

Case selection and data collection and access

Following Kunze and Becker (2015), the set of EDIs to be included for analysis of transition narratives was identified through a systematic process of online searches and evaluation of evidence, initially targeting 5 to 10 EDIs for each province and state within the region. Suitable organizations and programs were selected from those based in northeastern North America as defined by the following twelve provincial and state jurisdictions that constitute the Northeast Power Coordinating Council regional interconnection: Connecticut, Maine, Massachusetts, New Brunswick, New Hampshire, New York, Nova Scotia, Ontario, Prince Edward Island, Québec, Rhode Island, Vermont. Four criteria were used to identify and select an organization or program for inclusion in the set of EDIs working toward renewable energy transition in the selected region:

1) Initial discovery of the organization or program using selected search terms AND
2) explicit use of the term "energy democracy" either by the organization or program or by a secondary source in reference to the organization or program OR
3) evidence of support for energy democracy goals and outcomes, OR
4) evidence of advocacy for or implementation of energy democracy policy instruments (Burke & Stephens, 2017).

To be included in the set of EDIs, an organization or program must have met criteria #1 and at least one of the criteria #s 2-4, of which criterion #2 was considered the strongest and criterion #4 the weakest evidence that the organizations or program represents an EDI. Organizations or programs were identified as EDIs through an initial set of online searches performed in August 2017. This step also identified a first data source for each organization or program as a unique website or URL link. The set of potential EDIs and initial sources were discovered using search

engine-based desktop research and relevant key words. Search engines included DuckDuckGo and Google. Initial search terms included “energy democracy” and each selected province or state (e.g., energy democracy AND Ontario). Websites and URL links in English and French were reviewed (using Google Translate from French to English as needed) when referring to an organization or program operating within the targeted province or state and having demonstrated activity during the period 2013 to 2017. The websites and URL links returning at the top of the search results were assessed for inclusion in the data set according to the selection criteria, avoiding duplicates and combining groups when an umbrella organization or merger of organizations was identified. When both a local and a central office were available within the selected region, only the central office was included. Organizations operating at the national or federal levels were not included unless it was clear that they also operate at the provincial or state level, in which case it was included within the jurisdiction operating the central office. Similarly, organizations operating across multiple states were included within the jurisdiction in which the initiative was first discovered using this search procedure. This process identified 73 potential EDIs across all jurisdictions, ranging from 2 to 10 EDIs per jurisdiction.

The next step involved performing a second set of internet searches to identify additional sources for each EDI and assessing the strength of evidence for inclusion as an EDI. In September 2017, the second set of searches was performed as above but using the name of the EDI as the new search term. Additional sources were also discovered within the source selected through the initial search, for example, through a URL link. This second search process was repeated until a total of 2-4 sources were identified for each EDI. A greater number of sources were identified in the case that the first source used to find the EDI offered little information on the EDI, for example, a blog post that simply provides a link to the program. One of the sources must have been a primary source derived directly from the organization or program (e.g., the organizational website or annual report) and one source must have been secondary derived from an organization or outlet independent from the initiative (e.g., a media report or website of an organization broadly advocating for energy democracy). Sources were then reviewed and confirmed according to selection criteria and availability of primary and secondary sources for each organization, resulting in a set of 53 EDIs.

For this initial research on EDIs, the set was further reduced based on an assessment of strength of evidence according to the above criteria as well as geographic diversity. Because the priority here is to find those groups who self-identify with the term and movement, data were collected only for those EDIs using the term energy democracy within their primary sources to communicate publicly, and also having a secondary source using the term or the goals in its communication regarding the organization. An exception was made for organizations based in Québec because the English-language term "energy democracy" was not expected to necessarily translate to this context. Québec cases were ranked according to the remaining criteria. To support geographic diversity, no more than 3 EDIs were selected for any single jurisdiction. Fourteen organizations met these criteria. Those organizations not selected were noted for potential selection in the future. Together, these examples formed the basis of an original data base of energy democracy initiatives for the region.

A series of preliminary researcher-completed surveys of primary sources were then performed by the researcher to characterize each EDI according to a set of features and attributes, and to assess the breadth of evidence available for further analysis. At this time, the survey is not intended for use with non-researcher respondents, rather the researcher completes the survey using publicly available sources. The survey instrument was structured to include the following attributes for sustainability initiatives within social-ecological-technical systems at the regional scale (based on McGinnis and Ostrom (2014) and Orenstein and Shach-Pinsley (2017)): name and researcher-assigned identifier of the EDI; city or town; province or state; postal or zip code; year of initiation; organization type (public, private, nongovernmental/nonprofit, community-based, cooperative, hybrid); initiation or leadership approach (top-down, bottom-up or hybrid); social and ecological performance measures; social-ecological emphasis (social, ecological, social-ecological); breadth of focus (holistic or specific issues); geographic range/spatial scale (local, regional, national, global, cross-scalar); and available technologies (e.g., solar photovoltaics, wind, hydroelectric, all renewables). The survey of sources yielded responses or values for each attribute, which were collected within a spreadsheet data base. Due to a limited breadth of evidence for several EDIs, the set used for further analysis was then reduced to nine cases.

Having established the set of EDIs and their associated data sources to be included in this research on narratives (Moezzi et al., 2017), the final step of the process of initial data collection

involved collecting the text data from each source for each EDI. Text data were derived exclusively from publicly-available sources including website content, archival records and documents. Primary and secondary sources therefore yielded text data in the form of downloadable files or web content. Downloadable files were collected as and/or converted to PDF (.pdf) file format using PDF version 1.7 (Acrobat 8.x). For websites, text data were collected as PDF sources using NCapture 1.0.206.0 within QSR International's NVivo 11 Pro qualitative data analysis Software, using the "Article as PDF" option (.ncvx). French-language documents and websites were translated to English using Microsoft Translator and Google Translate, respectively. Translations of surveys and text data were verified through review of text samples by a colleague fluent in French language of Québec. Collectively, text documents including both downloadable files and collected web content constitute the text source data on the EDIs for this research. Raw text data for each EDI thus includes primary source data (text from the organizational website, recent publication or report) and up to 3 examples of secondary source data (journal article, independent report, news article). Data validation and quality assurance are achieved through use of multiple sources, assessment and further selection based on strength of evidence, and documentation of data. All text source data files are listed within a data listing that provides an inventory of the text sources used.

The data management plan describes specifics regarding file management, data storage and documentation, protocol for sharing data, etc. For this paper, the intention is to focus on the narratives rather than on the specific organizations, and thus in the presentation of results and discussion the attributes and narratives are given priority over the names of the organizations. The goal here is to support data revision and re-use, sharing and long-term documentation of the original source data files while protecting the interests of the organizations and their members for self-representation and affiliation. Datasets and the data management plan supporting this research are available for scholarly research through a publicly accessible repository (Burke, 2018).

Approach to analysis and synthesis of transition narratives

To analyze source data for transition narratives for the set of nine EDIs, a method of qualitative document analysis (Wesley, 2014) was performed using QSR International's NVivo 11 Software. The nine cases for the corresponding EDIs were first classified as organizations, with values

assigned to the organizational case attributes. All sources were imported to NVivo and coded to the relevant EDI as a case (node), thus linking each source to a specific case and its attribute values. To begin analysis, a directed mode of textual analysis was completed by coding a total of 97 text source data files to the categories (thematic nodes) used to define elements of a transition narrative (Table 5.1). A set of general subnodes for each of these elements was then developed using a combination of word frequency queries and open or exploratory coding of coded content of key sources (based on number of references) for each EDI. This exploratory process was additionally used to identify broad similarities within each category across all cases, to uncover a set of topics or themes that constitute a general energy democracy transition narrative for the set of EDIs of this region. A series of coding queries were performed to find the text coded at each element of the transition narrative for each EDI case (e.g., coded content for 'Agents for change' for a specified EDI). Using the resulting coded content, axial or analytical coding was then performed by 'coding on' all thematically coded content to find patterns, further refine subnode labels and draw out differences in transition narratives across the set of cases. Selective coding of the coded content for the most important subnodes (by number of references and sources) was used to recheck and further refine subnode categories.

A set of transition narratives was then constructed through several steps of analysis. The coded content identified through the coding queries was revisited to identify and draw out patterns and themes for each element of transition narratives per EDI. These patterns and themes were collected as words or short phrases and used to populate a table of excerpts of text as used by the EDIs. In this way, key concepts and phrases expressed directly within the sources of the EDIs were re-organized across the elements of transition narratives for each EDI, allowing comparison and synthesis. To represent similarities and differences across narratives and facilitate analysis, an initial Venn diagram of types or models of energy democracy transition narratives was drafted based on the scope and relative overlap among the elements of the narratives. This approach to developing energy democracy types or models, originating predominantly from organizations using the term energy democracy, is offered as an alternative yet complementary method to that of Becker and Naumann (2017) who draw from a review of literature of research in human geography and energy-related social sciences to develop a typology of energy democracy projects. Within NVivo, pairwise comparison diagrams for each pair of EDIs were then used to visualize and confirm the relationships as presented in the initial Venn diagram, noting points of

confirmation or uncertainty. Through this process, the nine EDIs were clustered within a smaller set of basic types or models of energy democracy for this region, with the resulting visualization as presented in Figure 5.1.

Finally, to facilitate comparison (Becker & Naumann, 2017, p. 9; Jasanoff, 2015, p. 18), a transition narrative was constructed for each of the basic types by systematically synthesizing the coded excerpts across similar EDIs. The process of synthesizing transition narratives follows a pattern for combining and integrating excerpts of coded material for the EDIs. Each narrative begins with the motivations for collective action and problems to be addressed, followed by the values and norms (discourses) that guide the approach to addressing these problems. Solutions are then presented, along with the temporal positioning of these efforts. The narrative goes on to describe the key set of agents advancing and adversaries preventing this program currently. Each narrative concludes by articulating statements on visions for a desired future. The transition narratives effectively represent a detailed paraphrasing of the coded excerpts for the relevant EDIs. The depth and breadth of the narratives vary depending on the extent and availability of coded content for the relevant EDIs.

To explore potential relationships between attributes and types of transition narratives, case charts were created within NVivo that display cases by attribute value for a selected attribute. EDI cases were charted to see how the cases are distributed across selected attributes, including province or state, year of initiation, organization type, initiation or leadership approach, social-ecological emphasis, breadth of focus, geographic range/spatial scale, and available technologies. This step of analysis was intended only to be suggestive, offering no explanatory power but rather pointing toward plausible relationships to be examined through further inquiry.

INTERCONNECTING TEXT TO CHAPTER 6

The three previous chapters have examined the theory, policies and social initiatives of energy democracy, constituting the original research of this thesis. Chapter 6 goes on to provide a comprehensive discussion and conclusion to the research, beginning with an overview in section 6.1. Section 6.2 pulls together the implications across the three chapters with respect to the broader research objectives. As informed by the methodological approach presented in the introduction, these implications are organized along two perspectives: first, in terms of co-evolution and its limits through the multi-level perspective, and second, in terms of the challenges for energy democracy during a time of increasing energy concentration, as a political-ecology account. These perspectives each yield a set of suggestions and recommendations for scholars and activists working both within and outside existing energy regimes. Section 6.3 summarizes the contributions to knowledge and practice in the context of growing contemporary relevance of energy democracy, while section 6.4 provides a description of three key limitations of the present research and subsequent suggestions and approaches for future research. The thesis closes in section 6.5 with general conclusions to the research.

CHAPTER 6: COMPREHENSIVE DISCUSSION AND CONCLUSIONS

6.1 Overview of the research

This research understands renewable energy transition as not only shaped by political struggle, but as an expression of political struggle. Conventional energy systems are organized around extreme concentrations of power and characterized by persistent patterns of gross social and ecological injustice and unsustainability. Despite a heightened sense of urgency, mainstream perspectives on pathways to renewable futures continue to be defined by stubborn commitments to logics and objectives of a fossil fuel era. For roughly half a century, advocates of renewables have asserted that an age of renewables will soon materialize, yet the basic patterns and trends remain insufficiently altered. Fossil fuels remain central to political economies, carbon emissions exceed targets, economic concentration and monopoly power overwhelmingly characterize energy systems, and political institutions appear incapable of making the necessary changes (EIA, 2018; IEA, 2018; Jackson et al., 2017). The recognition that these outcomes are rooted in persistently unjust and unsustainable social and political systems has inspired research and action in support of more transformative approaches to renewable energy transition, wherein social and technological systems profoundly change together.

In the context of political struggle as well as political opportunity and necessity, energy democracy opens up and urges a transformative approach to renewable energy transition. Informed by and contributing to communities of scholarship and activism that integrate social justice and ecological sustainability, this research examines and advances understanding of energy democracy as a nascent yet meaningful contemporary social phenomenon. This movement and agenda are context-specific, multi-faceted, and diverse in expression, yet unified in the drive for new approaches to renewable energy transition. We find in energy democracy an opportunity for an interconnected powershift (Brisbois, 2019), from fossil fuels to renewables, and from concentrated to democratized social power. Yet, energy democracy helps reveal not only these co-evolutionary and co-productive dynamics of renewable energy transition, but more importantly, energy democracy can help find ways toward a more transformative approach. Rather than calling upon existing structures of power for greater ambition or political will, this powershift is directed at building capacity among diverse communities empowered to drive the transition themselves. Research on energy democracy can therefore shed light on the potential and performance of renewable energy for social transformation, by describing and analyzing

what elements of social systems have changed or are proposed to change, and by offering careful and constructive engagement and critique regarding the challenges of renewable energy transition.

From a political ecology perspective on sociotechnical systems, this research has examined energy democracy to understand how social and technological systems co-evolve through renewable energy transition, and how such a transition organized by and through energy democracy may or may not influence the transformation of broader systems of energy governance. *Overall, at a time when neither renewable energy nor democracy is assured, this research can help us understand how renewable energy technologies and the democratization of energy systems may be better enabled together.* Given the limited influence of such efforts over the last five decades, this research is offered at a crucial moment, as both mainstream and alternative projects increasingly construct their hopes and dreams for a more desirable future upon and through the material infrastructures of renewable energy technologies. Ultimately energy democracy is about remaking this story of transition as one of beneficial relationships, among people, our relationships to energy, and through energy, our relationships to the rest of the world. A short summary of the findings of the research follows.

