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The global energy transition and its contradictions: emerging geographies of energy and finance
in Indonesia and California

A dissertation submitted in partial satisfaction
of the requirements for the degree Doctor of Philosophy in Urban Planning

by

Sean Francis Kennedy

2018

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ABSTRACT OF THE DISSERTATION

The global energy transition and its contradictions: emerging geographies of energy and finance
in Indonesia and California

by

Sean Francis Kennedy

Doctor of Philosophy in Urban Planning

University of California, Los Angeles, 2018

Professor Susanna B. Hecht, Chair

The term ‘energy transition’, typically referring to a transition from a carbon-intensive to a low-carbon economy, has become increasingly prevalent in academic and policy circles over the past few decades. Framing energy transition as a geographic process involving the uneven and at times contradictory reconfiguration of current patterns and scales of social and economic activity, this dissertation highlights the social and political limitations to what is often uncritically cast as a technically and economically feasible transition.

This dissertation is comprised of three distinct but related studies that examine energy transitions in three contexts: globally; in Indonesia; and in California. In the context of the global energy transition, I find that the rapid increase in private finance in the global renewable energy sector has led to unprecedented growth of renewable energy generation capacity at unprecedented scales

and at lower tariffs than previously thought possible. In both Indonesia and California, however, I find that the growing dominance of large-scale renewable energy projects despite the availability of smaller-scale alternatives suggests that private finance, particularly the influence of financial logic in determining project viability, has produced a particular geography of renewable energy generation that severely limits the potential for radical, systemic, and democratic transformation of the global energy system. By theorizing the relationship between forms and sources of renewable energy finance and the physical manifestation of renewable energy infrastructure, this dissertation offers a valuable counter-argument to the prevailing eco-modernist perspective that currently dominates global energy transition discourse, exemplified by the belief that “most of the new investment in renewables must come from the private sector” (IRENA and CPI, 2018, p. 38). I argue that shifting the responsibility for creating ‘bankable’ projects away from host governments toward private investors holds the potential to alter the prevailing logic of the global energy transition, which to date has rather myopically emphasized new and ever-larger renewable energy generation over the broader social and ecological benefits an energy transition may otherwise entail.

The empirical and theoretical contributions contained within this dissertation build on existing knowledge regarding the uneven political-ecological implications of the energy transition, while serving as a guide for policymakers seeking to manage the energy transition in a way that reduces the carbon-intensity of the economy while being attentive to potential contradictions and perverse outcomes that may result from reliance on particular means of achieving energy transition objectives.

The dissertation of Sean Kennedy is approved.

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CHAPTER 1 INTRODUCTION

1.1 The global energy ‘transition’: energy, finance, justice, and democracy

1.1.1 Geographies of energy transition

The concept of ‘energy transition’ has become increasingly prevalent in academic and policy circles over the past few decades, culminating in the United Nations dedicating 2014-2024 the ‘Decade of Sustainable Energy for All’ (United Nations, 2012). The International Energy Agency, World Bank, World Wildlife Fund, and Deutsche Bank are just a few of the intergovernmental organizations, multi-lateral development banks, international environmental NGOs and global investment banks to have produced numerous reports and studies outlining policy options, development and investment opportunities targeted at the transition to renewable energy sources. As a core pillar of the ‘green economy’ model of sustainable development, the transition to renewable energy is promoted as a means of reducing emissions while driving economic growth through the alleviation of energy poverty, green job growth, and wide-reaching investment opportunities (Frankfurt School-UNEP Centre/BNEF, 2017; UNEP, 2011). From a more radical perspective, the transition to renewable energy is seen as a means of addressing the deep inequities and injustices that have long characterized the prevailing fossil fuel regime, thus potentially leading to more just (Newell & Mulvaney, 2013) and democratic (Burke & Stephens, 2018) energy systems.