Chapter 3. This work began by exploring the theoretical basis for these co-evolutionary and co-productive dynamics. As a grounded theoretical foundation for empirical inquiry, chapter 3 provided a critical literature review, finding that solar and wind technologies offer flexibility rather than certainty. These technologies do not necessitate but may facilitate corresponding re-organization of social systems, yet not without committed effort among social groups. The review further finds that more democratic renewable energy futures would benefit from strengthening democratic practices and outcomes, extending democratization of energy systems across all components, stages and end uses, and sharpening positions relative to overriding pressures of capitalism and market ideology, the ideology of unlimited growth, and the modernist/industrialist agenda.

Chapter 4. The research proceeded to examine what changes to social systems energy democracy reveals in practice in terms of policy instruments of energy democracy. As a set of rules for governing collective efforts toward renewable energy transition, policy instruments, including and in addition to institutional reforms and innovations of property-rights systems, are arguably

the most evident changes to social systems governing energy transition. Results of this chapter include the identification of a set of three goals and 26 intended outcomes for energy democracy and the presentation of a descriptive summary of 22 specific policy instruments associated with an energy democracy agenda, especially in the United States, demonstrating the diversity of policy and institutional reforms implemented within specific contexts to advance renewable energy technologies.

Chapter 5. The research culminated with an empirical comparative inquiry of a set of organizations and their transition narratives actively working to promote energy democracy across eastern Canada and the northeast United States. A key finding of this research is the recognition of a convergence among the initiatives around a shared transition narrative. The research also finds differences across the elements of transition narratives that suggest a diversity of counter-narratives for the region.

6.2 Implications

6.2.1 Co-evolution and its limits: insights from a multi-level perspective[41]

Political struggle operates across multiple levels of change and scales of time. The implications of this research can be understood by returning to the multi-level perspective on sociotechnical transitions and elements of energy governance introduced in chapter 1. Each of the three levels and the interactions among them, the niche, the regime, and the landscape, present points of struggle and opportunities for change. At the niche level, advocates have connected radical social change to technological change, organized initiatives, and communicated narratives, yet the form of radical change embodied across these efforts is contested. In the context of climate change, those initiatives and narratives of energy democracy that more closely align with broader macro-level narratives such as the SDGs and ecological modernization, those characterized as more reformative than transformative, may prove more significant for influencing energy regime change in the short term. At the macro-level, these broader narratives are by definition beyond any direct influence of energy democracy or any other advocates for change, yet one of the key strengths of a narrative is its ability to spread among social groups. Because energy democracy works at the level of societal values and principles, narratives of energy democracy that appear radical now, or that may further radicalize going forward, may be adopted at broader levels over

[41] An abridged version of this subsection has been published as the discussion and conclusion to Burke (2018a).

time and thus influence the emergence of transformative regimes. Energy democracy can and must therefore operate across these three levels of novel innovations, existing regimes, and broader contextual narratives over different timeframes.

A key point of struggle concerns the interactions between innovations and existing energy regimes. Changing the broader narrative is necessary, as the possibility for energy democracy will largely depend on the social, political, economic and cultural context. In the short term, however, the necessary efforts involve aligning innovations at the niche level with elements of governance at the regime level. The research has demonstrated the existence of innovations at the niche level, yet the goal is not simply a collection of initiatives. Rather, energy democracy requires the stabilization of a democratized renewable energy regime as a system, involving innovations that target specific elements of existing energy regimes, and in turn, current energy regimes taking steps to reinforce and allow space for energy democracy initiatives. This work helps to clarify the elements of governance that are now changing and those that will require targeted selection and ongoing political work.

Renewable energy systems are co-evolving with systems of governance for a renewable energy society. Several specific elements of energy governance demonstrate notable capacity for change. The policy area for renewable energy is broadening as groups connect energy policy with policy areas including economy, work, inequality, environment, health, and community development. The population of participating individuals and communities is expanding beyond those historically authorized or expected to make decisions for energy systems, raising the profile of energy citizenship (Devine-Wright, 2007; Ryghaug, Skjølsvold, & Heidenreich, 2018). Rules and institutions for energy governance are expanding and innovating through the development of reforms such as renewable energy cooperatives, remunicipalization, green public service banks, and sustainable energy utilities. Patterns of ownership are pivoting toward models of community-based, cooperative and public control, and the types of organizations involved in energy governance are diversifying beyond public or private utilities and quasi-governmental regulatory agencies.

Systems of energy governance are also changing in less obvious ways. Energy democracy further demonstrates an expanding repertoire of norms and strategies being employed in the governance of renewable energy, based on views of energy as resource, necessity, and power, and

emphasizing corresponding norms of equity, justice, sustainability and resilience. The appearance of a growing number of energy democracy initiatives suggests the reshaping of the network structure of energy governance as new and restructured governing organizations actively seek to connect to and draw in diverse and historically marginalized communities and populations. Finally, under a variety of both social and technological pressures, the governance of modern energy systems is realizing a break in historical continuity, as experimentation, flexibility and variability increase.

Specific elements of governance prove more challenging to destabilize. This inquiry also finds limited influence upon some elements of energy governance. Policy instruments require broadening, to more directly address nonrenewable energy sources, and strengthening, to more directly relate to energy democracy outcomes such as social justice and ecological sustainability. Property-rights systems have resisted more fundamental changes to their basic assumptions and foundations, for example, by recognizing replenishable energy sources and associated technologies as energy commons rather than commodities and capital assets. Similarly, a legacy of predominantly growth-oriented, centralized and technocratic logics of energy regimes appears largely resistant to the realization of more decentralized or democratic modes of governance and the disruption to historical continuity this move might entail. Spatially, while renewable energy has the potential to re-organize the geographic range of governance, as energy regions or democratized microgrid interconnections, for example, governance systems show little evidence of restructuring existing political jurisdictions. Finally, regarding performance measures, the core outcomes of energy democracy, including for example, energy justice, have yet to be developed in such a way as to systematically guide decision making, thus limiting the potential for ongoing feedback and learning for energy governance.

Energy democracy demonstrates the emergence of an alternative system of energy governance for the renewable age yet stabilizing this system will require political struggle across multiple levels of change. Because technologies cannot be effectively changed without also changing social arrangements (Norgaard, 1994), the limits to institutionalized social change may help explain the lack of desired technological change. *This work then implies that if greater technological change and a broader change in the trajectory of transition is desired, more attention needs to be given to the selection and stabilization of the corresponding democratized*

institutions necessary for societies powered by renewable energy. Thinking in terms of co-evolution across the levels of change and elements of governance can open up new opportunities for research and application for renewable energy transition. Programmatically, suggestions are offered here across the three levels of change:

1. *Approach renewable energy development as a process of democratic development.* From the perspective of the broader context of transition, the research suggests that the possibilities for democratic models of renewable energy and deeper sociotechnical transformation require that renewable energy technologies be deployed through strongly democratic models of energy development. This suggestion follows directly from the understanding that although no energy source or technology can ensure a particular social or political order, the process of shifting these sources and technologies can open up new possibilities for social and political change. Democratic development implies a move away from the view of energy as commodity and transition or decarbonization as economic opportunity. Rather, this suggestion draws from a view of energy as both resource and necessity as well as a form of power and social relations, i.e., energy-power. A democratic approach is not solely symbolic or procedural but in fact carries real material consequences. There is then a need for improved models of democratic governance within the energy sector, targeting especially local capacities involving socially-, technologically-, and ecologically-informed practices. Similarly, the features and qualities of specific energy sources and technologies deserve greater understanding regarding the degree to which they may support this democratic approach or alternatively be made to support concentrated forms of energy-power and energy-politics. The shape of transition will be guided not only by intentional social choice but also through the dynamics among social groups and their (re-)alignments within the context of the era of fossil fuels. The pace of such a variation of values and perspectives is uncertain yet could be supported more immediately through a prefigurative approach to transition and reinforcement of initiatives at the regime level.
2. *Change existing patterns of energy governance as a system.* At the level of existing regimes, then, the research implies that the large-scale transformation demanded by the energy democracy movement will require systemic change, involving strengthening existing systems while further developing or selecting other changes across a broad set of elements of governance. Immediate actions include strengthening existing policy instruments by

broadening the scope of energy policy to address key social and environmental priorities, for example, improving the capacity for energy and climate planning among unions, low-income communities and communities of color. The necessity to innovate policy instruments in the short term is also identified, especially to reduce aggregate levels of energy use and resist and democratize incumbent fossil fuel regimes. While changes of policy instruments can contribute, this work emphasizes the need to influence a broad set of sociotechnical changes. Improving and expanding models of collective ownership is also clear priority for energy democracy, while equally crucial are efforts to expand and diversify employment opportunities for a carbon- and growth-constrained future. Over the longer term, important moves to support of democratized energy systems include: organization of democratic energy regions; increased capacity for energy citizenship; innovation of an energy commons approach and restoration of the commons; restructuring of energy governance networks to include historically marginalized and vulnerable groups; adjustments in regime logics to favor democratization and decentralization; development and adoption of indicators of justice and sustainability and related concepts for energy systems; and greater experimentation and flexibility in modes of response to crisis and potential economic contraction, matching the diversity, variability, and dynamism of the energy sources and communities involved. Together these shifts constitute integrated and systemic sociotechnical change.

3. *Anticipate and leverage both similarities and differences across initiatives for energy democracy.* A shared regional energy democracy narrative may prove effective for describing what, why, how and for whom members of these energy democracy organizations and their associated communities are taking action (Bushell, Buisson, Workman, & Colley, 2017). Employed flexibly and strategically as a co-productive synthesis, a shared narrative may serve to complement, integrate, and tie together diverse initiatives, organizations and campaigns for energy systems change, increasing their collective prominence and motivating action toward a positive and comprehensive vision of the future within and beyond this region (Avelino et al., 2017; Becker & Naumann, 2017; Bushell et al., 2017; Hess, 2018; Jasanoff, 2015; Moezzi, Janda, & Rotmann, 2017). However, this research also discovers important differences within energy democracy, regarding the possibility to connect, empower, or disempower specific social groups, to include robust theories of change and obduracy, to focus on specific institutional change, to resist negative as well as promote

positive agendas, and to work across scales. While uncertain in their effects, these differences may influence whether and how these varied narratives work to organize transformative social action. Differences across these narratives also hold implications for energy democracy in the sense that some perspectives of energy democracy may be easily accommodated within existing ideological and material systems without appearing to present a real challenge. It is further argued that multiple energy democracies may inevitably co-exist in a dynamic, strategic, and possibly at times conflictual consensus regarding the appropriate interpretation and application of justice and sustainability and other relevant aspirations for renewable energy futures.

6.2.2 Energy concentration or energy democracy: insights from a political ecology perspective

Concentrated forms of energy and economic and political power require and sustain each other. Renewable energy transition is an issue of power; the power to decide not only what types of technologies society will use, but also to what end and to whose benefit. The research began by recognizing the prevailing sociotechnical systems and the overriding context for renewable energy transition, based on views of energy as commodities and strategic resources, and the tendency to not only concentrate forms of power but to normalize and depoliticize these social relations. These systems, characterized by and associated with histories of authoritarianism, patterns of oligarchic power, and future imaginaries of modernist materialism, technocratic governance, and geopolitical dominance, presently shape and limit renewable energy transition. From an energy-politics perspective, established social systems have co-evolved with concentrated forms of energy, thus forming mutually enabling sociotechnical systems. In this context, renewables carry on the predominant views of energy and are made to serve these incumbent interests. The development of renewables proceeds only to the degree that such social patterns and orders can be sustained, effectively working to ensure that those who have most benefitted from the current systems will remain the key beneficiaries of the next energy system. To the extent that renewable futures can materialize, all paths would appear to lead toward further energy concentration and a failed transition.

Energy democracy seeks to counter this tendency by re-politicizing and re-imagining transition. Renewable energy transition is a unique kind of problem--unprecedented, urgent, ambitious,

complex, and politically charged. Energy democracy is a certain kind of response--a way of shifting energy and social systems based on shared principles and collective action, emphasizing the imperative of a transition in energy-power. Energy democracy can thus be understood as an interconnected power shift, from fossil fuels to renewables, and from concentrated to democratized social power. Whether energy democracy can ultimately influence broader or more fundamental social transformations is impossible to say and too much to ask of this incipient group of initiatives and narratives. Rather, at a time when conventional systems appear incapable of ending the fossil fuel age, and the consequences grow increasingly dire, energy democracy offers a unique contribution to the prospects for renewable energy transition by keeping attention on the key issues of who benefits from transition, who loses, and who decides. While pathways to energy concentration represent a closing down of options, seeking to accumulate, stagnate and fossilize energy and social relations, energy democracy offers an opening up, a continuously evolving process, through which the energy transition may enable the conditions for social transformation.

Through energy democracy, the fundamental issue of transition concerns the kind of societies people wish to create. As guided by energy democracy principles, the primary questions are not how to best advance whichever type of technology, but rather how to create just and sustainable societies, and what role renewable energy can serve in this effort. This is the value of energy democracy at the present moment: drawing attention to energy as social power and energy transition as a key site of material and ideological struggle, creating spaces for people to collectively deliberate and flexibly engage with energy systems transition, and urging a remaking of these systems based on principles before profit, as processes for circulating rather than accumulating energy-power. Rather than an instrumental matter of fuel substitution, energy democracy offers a pathway to substitute concentrated, technocratic, market- and production-based approaches with active collective governance. In this way, renewable energy and energy democracy could respectively serve as a crucial focal point and agenda within broader movements for sociotechnical transformation on a deeply transformed planet.

Yet energy democracy also faces limitations as a political movement. The implications of this research raise the prospect that energy democracy, at least in the context examined here, may paradoxically become depoliticized and thus made to work alongside, within or even in support

of existing unjust and unsustainable systems. The implementation of energy democracy may come up short in its aspiration to fundamentally re-imagine, challenge, transform, and ultimately displace present patterns of concentrated power, and instead be subsumed within seemingly apolitical narratives and agendas. Energy democracy risks being made apolitical in a similar way that common understandings of democracy (and energy) are seen as apolitical, by emphasizing technological dimensions while taking for granted and minimizing the thorny and problematic questions regarding their meaning, aims, intentions or purposes, and thus narrowing its more transformative political possibilities.

Energy democracy must hold open explicitly transformative possibilities for energy futures. The value of this analysis of energy democracy stems not only from the understanding of limits of co-evolutionary transition but also in finding ways forward, ways to hold out energy democracy as a fundamentally different transition pathway in the present context. While a variety of changes deserve consideration as described previously, returning to a political ecology perspective can help focus current efforts to avoid the possibility of an apolitical energy democracy, keeping front and center the systemic roots of crisis, the context of political struggle and volatility, the need to integrate ideological and material agendas, the need to align local actions toward broader changes to existing regimes of energy oligarchy, and the commitments to ethical standards of justice and sustainability and their attendant transformational outcomes and flexible political forms. From this perspective, recommendations are made for policy, politics, ecology and technology (Walker, 2005, 2006, 2007) for transformative energy futures.

1. *Advance policies for empowerment and disempowerment.* For any policy proposal, consideration can be given to whether it serves the interests of those with greater or lesser power, of those who have benefitted most from fossil fuel economies or those who have suffered its consequences. As an inclusive and pro-poor form of development, energy democracy can aggressively and consistently seek to displace the status quo in energy policy debates and decision-making, by providing counter-narratives that challenge political-economic interests of powerful elites and authoritarian tendencies and supporting a steady transference of power and decision-making for energy futures to less powerful and often marginalized social groups. Most immediately, this shift would center on policy instruments for changing ownership and expanding or addressing employment across the energy sector,

always supporting the "creation and maintenance of conditions for collective choice" (Byrne & Rich, 1983, p. 183). Here policies are needed that promote collective ownership and decent work among common people, with the associated building of technical, financial, ecological, and collective-action capacity. Various experiments in new institutionalized job and ownership patterns would include community energy ownership, renewable energy cooperatives, remunicipalization, green public service banks, community-owned microgrids, and sustainable energy utilities, while new opportunities exist across all stages of renewable energy systems including sites of extraction. This change in ownership and work also needs to be applied rapidly to conventional energy systems by re-imagining pathways and possibilities for their collective control (Speth, Skandier, & Bozuwa, 2018).

Over the longer term, and to sustain political support in a renewable, post-growth future, various options for the future of work deserve explicit consideration within an energy democracy agenda. Although energy democracy clearly recognizes the centrality of work to its agenda, as argued throughout this text, the position of energy democracy toward commitments to growth and industrialism remains uncertain and thus problematic. To this author, it is unclear whether reductions in high levels of energy use and high rates of economic growth imply more, less, or primarily different modes of work, during a period of transition and after. However, given the real yet largely underexamined possibilities for significant constraints in economic growth in an age of renewables (Heinberg & Fridley, 2016b), three possible responses, relevant to the diverse positions of energy democracy identified here, deserve consideration in the case of sharp reductions in employment. First, that the renewable energy transition prioritizes job expansions, including for example public jobs guarantee programs as prioritized by recent proposals for a Green New Deal and the aggressive organization of trade unions within emerging renewable energy sectors, especially solar and wind. Second, that this energy transition be linked to proposals that ensure income regardless of employment, such as a universal basic income. And third, that the path to sustainable wellbeing be decoupled from the need for either jobs or income, meaning the renewable energy transition is pursued as one element of a broader economic and cultural shift toward ways of living well that do not depend upon work in the formal economy. Given the impossibility of estimating levels of energy or economic growth in a renewable future,

such strategies are best pursued in combination (Sekulova, Kallis, Rodríguez-Labajos, & Schneider, 2013).

2. *Re-organize political networks.* Powerful interests will undoubtedly find ways to reap benefits from the transition to renewables, but this does not imply a need to organize political networks around their sustained cooperation. Perhaps the greatest need at this moment is to strengthen energy democracy as a political movement. Energy democracy therefore requires careful and ongoing de-alignments and re-alignments among groups promoting renewable energy (Verbong & Geels, 2012). Beyond any specific set of policies, the transition implies taking sides. Who is doing the transitioning of energy systems, who holds the power for transformation, with whom are they aligned, who has been left out, and who decides? Thoughtful and targeted alignments among social groups, including labor, local and regional governments, and diverse social movements, as well as academia, can help ensure that the capacity for change is developed where key levers of power exist, and that benefits of transition consistently flow to those most in need. To put it in stark political terms, alignments need continuous weakening of ties and dependence upon powerful interests, while strengthening circuits of community empowerment among the less powerful. This requires a deeper understanding of the evolving points of social power in renewable energy systems, and the social and material responses needed to increase willingness to participate in and lead transitions, especially among vulnerable communities of people. Organizing might begin by supporting small, self-organizing groups of energy citizens who share a commitment to energy democracy principles and goals, as related to Norgaard's (1994) coevolving discursive communities or Adams' (1975) organizational operating units. To influence change from the bottom up, many more energy democracy initiatives are needed to implement specific strategies as relevant to particular local and regional contexts, while maintaining trans-local ties among similarly-oriented groups working through diverse contexts and struggles for energy transition.
3. *Recognize and restore ecological interdependence.* For a transformative energy future, the needs of nonhuman communities deserve deeper consideration within energy democracy. As energy democracy expresses concern for ecology, environment, and the natural world, a closer examination of the relationships between these potentially replenishable sources of energy and biophysical ecology is needed (e.g., environmental histories, ecological analysis).

To move beyond the fossil fuel era, "(t)he coevolutionary perspective suggests that we had better get back to coevolving with the environment again" (Norgaard, 1995, p. 487). An ecological perspective could help weaken the popular view of energy as a commodity and strategic resource in favor its understanding as an ecological relationship and collective necessity. Focusing on integrated social and ecological aspects of renewable energy development further raises the fundamental issues of the need for continuous economic growth (Gupta & Vegelin, 2016; Theodoropoulos, 2018), the urgency to change patterns and levels of energy use, and the possibilities for decoupling social and ecological wellbeing from these recent historical trends. The concern here is not only with the distribution of energy-power but also with the aggregated quantity of energy-power available in the world and its associated capacity to transform the nonhuman world.

4. *Reconsider technological alternatives and alternatives to technology.* Finally, energy democracy cannot be technologically ambivalent, implying more reflexive, analytical, and political positions regarding differences across renewable energy technologies. Every modern energy system has in some sense yielded catastrophe, and failures should again be anticipated. Further, technologies are developed in response to perceived social needs, and thus both the technologies and the needs they are designed to serve are inseparable. Beyond the distinction between large-scale industrialized and small-scale distributed renewable technologies, this point urges renewed consideration of technological and non-technological options supported by earlier counter cultural movements yet now seemingly abandoned. As argued by Glover (2006):

> the closer renewable technologies come to meeting this need of a substitute fuel source, the more they will replicate the problems of conventional energy…What renewable energy advocates seem to have overlooked is that the social and environmental benefits of the old technology are not necessarily characteristic of this new generation [of renewable technologies]. These new technological developments have effectively closed off meaningful advances in the old technology in the developed world, so that designing technologies that people could buy and operate for their homes, farms, small factories, and commercial centers is no longer being pursued (p. 259).

> The idea is to open possibilities for new and meaningful advances in radical, transformative, and ecological technologies and their non-technological alternatives. A renewable transition would thus be made to serve genuine social and ecological needs on a modest scale, and otherwise find ways to limit or relinquish our collective reliance on modern, "high" technological solutions and encourage nonmaterial responses for living well (Bendell, 2018; Dunlap, 2018b; Jasanoff, 2018; Norgaard, 1995; Royston, Selby, & Shove, 2018).

6.3 Contributions to knowledge and practice

The significance of activism and scholarship for energy democracy has grown over the course of completing this work. That the contextual pressures that had inspired this project, including heightened risks and inequities of current energy systems, normalized profit-driven, oligarchical, and technocratic forms of transition, and inadequacies of such approaches to achieve the desired changes, not only persist but have arguably worsened since the project's inception, suggests the strong contemporary relevance of energy democracy. In addition to these dangerous patterns, new and troubling dynamics of transition, or lack of transition, have surfaced during the time of completing this research. Over the past four years, forceful expressions of concentrated energy-politics have been observed, where the material and ideational aspects of fossil fuels and nuclear energy are enrolled within agendas that undermine democracy, strengthen nationalism, authoritarianism, and militarism, and further consolidate social, economic, political, and energic power. Within North America, conspicuous examples can be found in the United States in the rhetoric of energy dominance, which brings together fossil fuels, markets, and appeals for restoration of traditional (i.e., racialized, gendered, etc.) social orders (Schneider & Peeples, 2018); in Puerto Rico, in the move to privatize energy systems as a form of disaster capitalism and energy colonialism (Báez, 2018; de Onís, 2018); and in Canada, in the nationalization of the Trans Mountain pipeline in Canada in the name of national interest and economic security (Rabson, 2018). To the extent that there remains a widespread push for renewables, it further appears that the prevailing view of transition remains firmly embedded within corporatized, market-centric, and green growth agendas as Glover (2006) had warned. Yet over the same period of time, diverse social movements have taken shape and intersected across a number of social and environmental concerns, while energy democracy, as one manifestation of this wider pattern, has gained prominence through the bourgeoning work of communities of both academics and activists (e.g., Delina, 2018; Fairchild & Weinrub, 2017; Speth et al., 2018; Sweeney &

Treat, 2018; Szulecki, 2018; van Veelen, 2018; van Veelen & van der Horst, 2018; Welton, 2017). These contemporary trends further demonstrate the timeliness of this work and add to its importance.

The research further relates to themes central to active research agendas on transition and transformation. The relevance of this work also follows from its relationship to themes articulated within the research agendas of several active research communities on transition and transformation. These themes emphasized among scholars and practitioners include: power and politics, governance, and social movements in transitions prioritized by the Sustainability Transitions Research Network (Kohler, Geels, Kern, Onsongo, & Wieczorek, 2017); politics, character and framing of transformations as emphasized by the STEPS Centre (Scoones et al., 2015; STEPS Centre, 2018); and innovation models, actors, and policy practices, as articulated by the Transformative Innovation Policy Consortium (Schot & Steinmueller, 2017) (See also the Alternatives Transformation Framework recently introduced in Temper et al., 2018, p. 761). The TRANsformative Social Innovation Theory (TRANSIT) research project additionally calls for research that participates in, studies, and supports movements for transformative social innovation, described as "processes of challenging, altering and replacing our dominant ways of doing, thinking and organizing" and "a story of change towards a common future that is more sustainable, just and resilient" (TRANSIT, 2017, p. 3). Meanwhile, researchers among the political ecology community increasingly advocate for the application of this perspective to problems of energy transitions (Bridge, Barca, Özkaynak, Turhan, & Wyeth, 2018; Cederlöf, 2015; Huber, 2015a; Labussière & Nadaï, 2018b; McCarthy & Thatcher, 2017; Sovacool, 2016b).

This research contributes to the work of both academic and activist communities. The objectives of this research are to broaden and deepen the understanding of energy democracy, to apply this engagement with energy democracy to uncover co-evolutionary dynamics of renewable energy transition, and to identify ways to advance the transformative potential of this transition. With limited systematic analysis of energy democracy at the outset of this research, this work increases the visibility of rapidly developing, on-the-ground social action for deep transformation through renewable energy transition. The research presents a novel analysis as well as a

normative assessment of energy democracy, while contributing to the development of approaches for the study of movements and narratives for social transformation.

Specific contributions to academic scholarship center on the political dimensions of renewable energy transition. As a contribution of original academic scholarship, the research presented here responds to the need to address issues of power and politics in renewable energy transition and the political dimensions of energy and sustainability transitions more broadly. The contributions to academic communities concern the ways specific social dimensions are or are not now changing through the process of renewable energy transition, with energy democracy providing a lens for analytical inquiry on issues of power, politics, and social transformation. This project specifically contributes a political-ecology account of renewable energy transition, emphasizing the political economic context as a key obstacle to realizing energy transition and supporting new narratives and pathways. The theoretical development of the politics of renewable energy systems is advanced, proposing a novel understanding of the relationships between energy systems and political power. Through empirical research, knowledge on energy democracy is expanded both in terms of goals, outcomes and policy instruments, as well as shared and diverse counter-narratives within North America. A data set is further made available for initiative-based and participatory research on energy democracy across this region (Burke, 2018b). The research also demonstrates the application of energy democracy to design of energy policy and evaluation of renewable energy transition and proposes a descriptive and analytical typology for examining and comparing transition counter-narratives.

For the implementation of energy democracy, the research contributes insights regarding the possibilities and limitations for renewable energy transition. Drawing attention to technological dimensions, historical experience, and the indeterminacy of technological change, the work presents to practitioners an assessment of the transformative potential and performance of renewable energy and important ways forward. Drawing attention to non-technological dimensions and political relations of technological change, the work broadly clarifies what is at stake in the renewable energy transition. The research serves to amplify a unique transition narrative and clarify diverse positions within the movement, which can contribute to the sharing, selection and stabilization of new practices. The presence is shown of various grassroots innovations, social movements, civil society organizations, and other alternative and often

marginalized interests required for driving transformative shifts and reshaping processes of consumption and production, power relations, and structures of governance. Important considerations have been raised regarding the overall purpose and direction of renewable energy transition. The research ultimately contributes a set of key suggestions and recommendations for the practice of energy democracy and energy transition. These critically (re-)constructivist academic perspectives (Adler et al., 2018) are offered as an opening for activist communities to reflect on the meanings, opportunities, and potential gaps and shortcomings for renewable energy transition as envisioned here.

6.4 Limitations and future research

Recognizing and responding to limitations of this research provides direction for further academic and activist work for energy democracy. The remainder of this thesis will underscore three key actions for research going forward, following on the various specific limitations and next steps that have been indicated within sections 3.5, 4.5.4, 5.5. Key actions include directly engaging with communities of practice, deepening understandings of ecological and technological aspects of energy transition, and improving assessments and understandings of outcomes, effectiveness, and successes and failures. Each of these steps would benefit from approaches of political ecology and social-ecological-technical systems science and the democratization of knowledge and inquiry.

Direct community engagement. From the perspective of this author, the most concerning limitation of this research thus far has been the lack of direct engagement with communities of practice. As political-ecology research, this is an important limitation given a responsibility to "give back" and provide meaningful benefits to the subjects of the research, despite institutional barriers (Walker, 2007). This concern is relevant to chapter 4 and especially chapter 5. For chapter 4, the selection of outcome statements and policy instruments that form the basis of the assessment reflects the limitations of the literature review. As noted, this process may result in redundancies and overlap, or have under- or mis-represented important instruments such as those for resistance. The categorization of instruments may not be the most useful approach for research or application. Similarly, for chapter 5, there is researcher subjectivity in the proposed groupings of initiatives and narratives. More importantly, the number of initiatives was limited and lacked direct engagement with their members. This lack of direct engagement may have

insufficiently advanced the practice of energy democracy and limited the contribution to activist communities to date.