The term ‘energy transition’ can be broadly defined as the “radical, systemic and managed change towards ‘more sustainable’ or ‘more effective’ patterns of provision and use of energy” (Rutherford & Coutard, 2014, p. 1354). While discussion of ‘energy transition’ dates back to the initial shift from manual labor to fossil fuels during the Industrial Revolution (Grubler, 2012), increasingly the term is used less in the context of energy input substitution and more to refer to

transformational changes in energy supply, distribution, and use as they occur across trans-local and transnational scales (Späth & Rohracher, 2012). In recent years the study of energy transitions has witnessed a geographic turn (Bridge, Bouzarovski, Bradshaw, & Eyre, 2013; Calvert, 2016), shifting from a focus on technological innovations driving change in socio-technical systems (Coenen & Truffer, 2012; Geels, 2004; Lawhon & Murphy, 2012) toward a conception of energy transition as a ‘geographical process, involving the reconfiguration of current patterns and scales of economic and social activity (Bridge et al., 2013, p. 331). Central to this radical, systemic and *geographic* conception of ‘energy transition’ is the way in which the transition plays out unevenly across space, both in terms of its drivers and its outcomes (Bridge et al., 2013). While climate change is perhaps the most commonly cited driver, the current transition away from fossil-fuels towards alternative energy sources is also attributed to concerns over biophysical constraints (i.e. depletion of fossil fuel stocks), rising energy prices, lifestyle changes, and population growth (Northrup & Wittemyer, 2013; Scheidel & Sorman, 2012), all of which vary spatially. In addition, networks of supply based around the natural availability of sun or wind, variations in usage patterns shaped by urban population densities and levels of economic development and the complex web of transmission and distribution infrastructure tying it all together lead to an array of highly variegated socio-technical interactions with diverse political-ecological outcomes (Northrup & Wittemyer, 2013; Rutherford & Coutard, 2014).

Taking seriously the spatiality of energy transitions requires attention to the specificities of place that position landscapes as sites of extensive renewable energy development, as well as the ways in which these specificities shape and are shaped by the energy regime as it extends vertically and horizontally across multiple scales of governance. Owing to the ways in which the production, distribution, and use of energy underpin material and immaterial relations, such as landscape form,

livelihood arrangements, and connections to place, energy can be understood as more than simply an economic asset or an ecological phenomenon, but rather, as a social relation (Calvert, 2016). As such, the concept of energy transition is best viewed as a socio-material transition as it necessarily involves users and institutions as well as built infrastructure and natural resources (Calvert, 2016). Given the centrality of energy to the functioning of human social and economic activity, the transition to a low-carbon economy is likely to involve a significant socio-spatial restructuring of the global energy economy (Bridge et al., 2013; Calvert, 2016). The form and extent of restructuring is dependent to a large extent on the specific end-goals and means of achieving them, as well as the inherent qualities of the energy system itself (Bale, Varga, & Foxon, 2015). Depending on how and by whom the transition is framed and governed, this process may involve substantial redirection of capital from fossil-based to renewable energy investments, reconfiguration of labor markets, or the appropriation and transformation of land in the production of renewable energy landscapes (Bridge et al., 2013; Calvert, 2016; J. McCarthy, 2015). As such, where and how energy transitions take place, and the inherent qualities of the system which is the object of transition, will not only shape the extent to which energy transition objectives can be met (whatever they may be), but will potentially reshape land use, livelihood and development trajectories, while also shaping the conditions of possibility for achieving alternative objectives.

Calls for space to be taken seriously in the context of energy transition research (Bridge et al., 2013; Calvert, 2016) have inspired a growing number of empirical studies in recent years that explore the interactions between the processes of energy transition and land use (R. R. Hernandez et al., 2014), land use planning (Outka, 2010), urbanization (Rutherford & Coutard, 2014) and urban governance (Hodson & Marvin, 2012). In addition, the higher land intensity of wind, solar and hydropower relative to conventional fossil fuels (McDonald, Fargione, Kiesecker, Miller, &