The research is well-positioned to proceed with more direct forms of engagement with energy democracy movements, through which research agendas can be developed. The most straightforward opportunities following this research include drawing from the set of initiatives and survey instruments within the publicly-available database (Burke, 2018b), connecting with the burgeoning scholarship on energy democracy and related topics, and initiating further inquiry with communities of practice. The set of initiatives could be broadened, especially to include the Global South. Important research topics include: historical, structural, and socio-political context and conditions preventing energy democracy; differences and leverage points in power, privilege, and access to ownership and decision making for energy futures; specific combinations of applied rules or targeted; identities, beliefs, guiding principles, practices, motivations, participation, challenges, and theories of change of organizations and their members; and characteristics of the networks of groups within and across specific regions and governing regimes. Useful research methods here include participatory and ethnographic methods, conventional social science methods such as surveys, interviews, network analyses, and case studies, as well as innovative social science methods involving story-telling, futures research, and long-term experimentation with new institutional models as experimental governance (Adler et al., 2018), always with consideration to how the research can support participants and advance the movement.

Integrated ecological and technological research. A second concern is the limited treatment of ecological and technological dimensions of transition in the selected regions, despite their obvious importance. From the perspectives of sociotechnical systems and social-ecological-technical systems, these dimensions of integrated systems motivate, guide, interact through, and ultimately indicate success of renewable energy transition. Like energy democracy, the research emphasizes the value of ecological and technological systems, but these elements are not examined in a deep or systematic manner. This limitation is called out explicitly in chapter 3 in terms of the uncertainties of democratic outcomes and the importance of temporal and spatial dynamics of energy systems. In chapter 5, the focus on initiatives in a regional context allows the most direct examination of the specific set technological and ecological elements relevant for

these initiatives across this region. This examination was limited, however, to determining a set of attributes associated with the initiatives. As discussed previously, a limited engagement with ecological and technological aspects risks depoliticizing these dimensions, reducing their visibility, and narrowing the capacity of research and activism to achieve and demonstrate desired outcomes.

Integrating social, ecological, and technological dimensions in future research is a challenging but necessary next step. The thesis of this research addresses directly ideas of change, co-evolution and co-production of the social and technological, yet this research was focused on changes to systems of governance and energy democracy as a social movement. In this way this limitation reflects the choice of analysis and the overall research design. The topics deserving of attention here broadly relate to issues of ecological and technological context, as well as the multiple ways that these non-human aspects and actors engage with social and political dimensions and change. Given the many uncertainties regarding the development of these new physical infrastructures, the ecological and biophysical implications of renewable energy transition notably deserve attention (e.g., Burke, 2018c; Gasparatos, Doll, Esteban, Ahmed, & Olang, 2017; Santangeli et al., 2016). A more fully developed framework and analytical approach for researching co-evolution across these systems is also needed (Kallis, 2007; Norgaard & Kallis, 2016). Such approaches would benefit from a more sophisticated, explicit, an unavoidably normative philosophical ontology (Jackson, 2016) for social-ecological-technical systems change, as well as ontologies that do not presume the categories of elements used here (Labussière & Nadaï, 2018a).

The research chapters describe ways to integrate these important and different bodies of knowledge within future inquiry for transition studies (Cherp et al., 2018). Chapter 3 points to various physical properties of technologies (e.g., density, portability, lifespan) and their relationships to social and political conditions (e.g., accumulation, ownership) that can be used to test and refine a theory of energy-politics. Through an energy-power lens, specific technologies can be evaluated, and systems of renewable energy technologies can be traced or mapped over time and space according to their (geo)political dimensions (Agustoni & Maretti, 2012; Auzanneau, 2018; Balmaceda, 2018; Cottrell, 1955; Hornborg, 2013; Nadaï & Labussière, 2018). In chapter 4 the suggestion is made to engage with work on social-ecological-technical

systems, specifically energy commons (Byrne et al., 2009; Martinez, 2017), to integrate these subsystems and learn from relevant, empirical research on common pool resources, while shaking up received notions of energy-as-commodity and the centrality of state and market actors. The survey instrument of chapter 5 would benefit from methods and measurements used within ecological and technological sciences, defining and operationalizing measures of outcomes while sharing ecological and technical expertise among practitioners. Relevant methods here include mixed methods and case study research that integrates local and regional data and knowledge on specific systems (Labussière & Nadaï, 2018a). Approaches from political ecology, critical geography, science and technology studies, as well as ecological economics can draw attention to these nonhuman elements as active participants in the processes of energy transition.

Indicators of impact and success. A third important limitation of this research concerns the limited capacity to assess outcomes and effectiveness of energy democracy. A limited understanding of actual impacts of energy democracy constrains the ability of the researcher to provide constructive critique and reduces the capacity for learning among practitioners. As discussed in chapter 3, energy democracy must work effectively as a form of governance if it is to maintain its relevance, implying the need to measure, monitor and respond to its impact in practice. This limitation relates to each chapter of the research. Chapter 3 offers plausible reasons for the relationships between social and technological systems but falls short of providing explanations. For chapter 4, the paper confines its assessment to the congruence, which as noted is a distinct issue from either coherence or effectiveness of policy instruments and instrument mixes. The selection of outcomes and the method of assessing congruence would benefit from more robust, empirical, and participatory procedures. The focus on transition narratives in chapter 5 emphasizes the possibility for rather than the achievement of the desired changes, while the research suggests but does not systematically investigate the relationship between attributes of initiatives and their narratives and outcomes. This limitation is understandable to some degree given the novelty of this movement and the uncertainty involved with long-term dynamics of energy transition.

This research provides a foundation for future empirical work on the effectiveness of democratization for renewable energy transition. However, research on indicators should proceed

thoughtfully and cautiously, eschewing instrumentalist thinking and recognizing that there are diverse ways of framing or understanding energy impacts (Szolucha, 2018). In other words, it is important to avoid a tendency to view outcomes solely as direct, proximate, easily measurable (and purely technological) effects, but rather to remain open to a wide set of elements of change over various periods of time and using diverse forms of measurement. Clearly this holds true for outcomes such as justice, sustainability, resilience, and so on. For renewable energy transition, it is also necessary to look at conventional and nonindustrial technologies, which constitute elements of an integrated energy system. Finally, it is important to actively develop indicators for measuring more directly outcomes of human and nonhuman wellbeing rather than relying upon increasingly problematic economic measures such as GDP. Here following Kunze and Becker (2015) and Alarcón Ferrari and Chartier (2017), the significant body of work on degrowth and related concepts can be usefully engaged (e.g., Brand, 2016; Foxon, 2018; Illich, 2013; Kallis et al., 2018; Schwartzman, 2016; Sekulova et al., 2013; Thombs, 2017; and Victor and Dolter, 2017).

Key topics for indicators concern the appropriate set of social, ecological, and technological measures of success and failure, and their explanations as related to interactions and broader sociopolitical contexts. The most direct extension of this work would include evaluating the effectiveness of mixes of policy instruments and defining and monitoring indicators of desirable outcomes among the initiatives. There is also a need to understand and explain persistent outcomes in terms of systemic or structural factors, and in turn to understand how outcomes, especially failures, can shape future efforts as ongoing processes of learning. Here then it would be worthwhile to more substantively engage with the growing body of literature on democratic theory and practice, including critiques of ‘actually existing democracy and proposed strategies for democratic renewal. The organizations and their narratives can themselves both explain and be explained by outcomes, serving as drivers and effects of energy transition. This work can proceed through methods including historical research, modeling, and long-term case study research, as well as participatory methods wherein communities of practice identify a set of normative criteria or ideal-type energy futures, and develop workable indicators and measures of social, ecological, and technical performance for energy democracy, as relevant to the specific context. Conventional methods of evaluation may also be useful to activist communities and planning efforts, whether or not contributing to academic scholarship.

Critical, inclusive, and reconstructive approaches to research. As argued throughout this text, equally if not more important than the specific questions or methods of research going forward is the approach to research on transitions and transformations. Through critique, research on energy transition can open space for reflection among communities of practice, draw attention to overlooked or underappreciated factors and communities, call into question conventional measures of success, and point to broader structural influences of persistent failure. Through an inclusive and democratized approach to knowledge and inquiry, research on transitions can help reduce unequal power relations, integrate diverse knowledge traditions, and develop co-productive sciences of energy citizenship. Embedded within networks of learning communities, such research can serve to empower ordinary citizens and build capacities for leadership and long-term engagement within emerging energy systems. And through commitment to systematic experimentation and social innovation, transition research can help create opportunities for collective learning regarding news modes of organization and governance. These reconstructive experiments can range from new policy instruments and energy institutions, to more unconventional and prefigurative explorations of desirable energy futures across specific contexts. These approaches to research and practice can help shape energy transition as an ongoing collective struggle toward "better, less coercive, less exploitative, and more sustainable ways of doing things" (Robbins, 2012, p. 20). This work provides a step in this direction.

6.5 General conclusions

In view of mounting evidence of social and ecological crises associated with conventional energy systems, there is an urgency and imperative for engaged and responsible scholarship that opens new possibilities for collective societal responses. This research has examined energy democracy in concept, principle and practice, as a way to understand how social arrangements change in relation to the renewable energy transition, and how a transition organized by and through energy democracy may or may not influence systemic transformation of energy governance. The work of chapter 3 yielded a theory of energy-power underlying energy democracy, along with its associated tensions and implications for practice. Chapter 4 proceeded to identify and assess the objectives and policies advanced by advocates of energy democracy. Finally, the work of chapter 5 demonstrated how energy democracy works as a counter-narrative to mainstream transition narratives and compared the ways diverse initiatives work in practice toward social transformation.

Energy democracy can serve to establish conditions for broader social transformations. Energy democracy involves a shift in both energy technologies and corresponding patterns of social relations, notably ownership patterns and their guiding norms, toward decidedly more distributed or decentralized sociotechnical energy systems. If greater technological change is desired, more attention needs to be given to the corresponding institutions necessary for societies powered by renewable energy. While practice may never match the ideal, real world models do exist, through which these efforts may be further tested, evaluated, debated, and improved.

The implications of this research follow from perspectives of co-evolution and political ecology, resulting in a set of suggestions for renewable energy transition. These suggestions include:

- Approach renewable energy development as a process of democratic development.
- Change existing patterns of energy governance as a system.
- Anticipate and leverage both similarities and differences across initiatives for energy democracy.
- Advance policies for empowerment and disempowerment.
- Re-organize political networks.
- Recognize and restore ecological interdependence.
- Reconsider technological alternatives and alternatives to technology.

Overall, the research has contributed to both scholarship and activism for renewable energy transition. With limited analysis of energy democracy at its outset, this work has increased the visibility of actually existing social practices for transformation through renewable energy transition. Through this engagement, the research has revealed co-evolutionary dynamics of renewable energy transition and identified ways to advance the transformative potential of this transition. The research more broadly contributes to the development of approaches for the study of movements and narratives for social transformation. The salience of this research for activist and academic communities of practice is demonstrated by the continuation of conflicts and failures surrounding efforts to shift from fossil fuels to renewables and the uptake of research interest on issues of transition and transformation. Future research on energy democracy and renewable energy transition would usefully emphasize direct community engagement, integration with ecological and technological research, development of indicators of impacts and success, and continuation of critical, inclusive, and reconstructive approaches to research.

REFERENCES

Abbasi, T., & Abbasi, S. A. (2012). Is the Use of Renewable Energy Sources an Answer to the Problems of Global Warming and Pollution? *Critical Reviews in Environmental Science and Technology*, *42*(2), 99–154. https://doi.org/10.1080/10643389.2010.498754

Adams, R. N. (1975). *Energy and structure: A theory of social power*. Austin: University of Texas Press.

Adler, M., Nowotny, H., Coglianese, C., Jasanoff, S., Kanbur, R., Levy, B., … Starobin, S. (2018). The Contribution of the Social Sciences to Policy and Institutional Change. In International Panel on Social Progress (IPSP), *Rethinking Society for the 21st Century: Report of the International Panel on Social Progress* (1st ed., Vol. 3: Transformations in Values, Norms, Cultures, pp. 847–887). Cambridge: Cambridge University Press. https://doi.org/10.1017/9781108399661

Agustoni, A., & Maretti, M. (2012). Energy and social change: an introduction. *International Review of Sociology*, *22*(3), 391–404. https://doi.org/10.1080/03906701.2012.730820

Ahlborg, H. (2017). Towards a conceptualization of power in energy transitions. *Environmental Innovation and Societal Transitions*, *25*, 122–141. https://doi.org/10.1016/j.eist.2017.01.004

Alarcón Ferrari, C., & Chartier, C. (2017). Degrowth, energy democracy, technology and social-ecological relations: Discussing a localised energy system in Vaxjö, Sweden. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2017.05.100

Angel, J. (2016a). *Strategies of Energy Democracy*. Brussels, Belgium: Rosa-Luxemburg-Stiftung. Retrieved from http://www.rosalux.eu/publications/strategies-of-energy-democracy-a-report/

Angel, J. (2016b). *Towards energy democracy: Discussions and outcomes from an international workshop* (Workshop report). Amsterdam: Transnational Institute.

Ariza-Montobbio, P., Lele, S., Kallis, G., & Martinez-Alier, J. (2010). The political ecology of Jatropha plantations for biodiesel in Tamil Nadu, India. *The Journal of Peasant Studies*, *37*(4), 875–897. https://doi.org/10.1080/03066150.2010.512462

Armaroli, N., & Balzani, V. (2011). *Energy for a sustainable world: from the oil age to a sun-powered future*. Weinheim, German: Wiley-VCH Verlag GmbH.

Audet, R. (2015). Le champ des sustainability transitions: origines, analyses et pratiques de recherche. *Cahiers de recherche sociologique*, (58), 73–93. https://doi.org/10.7202/1036207ar

Auzanneau, M. (2018). *Oil, power, and war: a dark history*. White River Junction, Vermont: Chelsea Green Publishing.

Avelino, F., Grin, J., Pel, B., & Jhagroe, S. (2016). The politics of sustainability transitions. *Journal of Environmental Policy & Planning*, *18*(5), 557–567. https://doi.org/10.1080/1523908X.2016.1216782

Avelino, F., & Rotmans, J. (2009). Power in Transition: An Interdisciplinary Framework to Study Power in Relation to Structural Change. *European Journal of Social Theory*, *12*(4), 543–569.

Avelino, F., Wittmayer, J. M., Pel, B., Weaver, P., Dumitru, A., Haxeltine, A., … O'Riordan, T. (2017). Transformative social innovation and (dis)empowerment. *Technological Forecasting and Social Change*. https://doi.org/10.1016/j.techfore.2017.05.002

Báez, A. C. (2018). *It takes a hurricane...Puerto Rico's yearning for energy democracy*. Amsterdam: Transnational Institute. Retrieved from https://www.tni.org/en/puertorico

Balmaceda, M. M. (2018). Differentiation, materiality, and power: Towards a political economy of fossil fuels. *Energy Research & Social Science*, *39*(Supplement C), 130–140. https://doi.org/10.1016/j.erss.2017.10.052

Becker, E. (2012). Social-ecological systems as epistemic objects. In M. Glaser (Ed.), *Human-nature interactions in the Anthropocene: potentials of social-ecological systems analysis*. New York: Routledge.

Becker, S., & Kunze, C. (2014). Transcending community energy: collective and politically motivated projects in renewable energy (CPE) across Europe. *People, Place and Policy Online*, *8*(3), 180–191. https://doi.org/10.3351/ppp.0008.0003.0004

Becker, S., & Naumann, M. (2017). Energy democracy: Mapping the debate on energy alternatives. *Geography Compass*, *11*(8), e12321. https://doi.org/10.1111/gec3.12321

Bendell, J. (2018). *Deep Adaptation: A Map for Navigating Climate Tragedy* (IFLAS Occasional Paper No. 2). University of Cumbria: Institute of Leadership and Sustainability. Retrieved from http://www.lifeworth.com/deepadaptation.pdf

Berkhout, F., Marcotullio, P., & Hanaoka, T. (2012). Understanding energy transitions. *Sustainability Science*, *7*(2), 109–111. https://doi.org/10.1007/s11625-012-0173-5

Binder, C. R., Hinkel, J., Bots, P. W. G., & Pahl-Wostl, C. (2013). Comparison of Frameworks for Analyzing Social-ecological Systems. *Ecology and Society*, *18*(4). https://doi.org/10.5751/ES-05551-180426

Blair, J. M. (1976). *The Control of Oil*. London: Palgrave Macmillan.

Blanchet, C. (2016). Is renewable energy a commons? Energy, commons and the rest. Retrieved June 19, 2018, from https://energycommonsblog.wordpress.com/2016/08/24/rc02-is-renewable-energy-a-commons/

Bookchin, M. (1980). *Toward an ecological society*. Montréal; Buffalo: Black Rose Books.

Boonstra, W. J. (2016). Conceptualizing power to study social-ecological interactions. *Ecology and Society*, *21*(1). https://doi.org/10.5751/ES-07966-210121

Boselli, F., & Leidreiter, A. (2017). *100% RE Building Blocks: A practical toolkit for a sustainable transition to 100% Renewable Energy*. Global 100% RE Campaign. Retrieved from http://www.go100re.net/

Brand, U. (2016). Beyond Green Capitalism: Social–Ecological Transformation and Perspectives of a *Global* Green-Left. *Fudan Journal of the Humanities and Social Sciences*, *9*(1), 91–105. https://doi.org/10.1007/s40647-015-0096-5

Brand, U., & Wissen, M. (2017). Social-Ecological Transformation. In D. Richardson, N. Castree, M. F. Goodchild, A. Kobayashi, W. Liu, & R. A. Marston (Eds.), *International Encyclopedia of Geography* (pp. 1–9). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118786352.wbieg0690

Breslau, D. (2013). Studying and Doing Energy Transition. *Nature and Culture*, *8*(3), 324–330. https://doi.org/10.3167/nc.2013.080306

Bridge, G., Barca, S., Özkaynak, B., Turhan, E., & Wyeth, R. (2018). Towards a Political Ecology of EU Energy Policy. In C. Foulds & R. Robison (Eds.), *Advancing Energy Policy: Lessons on the integration of Social Sciences and Humanities* (pp. 163–175). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-99097-2_11

Brisbois, M. C. (2019). Powershifts: A framework for assessing the growing impact of decentralized ownership of energy transitions on political decision-making. *Energy Research & Social Science*, *50*, 151–161. https://doi.org/10.1016/j.erss.2018.12.003

Brown, L. R., Larsen, J., Roney, J. M., & Adams, E. E. (2015). *The great transition: shifting from fossil fuels to solar and wind energy* (First edition). New York: W.W. Norton & Company.

Bryant, R. (2015). *The International Handbook of Political Ecology*. Edward Elgar Publishing. https://doi.org/10.4337/9780857936172

Bues, A., & Gailing, L. (2016). Energy Transitions and Power: Between Governmentality and Depoliticization. In L. Gailing & T. Moss (Eds.), *Conceptualizing Germany's Energy Transition* (pp. 69–91). London: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-50593-4_5

Burke, M. J. (2018a). Energy democracy and the co-production of social and technological systems in northeastern North America. In A. Szolucha (Ed.), *Energy, Resource Extraction and Society: Impacts and Contested Futures* (pp. 88–104). Abingdon, Oxon; New York, NY: Routledge.

Burke, M. J. (2018b). Energy democracy in northeastern North America [data set]. *Qualitative Data Repository.* https://doi.org/10.5064/F6BUAX58. QDR Main Collection. V1

Burke, M. J. (2018c). Mutually-beneficial renewable energy systems. *Relations. Beyond Anthropocentrism*, *6*(1), 87–116. https://doi.org/10.7358/rela-2018-001-burk

Burke, M. J., & Stephens, J. C. (2017). Energy democracy: Goals and policy instruments for sociotechnical transitions. *Energy Research & Social Science*, *33*, 35–48. https://doi.org/10.1016/j.erss.2017.09.024

Burke, M. J., & Stephens, J. C. (2018). Political power and renewable energy futures: A critical review. *Energy Research & Social Science*, *35*, 78–93. https://doi.org/10.1016/j.erss.2017.10.018

Buscher, C., Schippl, J., & Sumpf, P. (Eds.). (2018). *Energy as a socio-technical problem: An interdisciplinary perspective on control, change, and action in energy transformations*. Routledge, Taylor & Francis Group.

Bushell, S., Buisson, G. S., Workman, M., & Colley, T. (2017). Strategic narratives in climate change: Towards a unifying narrative to address the action gap on climate change. *Energy Research & Social Science*, *28*, 39–49. https://doi.org/10.1016/j.erss.2017.04.001

Byrne, J., Martinez, C., & Ruggero, C. (2009). Relocating Energy in the Social Commons: Ideas for a Sustainable Energy Utility. *Bulletin of Science, Technology & Society*, *29*(2), 81–94. https://doi.org/10.1177/0270467609332315

Byrne, J., & Rich, D. (1983). The Solar Energy Transition as a Problem of Political Economy. In D. Rich, J. M. Veigel, A. M. Barnett, & J. Byrne (Eds.), *The Solar Energy Transition: Implementations and Policy Implications* (pp. 163–186). Boulder, CO: Westview Press.

Byrne, J., & Toly, N. (2006). Energy as a Social Project: Recovering a Discourse. In J. Byrne, N. Toly, & L. Glover (Eds.), *Transforming Power: Energy, Environment, and Society in Conflict* (Vol. 9, pp. 1–32). New York, NY: Routledge.

Castree, N., & Christophers, B. (2015). Banking Spatially on the Future: Capital Switching, Infrastructure, and the Ecological Fix. *Annals of the Association of American Geographers*, *105*(2), 378–386. https://doi.org/10.1080/00045608.2014.985622

Cederlöf, G. (2015). Thermodynamics revisited: The political ecology of energy systems in historical perspective. In R. L. Bryant (Ed.), *The International Handbook of Political Ecology* (pp. 646–658). Northampton, MA: Edward Elgar Publishing. https://doi.org/10.4337/9780857936172

Chappin, E. J. L., & Ligtvoet, A. (2014). Transition and transformation: A bibliometric analysis of two scientific networks researching socio-technical change. *Renewable and Sustainable Energy Reviews*, *30*, 715–723. https://doi.org/10.1016/j.rser.2013.11.013

Chatti, D., Archer, M., Lennon, M., & Dove, M. R. (2017). Exploring the mundane: Towards an ethnographic approach to bioenergy. *Energy Research & Social Science*, *30*, 28–34. https://doi.org/10.1016/j.erss.2017.06.024

Chatzivasileiadis, S., Ernst, D., & Andersson, G. (2017). Global Power Grids for Harnessing World Renewable Energy. In L. E. Jones (Ed.), *Renewable Energy Integration: Practical Management of Variability, Uncertainty, and Flexibility in Power Grids* (Second, pp. 161–174). Elsevier. https://doi.org/10.1016/B978-0-12-809592-8.00012-3

Chavez, D., & Dove, F. (2015). The meaning, relevance and scope of energy democracy. Retrieved June 27, 2016, from https://www.tni.org/en/article/the-meaning-relevance-and-scope-of-energy-democracy

Cherp, A., Jewell, J., & Goldthau, A. (2011). Governing Global Energy: Systems, Transitions, Complexity: Governing Global Energy. *Global Policy*, *2*(1), 75–88. https://doi.org/10.1111/j.1758-5899.2010.00059.x

Cherp, A., Vinichenko, V., Jewell, J., Brutschin, E., & Sovacool, B. (2018). Integrating techno-economic, socio-technical and political perspectives on national energy transitions: A meta-theoretical framework. *Energy Research & Social Science*, *37*, 175–190. https://doi.org/10.1016/j.erss.2017.09.015

Child, M., & Breyer, C. (2017). Transition and transformation: A review of the concept of change in the progress towards future sustainable energy systems. *Energy Policy*, *107*, 11–26. https://doi.org/10.1016/j.enpol.2017.04.022

Cleveland, C. J., & Morris, C. (Eds.). (2015). *Dictionary of energy* (2nd edition). Amsterdam: Elsevier. Retrieved from https://doi.org/10.1016/C2009-0-64490-1

Cloke, J., Mohr, A., & Brown, E. (2017). Imagining renewable energy: Towards a Social Energy Systems approach to community renewable energy projects in the Global South. *Energy Research & Social Science*, *31*(Supplement C), 263–272. https://doi.org/10.1016/j.erss.2017.06.023

Cottrell, F. (1955). *Energy and society; the relation between energy, social change, and economic development*. New York: McGraw Hill book company.

CSI. (2010). *Energy democracy: community-scale green energy solutions*. New York, N.Y.: Center for Social Inclusion. Retrieved from centerforsocialinclusion.org

Curran, G. (2015). *Sustainability and energy politics: ecological modernisation and corporate social responsibility*. Houndmills, Basingstoke, Hampshire; New York: Palgrave Macmillan.

de Onís, C. M. (2018). Energy Colonialism Powers the Ongoing Unnatural Disaster in Puerto Rico. *Frontiers in Communication*, *3*. https://doi.org/10.3389/fcomm.2018.00002

Delina, L. L. (2018). Energy democracy in a continuum: Remaking public engagement on energy transitions in Thailand. *Energy Research & Social Science*, *42*, 53–60. https://doi.org/10.1016/j.erss.2018.03.008

Delucchi, M. A., & Jacobson, M. Z. (2011). Providing all global energy with wind, water, and solar power, Part II: Reliability, system and transmission costs, and policies. *Energy Policy*, *39*(3), 1170–1190. https://doi.org/10.1016/j.enpol.2010.11.045

Desbiens, C. (2013). *Power from the north: territory, identity, and the culture of hydroelectricity in Quebec*. Vancouver: University of British Columbia Press.

Devine-Wright, P. (2007). Energy citizenship: Psychological aspects of evolution in sustainable energy technologies. In J. Murphy (Ed.), *Governing Technology for Sustainability* (pp. 63–88). London; Sterling, VA: Earthscan.

Diesendorf, M., & Elliston, B. (2018). The feasibility of 100% renewable electricity systems: A response to critics. *Renewable and Sustainable Energy Reviews*, *93*, 318–330. https://doi.org/10.1016/j.rser.2018.05.042

Dietz, K. (Ed.). (2015). *The political ecology of agrofuels*. Abingdon, Oxon; New York, NY: Routledge.

Dubash, N. K., & Florini, A. (2011). Mapping Global Energy Governance. *Global Policy*, *2*, 6–18. https://doi.org/10.1111/j.1758-5899.2011.00119.x

Dunlap, A. (2018a). Counterinsurgency for wind energy: the Bíi Hioxo wind park in Juchitán, Mexico. *The Journal of Peasant Studies*, *45*(3), 630–652. https://doi.org/10.1080/03066150.2016.1259221

Dunlap, A. (2018b). End the "Green" Delusions: Industrial-scale Renewable Energy is Fossil Fuel+. Retrieved July 3, 2018, from https://www.versobooks.com/blogs/3797-end-the-green-delusions-industrial-scale-renewable-energy-is-fossil-fuel

EIA (2018). *International Energy Outlook 2018.* US Energy Information Administration. https://www.eia.gov/outlooks/ieo/

Ellabban, O., Abu-Rub, H., & Blaabjerg, F. (2014). Renewable energy resources: Current status, future prospects and their enabling technology. *Renewable and Sustainable Energy Reviews*, *39*, 748–764. https://doi.org/10.1016/j.rser.2014.07.113

Elzen, B., Geels, F. W., & Green, K. (Eds.). (2004). *System innovation and the transition to sustainability: theory, evidence and policy*. Cheltenham, UK; Northhampton, MA, USA: Edward Elgar.

Engler, R. (1977). *The brotherhood of oil: energy policy and the public interest*. Chicago: University of Chicago Press.

Fabinyi, M., Evans, L., & Foale, S. J. (2014). Social-ecological systems, social diversity, and power: insights from anthropology and political ecology. *Ecology and Society*, *19*(4). https://doi.org/10.5751/ES-07029-190428

Fairchild, D., & Weinrub, A. (Eds.). (2017). *Energy democracy: advancing equity in clean energy solutions*. Washington, DC: Island Press.

Feola, G. (2015). Societal transformation in response to global environmental change: A review of emerging concepts. *Ambio*, *44*(5), 376–390. https://doi.org/10.1007/s13280-014-0582-z

Few, R., Morchain, D., Spear, D., Mensah, A., & Bendapudi, R. (2017). Transformation, adaptation and development: relating concepts to practice. *Palgrave Communications*, *3*, 17092. https://doi.org/10.1057/palcomms.2017.92

Fletcher, R. (2010). When environmental issues collide: climate change and the shifting political ecology of hydroelectric power. *Peace and Conflict Review*, *5*(1), 14–30.

Foxon, T. (2018). *Energy and economic growth: why we need a new pathway to prosperity*. Abingdon, Oxon; New York, NY: Routledge.

Frankfurt School-UNEP Centre/BNEF. (2017). *Global Trends in Renewable Energy Investment 2017*. Frankfurt School of Finance & Management. Retrieved from http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-2017

Franklin, R., & Osborne, T. (2017). Toward an urban political ecology of energy justice: the case of rooftop solar in Tucson, AZ. *Journal of Political Ecology*, *24*(1), 1055–1076.