Powell, 2009; Vaclav Smil, 2008) has generated significant attention toward the potential impacts of renewable expansion on rural land use and livelihoods (Frantál, Pasqualetti, & van Der Horst, 2014), and the resulting land-use and land-cover change and its implications for biodiversity, soils, water resources and human health (R. R. Hernandez et al., 2014). While the processes related to energy transitions operate within and across multiple sites and scales, many of the social and environmental impacts attributed to renewable energy generation are linked to the scale at which these projects are employed. The potential for distributed technologies such as small-scale solar photovoltaic (PV) is seen as highly desirable in contexts where physical geography largely prohibits centralized models of energy generation, such as the archipelago nation of Indonesia which contains no fewer than 6,000 inhabited islands (Gunningham, 2013). While large-scale systems (e.g., megawatt-scale and up) provide cheaper electricity when measured in narrow terms of cents per kilowatt-hour, larger-scale projects are both land- and capital-intensive, require significant additional investment in transmission infrastructure, and often generate serious negative social and environmental impacts (R. R. Hernandez et al., 2014).

Advances in energy storage technologies mean that distributed technologies such as small-scale solar may soon have the potential to improve energy access and alleviate the need for utility-scale investments in infrastructure, while still meeting demand. In California, for example, the quantity of accessible energy potentially produced from distributed solar technologies within the built environment has been found to exceed current statewide demand¹ (Rebecca R. Hernandez, Hoffacker, & Field, 2015). Despite these options, however, globally, renewable electricity production continues to be dominated by large generators that are owned by utilities or large

¹ It should be noted that without adequate energy storage, 'excess' energy generation during the day over what is already generated and can be used may not be able to meet night time demand. As such reliance on distributed generation may cause unintended lock-in of greenhouse gas-emitting natural gas for that generation.

investors (REN21, 2016). While the construction of renewable energy generation facilities represents but one aspect of the extent of systemic transformation required to transition to renewable energy, the particular geography of renewable energy generation nevertheless suggests a dominance of particular energy transition objectives over others. In this way, the varied objectives associated with the transition to renewable energy not only reflect differences in the ideologies and discourses working to shape particular trajectories of energy transition, but may ultimately shape the extent to which energy transitions produce radical social and political change (Rutherford & Coutard, 2014).

While divergence in energy transition objectives is to be expected given the range of political interests an energy transition may affect, when it comes to implementing these visions of energy transition, the particular means advocated by the various actors represent potential contradictions. The pursuit of one objective, such as using renewable energy as a means of economic development by attracting investment in large-scale centralized generation, may work in direct opposition to the potential to achieve another, such as alleviating energy poverty or improving energy access. In addition, the means employed, such as capital-intensive centralized renewable energy generation, may work in opposition to very goals a particular energy transition is intended to achieve, such as more even distribution of energy resource ownership and profits.

Understanding the relationship between the discursive and material elements of energy transition outlined above requires attention to the underlying logics working to inform particular trajectories of energy transition, a topic I turn to next.

1.1.2 Renewable energy finance

As with other sectors of the global economy, the renewable energy industry has witnessed increased influence from financial institutions and markets over the past decade. In 2015, new

investments of over USD 285 billion pushed renewable energy to account for almost 20% of total energy usage worldwide (REN21, 2016). In contrast to the early 2000s, during which time renewable energy investment was dominated by state institutions and development banks, over 90% of total new investment in renewable energy in 2016 came from private sources (IRENA and CPI, 2018). The growing influence of private finance has coincided with a spate of innovations in renewable energy finance, including tradable renewable energy certificates (Holt, Sumner, & Bird, 2011) and renewable energy derivatives based on the pooling and repackaging of cash-flow-producing financial assets into securities which can be sold to investors (IRENA, 2016b).

These recent trends in renewable energy finance reflect many of the core principles underlying the green economy framework, of which renewable energy has long been a core component (Brundtland, 1987). Grounded in the logic of ecological modernization (Anderson, Kusters, McCarthy, & Obidzinski, 2016; Brockington, 2012), green economy has emerged as the dominant discourse in both development and environmental policy and management arenas, drastically reshaping nature-society and public-private sector relations in the process (Fairhead, Leach, & Scoones, 2012). Extending the core assumption of ecological modernization that market reform, industrial advancement, and consumer preferences can facilitate the decoupling of negative environmental and social externalities from economic growth to produce positive social and environmental change (Anderson et al., 2016), green economy is grounded in a win-win narrative that economic growth can continue while environmental degradation and social inequity decline (Anderson et al., 2016; Brockington, 2012). The emphasis on market- and technology-driven approaches that underpins green economy discourse and its ideological foundations implies a particular configuration of public and private sector relations, one in which the ‘the bulk of green economy investment will ultimately have to come from the private sector’ (UNEP, 2011, p. 549),

while the role of public sector is relegated to shaping the initial conditions to facilitate extensive private sector participation (Brockington, 2012).