Frigo, G. (2017). Energy ethics, homogenization, and hegemony: A reflection on the traditional energy paradigm. *Energy Research & Social Science*, *30*(Supplement C), 7–17. https://doi.org/10.1016/j.erss.2017.06.030

Gasparatos, A., Doll, C. N. H., Esteban, M., Ahmed, A., & Olang, T. A. (2017). Renewable energy and biodiversity: Implications for transitioning to a Green Economy. *Renewable and Sustainable Energy Reviews*, *70*, 161–184. https://doi.org/10.1016/j.rser.2016.08.030

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, *31*(8), 1257–1274.

Geels, F. W. (2005a). Co-evolution of technology and society: The transition in water supply and personal hygiene in the Netherlands (1850–1930)—a case study in multi-level perspective. *Technology in Society*, *27*(3), 363–397. https://doi.org/10.1016/j.techsoc.2005.04.008

Geels, F. W. (2005b). Processes and patterns in transitions and system innovations: Refining the co-evolutionary multi-level perspective. *Technological Forecasting and Social Change*, *72*(6), 681–696. https://doi.org/10.1016/j.techfore.2004.08.014

Geels, F. W. (2005c). The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). *Technology Analysis & Strategic Management*, *17*(4), 445–476. https://doi.org/10.1080/09537320500357319

Geels, F. W. (2014). Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory, Culture & Society*, *31*(5), 21–40. https://doi.org/10.1177/0263276414531627

Geels, F. W., & Kemp, R. (2007). Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. *Technology in Society*, *29*(4), 441–455. https://doi.org/10.1016/j.techsoc.2007.08.009

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Geels, F. W., Schwanen, T., Sorrell, S., Jenkins, K., & Sovacool, B. K. (2018). Reducing energy demand through low carbon innovation: A sociotechnical transitions perspective and thirteen research debates. *Energy Research & Social Science*, *40*, 23–35. https://doi.org/10.1016/j.erss.2017.11.003

Geels, F. W., Sovacool, B. K., Schwanen, T., & Sorrell, S. (2017a). Sociotechnical transitions for deep decarbonization. *Science*, *357*(6357), 1242–1244. https://doi.org/10.1126/science.aao3760

Geels, F. W., Sovacool, B. K., Schwanen, T., & Sorrell, S. (2017b). The Socio-Technical Dynamics of Low-Carbon Transitions. *JOUL Joule*, *1*(3), 463–479.

Georgescu-Roegen, N. (1984). Feasible recipes versus viable technologies. *Atlantic Economic Journal*, *12*(1), 21–31.

Giancatarino, A. (2013). *Community-Scale Energy: Models, Strategies and Racial Equity - A Scan of Community Innovation around Efficiency and Renewable Energy*. New York, N.Y.: Center for Social Inclusion.

Global 100% RE. (2017). The Global 100% Renewable Energy Platform. Retrieved September 28, 2017, from http://www.go100re.net/

Glover, L. (2006). From Love-ins to Logos: Charting the Demise of Renewable Energy as a Social Movement. In J. Byrne, N. Toly, & L. Glover (Eds.), *Transforming power: energy, environment, and society in conflict* (pp. 247–268). New Brunswick, NJ: Transaction Publishers.

Goldemberg, J. (2012). *Energy: what everyone needs to know*. Oxford; New York: Oxford University Press.

Graham, J. K. G., & Roelvink, G. (2010). An Economic Ethics for the Anthropocene. *Antipode*, *41*, 320–346. https://doi.org/10.1111/j.1467-8330.2009.00728.x

Gross, M., & Mautz, R. (2015). *Renewable energies*. London; New York: Routledge, Taylor & Francis Group.

Grubler, A., Wilson, C., & Nemet, G. (2016). Apples, oranges, and consistent comparisons of the temporal dynamics of energy transitions. *Energy Research & Social Science*, *22*, 18–25. https://doi.org/10.1016/j.erss.2016.08.015

Gui, E. M., & MacGill, I. (2018). Typology of future clean energy communities: An exploratory structure, opportunities, and challenges. *Energy Research & Social Science*, *35*, 94–107. https://doi.org/10.1016/j.erss.2017.10.019

Gupta, J., & Vegelin, C. (2016). Sustainable development goals and inclusive development. *International Environmental Agreements: Politics, Law and Economics*, *16*(3), 433–448. https://doi.org/10.1007/s10784-016-9323-z

Hansen, J. P., Narbel, P. A., & Aksnes, D. L. (2017). Limits to growth in the renewable energy sector. *Renewable and Sustainable Energy Reviews*, *70*, 769–774. https://doi.org/10.1016/j.rser.2016.11.257

Haxeltine, A., Avelino, F., Pel, B., Dumitru, A., Kemp, R., Longhurst, N., … Wittmayer, J. M. (2016). *A framework for Transformative Social Innovation* (No. TRANSIT working paper #5). Rotterdam: TRANSIT.

Haxeltine, A., Avelino, F., Wittmayer, J. M., Kunze, I., Longhurst, N., Dumitru, A., & O'Riordan, T. (2017). Conceptualising the role of social innovation in sustainability transformations. In J. Backhaus, A. Genus, S. Lorek, E. Vadovics, & J. M. Wittmayer (Eds.), *Social Innovation and Sustainable Consumption: Research and Action for Societal Transformation* (1st ed., pp. 12–25). London: Routledge, Taylor & Francis Group.

Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition." *Energy Policy*, *108*, 451–459. https://doi.org/10.1016/j.enpol.2017.06.014

Heard, B. P., Brook, B. W., Wigley, T. M. L., & Bradshaw, C. J. A. (2017). Burden of proof: A comprehensive review of the feasibility of 100% renewable-electricity systems. *Renewable and Sustainable Energy Reviews*, *76*, 1122–1133. https://doi.org/10.1016/j.rser.2017.03.114

Heffron, R. J., & McCauley, D. (2018). What is the 'Just Transition'? *GEOF Geoforum*, *88*, 74–77.

Heinberg, R., & Fridley, D. (2016a). Energy 101. In *Our renewable future: Laying the path for one hundred percent clean energy* (pp. 15–34). Washington, DC: Island Press.

Heinberg, R., & Fridley, D. (2016b). Energy supply: How much will we have? How much will we need? In *Our renewable future: Laying the path for one hundred percent clean energy* (pp. 115–130). Washington, DC: Island Press.

Henderson, H. (1988). *The politics of the solar age: alternatives to economics* (Rev. edition). Indianapolis, IN: Knowledge Systems, Inc.

Hess, D. J. (2014). Sustainability transitions: A political coalition perspective. *Research Policy*, *43*(2), 278–283. https://doi.org/10.1016/j.respol.2013.10.008

Hess, D. J. (2018). Energy democracy and social movements: A multi-coalition perspective on the politics of sustainability transitions. *Energy Research & Social Science*, *40*, 177–189. https://doi.org/10.1016/j.erss.2018.01.003

Hildyard, N. (2016). *Energy Transitions: Some Questions from the Netherworld*. Presented at the Energy transition – why and for whom? Vienna. Retrieved from http://www.thecornerhouse.org.uk/resource/energy-transitions

Hoffman, S. M., & High-Pippert, A. (2005). Community Energy: A Social Architecture for an Alternative Energy Future. *Bulletin of Science, Technology & Society*, *25*(5), 387–401. https://doi.org/10.1177/0270467605278880

Hopkins, R. (2008). *The transition handbook: from oil dependency to local resilience*. Totnes, Devon: Green Books.

Hornborg, A. (2013). The fossil interlude: Euro-American power and the return of the Physiocrats. *Cultures of Energy: Power, Practices, Technologies*, 41–59.

Huber, M. (2015a). Energy and Social Power: from political ecology to the ecology of politics. In T. A. Perreault, G. Bridge, & J. McCarthy (Eds.), *Routledge Handbook of Political Ecology* (pp. 481–492). Abingdon: Routledge.

Huber, M. (2015b). Theorizing Energy Geographies. *Geography Compass*, *9*(6), 327–338. https://doi.org/10.1111/gec3.12214

Huber, M. T., & McCarthy, J. (2017). Beyond the subterranean energy regime? Fuel, land use and the production of space. *Transactions of the Institute of British Geographers*, *42*(4), 655–668. https://doi.org/10.1111/tran.12182

Hughes, T. P. (1983). *Networks of power: electrification in Western society, 1880-1930*. Baltimore: Johns Hopkins University Press.

IEA (2018). *Global energy and CO_2 status report 2017.* OECD/IEA. https://www.iea.org/geco/

Illich, I. (2009). The social construction of energy. *New Geographies*, *2*, 11–19.

Illich, I. (2013). *Beyond economics and ecology: the radical thought of Ivan Illich*. New York: Marion Boyars Publishers Ltd.

IRENA. (2015). *The Age of Renewable Power: Designing national roadmaps for a successful transformation*. Abu Dhabi. Retrieved from http://www.actu-environnement.com/media/pdf/news-25541-irena-age-renewable-power.pdf

Jackson, P. T. (2016). *The conduct of inquiry in international relations: philosophy of science and its implications for the study of world politics* (2nd ed.). Milton Park, Abingdon, Oxon; New York, NY: Routledge.

Jackson, R. B., Quéré, C. L., Andrew, R. M., Canadell, J. G., Peters, G. P., Roy, J., & Wu, L. (2017). Warning signs for stabilizing global CO 2 emissions. *Environmental Research Letters*, *12*(11), 110202. https://doi.org/10.1088/1748-9326/aa9662

Jacobson, M. Z., & Delucchi, M. A. (2011). Providing all global energy with wind, water, and solar power, Part I: Technologies, energy resources, quantities and areas of infrastructure, and materials. *Energy Policy*, *39*(3), 1154–1169. https://doi.org/10.1016/j.enpol.2010.11.040

Jacobson, M. Z., Delucchi, M. A., Cameron, M. A., & Frew, B. A. (2017). The United States can keep the grid stable at low cost with 100% clean, renewable energy in all sectors despite inaccurate claims. *Proceedings of the National Academy of Sciences*, *114*(26), E5021–E5023. https://doi.org/10.1073/pnas.1708069114

Jasanoff, S. (Ed.). (2004). *States of Knowledge: The Co-Production of Science and the Social Order*. New York, New York: Routledge, Taylor & Francis Group. Retrieved from http://ebookcentral.proquest.com/lib/mcgill/detail.action?docID=200656

Jasanoff, S. (2015). Future Imperfect: Science, Technology, and the Imaginations of Modernity. In S. Jasanoff & S.-H. Kim (Eds.), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (pp. 1–33). Chicago; London: University of Chicago Press.

Jasanoff, S. (2018). Just transitions: A humble approach to global energy futures. *Energy Research & Social Science*, *35*, 11–14. https://doi.org/10.1016/j.erss.2017.11.025

Jonas, M. (2017). Societal transformation, social innovations and sustainable consumption in an era of metamorphosis. In J. Backhaus, A. Genus, S. Lorek, E. Vadovics, & J. M. Wittmayer (Eds.), *Social Innovation and Sustainable Consumption: Research and Action for Societal Transformation* (1st ed., pp. 41–53). London: Routledge, Taylor & Francis Group.

Jones, C. F. (2013). Building More Just Energy Infrastructure: Lessons from the Past. *Science as Culture*, *22*(2), 157–163. https://doi.org/10.1080/09505431.2013.786991

Kallis, G. (2007). Socio-environmental co-evolution: some ideas for an analytical approach. *International Journal of Sustainable Development and World Ecology; London*, *14*(1), 4–13.

Kallis, G., Kostakis, V., Lange, S., Muraca, B., Paulson, S., & Schmelzer, M. (2018). Research on Degrowth. *Annual Review of Environment and Resources*, (0).

Karlsson-Vinkhuyzen, S. I., Jollands, N., & Staudt, L. (2012). Global governance for sustainable energy: The contribution of a global public goods approach. *Ecological Economics*, *83*, 11–18. https://doi.org/10.1016/j.ecolecon.2012.08.009

Kemp, R., Loorbach, D., & Rotmans, J. (2007). Transition management as a model for managing processes of co-evolution towards sustainable development. *International Journal of Sustainable Development & World Ecology*, *14*(1), 78–91. https://doi.org/10.1080/13504500709469709

Kenis, A., Bono, F., & Mathijs, E. (2016). Unravelling the (post-)political in Transition Management: Interrogating Pathways towards Sustainable Change. *Journal of*

Environmental Policy & Planning, *18*(5), 568–584. https://doi.org/10.1080/1523908X.2016.1141672

Kern, F., & Markard, J. (2016). Analysing Energy Transitions: Combining Insights from Transition Studies and International Political Economy. In T. Van de Graaf, B. K. Sovacool, A. Ghosh, F. Kern, & M. T. Klare (Eds.), *The Palgrave Handbook of the International Political Economy of Energy* (pp. 291–318). London: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-55631-8_12

Kern, F., & Rogge, K. S. (2016). The pace of governed energy transitions: Agency, international dynamics and the global Paris agreement accelerating decarbonisation processes? *Energy Research & Social Science*, *22*, 13–17. https://doi.org/10.1016/j.erss.2016.08.016

Klein, D. (2015). *Capitalism and Climate Change: The Science and Politics of Global Warming*. (S. McMillan, Ed.) (First Edition). Online: Gumroad, Inc. Retrieved from https://gumroad.com/l/climatechange

Klein, N. (2014). *This changes everything: capitalism vs. the climate* (First Simon & Schuster hardcover edition). New York: Simon & Schuster.

Kohler, J., Geels, F., Kern, F., Onsongo, E., & Wieczorek, A. (2017). A research agenda for the Sustainability Transitions Research Network. STRN. Retrieved from https://transitionsnetwork.org/about-strn/research_agenda/

Koirala, B. P., Koliou, E., Friege, J., Hakvoort, R. A., & Herder, P. M. (2016). Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems. *Renewable and Sustainable Energy Reviews*, *56*, 722–744. https://doi.org/10.1016/j.rser.2015.11.080

Krupa, J., & Burch, S. (2011). A new energy future for South Africa: The political ecology of South African renewable energy. *Energy Policy*, *39*(10), 6254–6261. https://doi.org/10.1016/j.enpol.2011.07.024

Kumi, E., Arhin, A. A., & Yeboah, T. (2014). Can post-2015 sustainable development goals survive neoliberalism? A critical examination of the sustainable development–neoliberalism nexus in developing countries. *Environment, Development and Sustainability*, *16*(3), 539–554. https://doi.org/10.1007/s10668-013-9492-7

Kunze, C., & Becker, S. (2014). *Energy democracy in Europe: A survey and outlook*. Brussels, Belgium: Rosa-Luxemburg-Stiftung. Retrieved from http://www.rosalux.eu/publications

Kunze, C., & Becker, S. (2015). Collective ownership in renewable energy and opportunities for sustainable degrowth. *Sustainability Science*, *10*(3), 425–437. https://doi.org/10.1007/s11625-015-0301-0

Kunze, I., & Avelino, F. (2015). *Social innovation and the Global Ecovillage Network* (TRANSIT research report No. EU SSH.2013.32-1). Rotterdam: TRANSIT.

Kuzemko, C., Lockwood, M., Mitchell, C., & Hoggett, R. (2016). Governing for sustainable energy system change: Politics, contexts and contingency. *Energy Research & Social Science*, *12*, 96–105. https://doi.org/10.1016/j.erss.2015.12.022

Labanca, N. (2017). Ontological Fallacies Linked to Energy, Information and Related Technologies. In N. Labanca (Ed.), *Complex Systems and Social Practices in Energy Transitions: Framing Energy Sustainability in the Time of Renewables* (pp. 171–205). Cham, Switzerland: Springer International Publishing.

Labussière, O., & Nadaï, A. (Eds.). (2018a). *Energy transitions: a socio-technical inquiry* (1st edition 2018). Cham, Switzerland: Palgrave Macmillan.

Labussière, O., & Nadaï, A. (2018b). Energy Transitions and Potentials for Democratic Change. In O. Labussière & A. Nadaï (Eds.), *Energy Transitions: A Socio-technical Inquiry* (pp. 319–334). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-77025-3_8

Laird, F. N. (2003). Constructing the Future: Advocating Energy Technologies in the Cold War. *Technology and Culture*, *44*(1), 27–49. https://doi.org/10.1353/tech.2003.0030

Laird, F. N. (2013). Against Transitions? Uncovering Conflicts in Changing Energy Systems. *Science as Culture*, *22*(2), 149–156. https://doi.org/10.1080/09505431.2013.786992

Lawhon, M., & Murphy, J. T. (2012). Socio-technical regimes and sustainability transitions: Insights from political ecology. *Progress in Human Geography*, *36*(3), 354–378. https://doi.org/10.1177/0309132511427960

Leach, M., Rockström, J., Raskin, P., Scoones, I., Stirling, A. C., Smith, A., … Olsson, P. (2012). Transforming Innovation for Sustainability. *Ecology and Society*, *17*(2). https://doi.org/10.5751/ES-04933-170211

Ley, D. (2017). Sustainable Development, Climate Change, and Renewable Energy in Rural Central America. In J. I. Uitto, J. Puri, & R. D. van den Berg (Eds.), *Evaluating Climate*

Change Action for Sustainable Development (pp. 187–212). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-43702-6_11

Liu, Z. (2015). *Global energy interconnection*. Amsterdam; Boston; Heidelberg; London; New York; Oxford; Paris; San Diego; San Francisco; Singapore; Sydney; Tokyo: Elsevier.

Loftus, P. J., Cohen, A. M., Long, J. C. S., & Jenkins, J. D. (2015). A critical review of global decarbonization scenarios: what do they tell us about feasibility? *Wiley Interdisciplinary Reviews: Climate Change*, *6*(1), 93–112. https://doi.org/10.1002/wcc.324

Lohmann, L., & Hildyard, N. (2014). *Energy, Work and Finance*. Dorset, UK: Corner House. Retrieved from http://www.thecornerhouse.org.uk

Lovins, A. B. (1976). Energy Strategy: The Road Not Taken? *Foreign Affairs*, *55*(1), 65. https://doi.org/10.2307/20039628

Löwy, M. (2015). *Ecosocialism: a radical alternative to capitalist catastrophe*. Chicago: Haymarket Books.

Magdoff, F. (2008). The Political Economy and Ecology of Biofuels. *Monthly Review: An Independent Socialist Magazine*, *60*(3), 34–50.

Magdoff, F., & Williams, C. (2017). *Creating an ecological society: toward a revolutionary transformation*. New York: Monthly Review Press.

Mann, P. S. (2016). On the Precipice with Naomi Klein, Karl Marx and the Pope: Towards a Postcapitalist Energy Commons and Beyond. *Radical Philosophy Review*, *19*(3), 621–652. https://doi.org/10.5840/radphilrev20168864

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy*, *41*(6), 955–967. https://doi.org/10.1016/j.respol.2012.02.013

Martinez, C. (2017). From commodification to the Commons: Charting the pathway for energy democracy. In D. Fairchild & A. Weinrub (Eds.), *Energy democracy: advancing equity in clean energy solutions* (pp. 21–36). Washington, DC: Island Press.

Martinez-Alier, J., Anguelovski, I., Bond, P., Bene, D. D., Demaria, F., Gerber, J.-F., … Yánez, I. (2014). Between activism and science: grassroots concepts for sustainability coined by Environmental Justice Organizations. *Journal of Political Ecology*, *21*(1), 19–60.

Martinot, E. (2017). Global Initiative for Distributed and Local Energy. Retrieved September 28, 2017, from http://martinot.info/dale/

McCarthy, J. (2015). A socioecological fix to capitalist crisis and climate change? The possibilities and limits of renewable energy. *Environment and Planning A*, *47*(12), 2485–2502. https://doi.org/10.1177/0308518X15602491

McCarthy, J., & Thatcher, J. (2017). Visualizing new political ecologies: A critical data studies analysis of the World Bank's renewable energy resource mapping initiative. *Geoforum*. https://doi.org/10.1016/j.geoforum.2017.03.025

McEwan, C. (2017). Spatial processes and politics of renewable energy transition: Land, zones and frictions in South Africa. *Political Geography*, *56*(Supplement C), 1–12. https://doi.org/10.1016/j.polgeo.2016.10.001

McGinnis, M. D., & Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society*, *19*(2). https://doi.org/10.5751/ES-06387-190230

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences*, *42*(4), 323–340. https://doi.org/10.1007/s11077-009-9097-z

Meadowcroft, J. (2011). Engaging with the politics of sustainability transitions. *Environmental Innovation and Societal Transitions*, *1*(1), 70–75. https://doi.org/10.1016/j.eist.2011.02.003

Meadowcroft, J. (2016). Let's Get This Transition Moving! *Canadian Public Policy*, *42*(S1), S10–S17. https://doi.org/10.3138/cpp.2015-028

Mitchell, T. (2011). *Carbon democracy: political power in the age of oil*. London: Verso.

Mittlefehldt, S. (2018). From appropriate technology to the clean energy economy: renewable energy and environmental politics since the 1970s. *Journal of Environmental Studies and Sciences*, *8*(2), 212–219. https://doi.org/10.1007/s13412-018-0471-z

Moezzi, M., Janda, K. B., & Rotmann, S. (2017). Using stories, narratives, and storytelling in energy and climate change research. *Energy Research & Social Science*, *31*, 1–10. https://doi.org/10.1016/j.erss.2017.06.034

Moore, M.-L., Tjornbo, O., Enfors, E., Knapp, C., Hodbod, J., Baggio, J. A., … Biggs, D. (2014). Studying the complexity of change: toward an analytical framework for understanding deliberate social-ecological transformations. *Ecology and Society*, *19*(4). https://doi.org/10.5751/ES-06966-190454

Moriarty, P., & Honnery, D. (2016). Can renewable energy power the future? *Energy Policy*, *93*, 3–7. https://doi.org/10.1016/j.enpol.2016.02.051

Morris, & Jungjohann, A. (2016). *Energy democracy: Germanys Energiewende to renewables*. Basingstoke: Palgrave Macmillan.

Müller, F. (2017). IRENA as a glocal actor: pathways towards energy governmentality. *Innovation: The European Journal of Social Science Research*, 1–17. https://doi.org/10.1080/13511610.2017.1279538

Mumford, L. (1964). Authoritarian and Democratic Technics. *Technology and Culture*, *5*(1), 1. https://doi.org/10.2307/3101118

Nadaï, A., & Labussière, O. (2018). New Energy Resources in the Making. In O. Labussière & A. Nadaï (Eds.), *Energy Transitions: A Socio-technical Inquiry* (pp. 49–100). Cham, Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-77025-3_2

National Research Council. (1984). *Energy Use: The Human Dimension*. (P. C. Stern & E. Aronson, Eds.). New York; Washington, DC: W.H. Freeman and Company / The National Academies Press. https://doi.org/10.17226/9259

New Climate Economy. (2018). *Unlocking the inclusive growth story of the 21st Century: accelerating climate action in urgent times*. Washington, DC: World Resources Institute. Retrieved from www.newclimateeconomy.report

Newell, P., & Mulvaney, D. (2013). The political economy of the 'just transition.' *GEOJ The Geographical Journal*, *179*(2), 132–140.

Norgaard, R. B. (1994). *Development betrayed: the end of progress and a coevolutionary revisioning of the future*. London; New York: Routledge.

Norgaard, R. B. (1995). Beyond materialism: A coevolutionary reinterpretation of the environmental crisis. *Review of Social Economy*, *53*(4), 475–475.

Norgaard, R. B., & Kallis, G. (2016). Coevolutionary contradictions: prospects for a research programme on social and environmental change. *Geografiska Annaler: Series B, Human Geography*, *93*(4), 289–300. https://doi.org/10.1111/j.1468-0467.2011.00383.x

O'Brien, K. (2012). Global environmental change II: From adaptation to deliberate transformation. *Progress in Human Geography*, *36*(5), 667–676. https://doi.org/10.1177/0309132511425767

Ockwell, D. G., & Byrne, R. (2017). *Sustainable energy for all: innovation, technology and pro-poor green transformations*. London; New York: Routledge, Taylor & Francis Group, Earthscan, from Routledge.

OECD. (2012). *Energy*. OECD Publishing. Retrieved from http://www.oecd-ilibrary.org/environment/energy_9789264115118-en

Osborne, T. (2017). Public Political Ecology: a community of praxis for earth stewardship. *Journal of Political Ecology*, *24*(1), 843–860.

Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences*, *104*(39), 15181–15187.

Ostrom, E. (2009). A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science*, *325*(5939), 419–422. https://doi.org/10.1126/science.1172133

Papachristos, G. (2017). Diversity in technology competition: The link between platforms and sociotechnical transitions. *Renewable and Sustainable Energy Reviews*, *73*, 291–306. https://doi.org/10.1016/j.rser.2017.01.146

Paredis, E. (2010). Sustainability Transitions and the Nature of Technology. *Foundations of Science*, *16*(2–3), 195–225. https://doi.org/10.1007/s10699-010-9197-4

Pasqualetti, M. J. (2011). Social Barriers to Renewable Energy Landscapes. *Geographical Review*, *101*(2), 201–223. https://doi.org/10.1111/j.1931-0846.2011.00087.x

Patterson, J., Schulz, K., Vervoort, J., Adler, C., Hurlbert, M., van der Hel, S., … others. (2015). "Transformations towards sustainability": Emerging approaches, critical reflections, and a research agenda. Retrieved from https://ueaeprints.uea.ac.uk/54624/

Patterson, J., Schulz, K., Vervoort, J., van der Hel, S., Widerberg, O., Adler, C., … Barau, A. (2017). Exploring the governance and politics of transformations towards sustainability. *Environmental Innovation and Societal Transitions*, *24*, 1–16. https://doi.org/10.1016/j.eist.2016.09.001

Perreault, T. A., Bridge, G., & McCarthy, J. (Eds.). (2015). *Routledge handbook of political ecology*. Abingdon, Oxon; New York, NY: Routledge.

Phadke, R. (2011). Resisting and Reconciling Big Wind: Middle Landscape Politics in the New American West. *Antipode*, *43*(3), 754–776. https://doi.org/10.1111/j.1467-8330.2011.00881.x

Polanyi, K. (2001)[1944]. *The great transformation: the political and economic origins of our time* (2nd Beacon Paperback ed). Boston, MA: Beacon Press.

Rabson, M. (2018). Ottawa buying Kinder Morgan's Trans Mountain pipeline, terminal for $4.5 billion. *Maclean's*. Retrieved from https://www.macleans.ca/politics/ottawa/kinder-morgan-pipeline-bill-morneau-to-announce-if-ottawa-is-buying-trans-mountain-live-video/

Raman, S. (2013). Fossilizing Renewable Energies. *Science as Culture*, *22*(2), 172–180. https://doi.org/10.1080/09505431.2013.786998

Rauschmayer, F., Bauler, T., & Schäpke, N. (2015). Towards a thick understanding of sustainability transitions — Linking transition management, capabilities and social practices. *Ecological Economics*, *109*, 211–221. https://doi.org/10.1016/j.ecolecon.2014.11.018

REN21. (2016). *Renewables 2016 Global Status Report*. Paris: REN21 Secretariat. Retrieved from http://www.ren21.net/status-of-renewables/global-status-report/

REN21. (2017). *Renewables 2017 Global Status Report*. Paris: REN21 Secretariat. Retrieved from http://www.ren21.net/gsr-2017/

Robbins, P. (2012). *Political ecology: a critical introduction* (2nd ed). Chichester, West Sussex; Malden, MA: J. Wiley & Sons.

Roehrkasten, S. (2015). Global Governance on Renewable Energy. In S. Roehrkasten, *Global Governance on Renewable Energy* (pp. 73–116). Wiesbaden: Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-10480-1_3

Roggema, R., Vermeend, T., Dobbelsteen, A., Roggema, R., Vermeend, T., & Dobbelsteen, A. van den. (2012). Incremental Change, Transition or Transformation? Optimising Change Pathways for Climate Adaptation in Spatial Planning. *Sustainability*, *4*(10), 2525–2549. https://doi.org/10.3390/su4102525

Rojey, A. (2009). *Energy & climate: how to achieve a successful energy transition*. Chichester, UK: London: Wiley; SCI.

Rolffs, P., Ockwell, D., & Byrne, R. (2015). Beyond technology and finance: pay-as-you-go sustainable energy access and theories of social change. *Environment and Planning A*, *47*(12), 2609–2627. https://doi.org/10.1177/0308518X15615368

Rotmans, J., Kemp, R., & van Asselt, M. (2001). More evolution than revolution: transition management in public policy. *Foresight*, *3*(1), 15–31. https://doi.org/10.1108/14636680110803003

Royston, S., Selby, J., & Shove, E. (2018). Invisible energy policies: A new agenda for energy demand reduction. *Energy Policy*, *123*, 127–135. https://doi.org/10.1016/j.enpol.2018.08.052

Ruotsalainen, J., Karjalainen, J., Child, M., & Heinonen, S. (2017). Culture, values, lifestyles, and power in energy futures: A critical peer-to-peer vision for renewable energy. *Energy Research & Social Science*, *34*, 231–239. https://doi.org/10.1016/j.erss.2017.08.001

Ryghaug, M., Skjølsvold, T. M., & Heidenreich, S. (2018). Creating energy citizenship through material participation. *Social Studies of Science*, *48*(2), 283–303. https://doi.org/10.1177/0306312718770286

Sampson, A. (1975). *The seven sisters: the great oil companies and the world they shaped*. New York: Viking Press.