In the context of the global energy transition, the deep commitment to private sector participation in the renewable energy sector has prompted a reshaping of the ways in which public finance has traditionally been used to support the development of renewable energy. Since the early 2000s, renewable energy development has been closely associated with concessional lending, grants, and various forms of subsidies, including favorable feed-in tariffs well above wholesale power prices in Europe, and tax credits in the United States (Frankfurt School-UNEP Centre/BNEF, 2017; IRENA, 2016b). In recent years, however, efforts to maximize the potential of limited public resources have informed a shift away from direct support measures such as grants and subsidies toward a focus on creating the enabling conditions to facilitate greater investment from the private sector. Specific examples include innovations in risk management that shift financial and political risks from private to public entities (Castree & Christophers, 2015; Waissbein, Glemarec, Bayraktar, & Schmidt, 2013), and the shift from state-determined feed-in tariffs to competitive reverse auctions as a means of allocating potential projects to private developers (Buckman, Sibley, & Bourne, 2014; D'Monte, 2017; Frankfurt School-UNEP Centre/BNEF, 2017). In particular, auctions have experienced rapid uptake globally (Frankfurt School-UNEP Centre/BNEF, 2017), notably in India (IRENA, 2017b), and recently in Indonesia (MEMR, 2017b). While feed-in tariffs are considered desirable as they minimize the risk for developers, misalignment between the feed-in tariff and actual generation costs can lead to feed-in tariffs in excess of the actual generation costs, effectively resulting in a subsidy for the developer (Buckman et al., 2014). By allowing developers to calculate and commit to their own prices, reverse auctions transform what was previously a government or regulator risk of overcompensation into a

developer risk stemming from inaccurate estimation of input costs and currency fluctuations (IRENA, 2015). Combined, these measures have demonstrated significant success in meeting their stated objectives. In 2016, over 90% of total new investment in renewable energy came from private sources (IRENA and CPI, 2018), while power tariffs in competitive auctions dropped to unprecedented levels, notably in Chile (Parkinson, 2017) and the United Arab Emirates (Shumkov, 2016).

On closer inspection, however, these trends suggest a shift in the underlying logic driving the trajectory of energy transition. In contrast to renewable energy initiatives supported by public finance and motivated primarily by commitments to emissions reductions targets and local economic development, the mode of transition outlined here, through its reliance on private finance, points to an unprecedented influence of the risk-return logic of finance in shaping renewable energy investment decisions. While the ways in which the apparent ‘financialization’ of the renewable energy sector translates into ownership, control, and geographical organization of the renewable energy industry has received limited attention, recent work suggest that financialization may promote a particular *type* of transition, one predicated on ‘bankability’, risk minimization, and short term profit maximization (Baker, 2015). It follows that this logic may result in particular contradictions as energy transition moves in a direction favoring safe investments in tested large-scale, land-intensive technologies, while neglecting goals of energy efficiency, system resilience and improved energy access that may not present such attractive investments to financiers, thus exacerbating the unevenness of energy transitions while closing the possibility for alternative energy transition futures.