Santangeli, A., Toivonen, T., Pouzols, F. M., Pogson, M., Hastings, A., Smith, P., & Moilanen, A. (2016). Global change synergies and trade-offs between renewable energy and biodiversity. *GCB Bioenergy*, *8*(5), 941–951. https://doi.org/10.1111/gcbb.12299

Scheer, H. (2012). *The energy imperative: 100 per cent renewable now* (1st ed). London; New York: Earthscan.

Schneider, J., & Peeples, J. (2018). The Energy Covenant: Energy Dominance and the Rhetoric of the Aggrieved. *Frontiers in Communication*, *3*. https://doi.org/10.3389/fcomm.2018.00005

Schneidewind, U., Augenstein, K., & Scheck, H. (2013). The Transition to Renewable Energy Systems – On the Way to a Comprehensive Transition Concept. In D. Stolten & V. Scherer (Eds.), *Transition to Renewable Energy Systems* (pp. 119–136). Weinheim: Wiley-VCH. https://doi.org/10.1002/9783527673872.ch8

Schot, J., & Kanger, L. (2018). Deep transitions: Emergence, acceleration, stabilization and directionality. *Research Policy*, *47*(6), 1045–1059. https://doi.org/10.1016/j.respol.2018.03.009

Schot, J., & Steinmueller, W. E. (2017). *Three Frames for Innovation Policy: R&D, Systems of Innovation and Transformative Change* (Working Paper) (p. 26). University of Sussex: Science Policy Research Unit (SPRU). Retrieved from http://tipconsortium.net

Schumacher, E. F. (1973). *Small is beautiful: a study of economics as if people mattered*. London: Blond and Briggs.

Schwartzman, D. (2016). How Much and What Kind of Energy Does Humanity Need? *Socialism and Democracy*, *30*(2), 97–120. https://doi.org/10.1080/08854300.2016.1183999

Scoones, I., Leach, M., & Newell, P. (Eds.). (2015). *The politics of green transformations*. London; New York: Routledge.

Sekulova, F., Kallis, G., Rodríguez-Labajos, B., & Schneider, F. (2013). Degrowth: from theory to practice. *Degrowth: From Theory to Practice*, *38*, 1–6. https://doi.org/10.1016/j.jclepro.2012.06.022

Sgouridis, S., & Csala, D. (2014). A Framework for Defining Sustainable Energy Transitions: Principles, Dynamics, and Implications. *Sustainability*, *6*(5), 2601–2622. https://doi.org/10.3390/su6052601

Shaner, M. R., Davis, S. J., Lewis, N. S., & Caldeira, K. (2018). Geophysical constraints on the reliability of solar and wind power in the United States. *Energy & Environmental Science*. https://doi.org/10.1039/C7EE03029K

Shove, E., & Walker, G. (2007). Caution! Transitions Ahead: Politics, Practice, and Sustainable Transition Management. *Environment and Planning A*, *39*(4), 763–770. https://doi.org/10.1068/a39310

Shove, E., & Walker, G. (2014). What Is Energy For? Social Practice and Energy Demand. *Theory, Culture & Society*, *31*(5), 41–58. https://doi.org/10.1177/0263276414536746

Smil, V. (2008). *Energy in nature and society: general energetics of complex systems*. Cambridge, Mass: The MIT Press.

Smil, V. (2009). Energy in our minds: concepts and measures. In *Energy: A beginner's guide* (pp. 1–25). London: Oneworld Publications.

Smil, V. (2010). *Energy transitions: history, requirements, prospects*. Santa Barbara, Calif: Praeger.

Smil, V. (2015). Energy transitions, renewables and rational energy use: A reality check. *OECD Observer*, (304), 36–37.

Smil, V. (2016). Examining energy transitions: A dozen insights based on performance. *Energy Research & Social Science*, *22*, 194–197. https://doi.org/10.1016/j.erss.2016.08.017

Smil, V. (2017). *Energy and civilization: a history*. Cambridge, MA: The MIT Press.

Smith, A. (2011). The Transition Town Network: A Review of Current Evolutions and Renaissance. *Social Movement Studies*, *10*(1), 99–105. https://doi.org/10.1080/14742837.2011.545229

Smith, A., & Stirling, A. (2010). The politics of social-ecological resilience and sustainable socio-technical transitions. *Ecology and Society*, *15*(1), 11.

Smith, A., Voß, J.-P., & Grin, J. (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy*, *39*(4), 435–448. https://doi.org/10.1016/j.respol.2010.01.023

Smith, R. (2011). Green capitalism: the god that failed. *Real-World Economics Review*, *56*, 112–144.

Sneddon, C. (2015). Large dams, technopolitics, and development. In *Concrete Revolution: Large Dams, Cold War Geopolitics, and the US Bureau of Reclamation* (1st ed., pp. 1–27). Chicago; London: The University of Chicago Press.

Sovacool, B. K. (2014). What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda. *Energy Research & Social Science*, *1*, 1–29. https://doi.org/10.1016/j.erss.2014.02.003

Sovacool, B. K. (2016a). How long will it take? Conceptualizing the temporal dynamics of energy transitions. *Energy Research & Social Science*, *13*, 202–215. https://doi.org/10.1016/j.erss.2015.12.020

Sovacool, B. K. (2016b). The Political Ecology and Justice of Energy. In T. Van de Graaf, B. K. Sovacool, A. Ghosh, F. Kern, & M. T. Klare (Eds.), *The Palgrave Handbook of the International Political Economy of Energy* (pp. 529–558). London: Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-55631-8_22

Sovacool, B. K., & Brossmann, B. (2013). Fantastic Futures and Three American Energy Transitions. *Science as Culture*, *22*(2), 204–212. https://doi.org/10.1080/09505431.2013.786999

Sovacool, B. K., & Florini, A. (2012). Examining the Complications of Global Energy Governance. *Journal of Energy & Natural Resources Law*, *30*(3), 235–263. https://doi.org/10.1080/02646811.2012.11435295

Sovacool, B. K., & Geels, F. W. (2016). Further reflections on the temporality of energy transitions: A response to critics. *Energy Research & Social Science*, *22*, 232–237. https://doi.org/10.1016/j.erss.2016.08.013

Sovacool, B. K., & Hess, D. J. (2017). Ordering theories: Typologies and conceptual frameworks for sociotechnical change. *Social Studies of Science*, *47*(5), 703–750. https://doi.org/10.1177/0306312717709363

Speth, J. G., Skandier, C. S., & Bozuwa, J. (2018). *Taking climate action to the next level* (p. 32). Washington, DC: The Next System Project. Retrieved from https://thenextsystem.org/climateaction

Stephens, J. C., Peterson, T. R., & Wilson, E. J. (2014). Socio-Political Evaluation of Energy Deployment (SPEED): A Framework Applied to Smart Grid. *UCLA L. Rev.*, *61*, 1930.

Stephenson, J. (2017). What does energy mean? An interdisciplinary conversation. *Energy Research & Social Science*, *26*, 103–106. https://doi.org/10.1016/j.erss.2017.01.014

STEPS Centre. (2018). Transformations. Retrieved June 20, 2018, from https://steps-centre.org/transformations/

Stevis, D., & Felli, R. (2015). Global labour unions and just transition to a green economy. *International Environmental Agreements: Politics, Law and Economics*, *15*(1), 29–43. https://doi.org/10.1007/s10784-014-9266-1

Stirling, A. (2014a). *Emancipating Transformations: From controlling 'the transition' to culturing plural radical progress* (STEPS Working Paper No. 64). Brighton: STEPS Centre.

Stirling, A. (2014b). Transforming power: Social science and the politics of energy choices. *Energy Research & Social Science*, *1*, 83–95. https://doi.org/10.1016/j.erss.2014.02.001

Sweeney, S. (2014). Working Toward Energy Democracy. In *Governing for Sustainability: State of the World 2014* (pp. 215–227). Washington, DC: Island Press.

Sweeney, S., & Treat, J. (2017). *Towards a Progressive Labor Vision for Climate Justice and Energy Transition in the Time of Trump.* New York, NY: Trade Unions for Energy Democracy/Rosa Luxemburg Stiftung. Retrieved from

http://unionsforenergydemocracy.org/towards-a-progressive-labor-vision-for-climate-justice-and-energy-transition/

Sweeney, S., & Treat, J. (2018). *Trade Unions and Just Transition: The Search for a Transformative Politics* (Working Paper No. 11). New York, NY: Trade Unions for Energy Democracy. Retrieved from http://unionsforenergydemocracy.org/resources/tued-publications/

Szklo, A., & Schaeffer, R. (2006). Alternative energy sources or integrated alternative energy systems? Oil as a modern lance of Peleus for the energy transition. *Energy*, *31*(14), 2513–2522. https://doi.org/10.1016/j.energy.2005.11.001

Szolucha, A. (Ed.). (2018). *Energy, resource extraction and society: impacts and contested futures*. Abingdon, Oxon; New York, NY: Routledge.

Szulecki, K. (2018). Conceptualizing energy democracy. *Environmental Politics*, *27*(1), 21–41. https://doi.org/10.1080/09644016.2017.1387294

Temper, L., Walter, M., Rodriguez, I., Kothari, A., & Turhan, E. (2018). A perspective on radical transformations to sustainability: resistances, movements and alternatives. *Sustainability Science*, *13*(3), 747–764. https://doi.org/10.1007/s11625-018-0543-8

Theodoropoulos, M. (2018). Political Ecology and Degrowth [Transnational Institute of Social Ecology]. Retrieved July 3, 2018, from https://trise.org/2018/01/25/political-ecology-and-degrowth/

Thombs, R. P. (2017). The Paradoxical Relationship between Renewable Energy and Economic Growth: A Cross-National Panel Study, 1990-2013. *Journal of World-Systems Research*, *23*(2), 540–564. https://doi.org/10.5195/jwsr.2017.711

Tokar, B. (2015). Democracy, localism, and the future of the climate movement. *World Futures*, *71*(3–4), 65–75. https://doi.org/10.1080/02604027.2015.1092785

TRANSIT. (2017). Manifesto for Transformative Social Innovation [Version 0.1]. Retrieved from tsimanifesto.org

United Nations. (2017). Sustainable Development Goal 7: Sustainable Development Knowledge Platform. Retrieved July 24, 2017, from https://sustainabledevelopment.un.org/sdg7

UNRISD. (2016). *Policy Innovations for Transformative Change: Implementing the 2030 Agenda for Sustainable Development*. Geneva: UNRISD/UN Publications.

Urpelainen, J., & Van de Graaf, T. (2015). The International Renewable Energy Agency: a success story in institutional innovation? *International Environmental Agreements: Politics, Law and Economics*, *15*(2), 159–177. https://doi.org/10.1007/s10784-013-9226-1

Van de Graaf, T. (2013). *The politics and institutions of global energy governance*. New York, NY: Palgrave Macmillan.

van der Horst, D., & Evans, J. (2010). Carbon Claims and Energy Landscapes: Exploring the Political Ecology of Biomass. *Landscape Research*, *35*(2), 173–193. https://doi.org/10.1080/01426390903564879

van Veelen, B. (2018). Negotiating energy democracy in practice: governance processes in community energy projects. *Environmental Politics*, *27*(4), 644–665. https://doi.org/10.1080/09644016.2018.1427824

van Veelen, B., & van der Horst, D. (2018). What is energy democracy? Connecting social science energy research and political theory. *Energy Research & Social Science*, *46*, 19–28. https://doi.org/10.1016/j.erss.2018.06.010

Verbong, G., & Geels, F. (2012). Future electricity systems: visions, scenarios and transition pathways. In G. Verbong & D. Loorbach (Eds.), *Governing the energy transition: reality, illusion or necessity?* (pp. 203–219). New York: Routledge.

Verbong, G., & Loorbach, D. (Eds.). (2012). *Governing the energy transition: reality, illusion or necessity?* New York: Routledge.

Victor, P. A., & Dolter, B. (Eds.). (2017). *Handbook on Growth and Sustainability*. Cheltenham, UK; Northhampton, MA, USA: Edward Elgar Publishing.

Walker, G., & Devine-Wright, P. (2008). Community renewable energy: What should it mean? *Energy Policy*, *36*(2), 497–500. https://doi.org/10.1016/j.enpol.2007.10.019

Walker, P. A. (2005). Political ecology: where is the ecology? *Progress in Human Geography*, *29*(1), 73–82.

Walker, P. A. (2006). Political ecology: where is the policy? *Progress in Human Geography*, *30*(3), 382–395.

Walker, P. A. (2007). Political ecology: where is the politics? *Progress in Human Geography*, *31*(3), 363–369. https://doi.org/10.1177/0309132507077086

Warlenius, R. (2015). A renewable energy transition: capitalist barriers, socialist enticements. In K. Borgnäs, T. Eskelinen, J. Perkiö, & R. Warlenius (Eds.), *The politics of ecosocialism: transforming welfare* (pp. 83–100). Abingdon, Oxon; New York, NY: Routledge, Taylor & Francis Group.

Weinrub, A., & Giancatarino, A. (2015). *Toward a climate justice energy platform: Democratizing our energy future*. Local Clean Energy Alliance / Center for Social Inclusion. Retrieved from localcleanenergy.org

Welton, S. (2017). Grasping for Energy Democracy. *Michigan Law Review*, *116*, 581–644.

White, L. A. (1943). Energy and the evolution of culture. *American Anthropologist*, *45*(3), 335–356.

World Bank. (2017). *Global Tracking Framework 2017: Progress Towards Sustainable Energy*. Washington, DC: World Bank.

Wu, B., Schiffer, A., & Burns, B. (2016). *Power for the People: Delivering on the Promise of Decentralized, Community-Controlled Renewable Energy Access*. Washington, DC: ActionAid USA. Retrieved from http://wedo.org/publication-delivering-decentralized-community-controlled-renewable-energy-access/

Zografos, C., & Saladie, S. (2012). La ecología política de conflictos sobre energía eólica: un estudio de caso en cataluña. *Doc. Anal. Geogr. Documents d'Analisi Geografica*, *58*(1), 177–192.