1.1.3 Energy justice and energy democracy

Awareness of and attention to the uneven political dimensions of energy transitions has given rise to a range of terms and concepts including ‘energy justice’ (Jenkins, McCauley, Heffron, Stephan, & Rehner, 2016; Sovacool & Dworkin, 2015), ‘just transition’ (Newell & Mulvaney, 2013), and ‘energy democracy’ (Burke & Stephens, 2018; Szulecki, 2018). Building on the concept of environmental justice (Sovacool & Dworkin, 2015), proponents of energy justice seek to address barriers to ownership, finance, and access to technology prevent broader distribution of the potential benefits of energy and energy transitions may provide, particularly for communities of color (NAACP, 2017). More broadly, energy justice seeks to apply principles of distributional, recognition, and procedural justice to energy policy, energy production and systems, energy consumption, energy activism, energy security and climate change (Jenkins et al., 2016). Within the energy justice framework, a ‘just transition’ to renewable energy sources is thus conceived of as an effort to steer society towards a lower carbon future underpinned by attention to issues of equity and justice (Newell & Mulvaney, 2013). Considerations of equity and justice extend to those currently without access to reliable energy supplies and living in energy poverty, to those whose livelihoods are dependent on a fossil fuel economy and thus may be adversely affected by an energy transition (Newell & Mulvaney, 2013).

While sustainability transitions may on the surface appear intended to address forms of environmental injustice, the uneven power dynamics driving such transitions and the broad and variegated constituencies such transitions affect may also give rise to new injustices, particularly due to the highly disruptive impacts on existing industries. Whether job losses for some portion of society can be justified on the grounds of improved health conditions for those no longer working in extractive industries or reduced emissions for society at large others are a trade-offs that cannot be easily reconciled. In addition, an energy transition may do little to address patterns of

exploitation and dispossession that have long characterized the fossil fuel economy unless the social and environmental consequences of the transition are taken into account as part of a ‘just transition’ (Newell & Mulvaney, 2013). The challenge of a ‘just transition’ therefore, is to ensure efforts to reduce the carbon-intensity of the economy not only minimize future injustices, but actively work to address the injustices and inequities that have historically underpinned the fossil-fuel based energy system (Rutherford & Coutard, 2014).

The scale of renewable energy generation – be it large-scale centralized facilities occupying thousands of acres or distributed generation systems such as rooftop photovoltaic and biomass – poses direct challenges when viewed through the lens of environmental and energy justice. Private financing, which often serves as the basis for large-scale generation projects, may serve to preclude access to green economic development strategies or reduce investor accountability for environmental justice harms in the communities in which such projects are located (Outka, 2012). Others have argued that energy transitions have the potential to contribute further to the global land rush due to the lower power densities of alternative energy options relative to fossil-based technologies (Scheidel & Sorman, 2012). In parts of Africa and South Asia, for example, the installation of spatially extensive solar power facilities have been linked to the displacement of rural populations and disruption of livelihood strategies (Rignall, 2016; Yenneti, Day, & Golubchikov, 2016). Conversely, distributed generation has potential to avoid environmental justice harms while providing a means for energy cost savings and green economic development in environmental justice communities, while also reducing the demand for utility-scale fossil energy or polluting renewable energy plants (Outka, 2012). While the environmental justice implications of energy transition must consider the broader historical and political-ecological context of the transition and thus cannot be attributed solely to the scale of a particular project,

variations in land and capital intensity of various technologies and the extent to which these constraints allow for the siting of projects in proximity to sites of consumption have direct implications for processes of decision-making and allocations of costs and benefits.

While energy justice and ‘just transition’ have focused primarily on addressing inequities resulting from the prevailing fossil fuel regime and minimizing the unequal distribution of costs associated with energy transitions, energy democracy typically embraces a more proactive political agenda. At its core, energy democracy advocates view energy transitions as a political opportunity to advance positive social and environmental change. While there exists some degree of variation in the ways in which the term is employed across different contexts (Tarhan, 2017), energy democracy typically emphasizes the integration of the transition to 100% renewable energy sources with the promotion of social justice and economic equity (Burke & Stephens, 2018). In integrating technical and social concerns, energy democracy advocates view decentralized distributed renewable energy resources, such as residential- and community-scale energy generation and storage, as being closely linked to particular political outcomes (Burke & Stephens, 2018). Distributed solar energy systems, being relatively small in capacity (e.g., <1 megawatt [MW]) and able to function autonomously from the grid, afford greater opportunity for community ownership and control of the energy system (Farrell, 2017). In addition, distributed generation has potential to avoid environmental justice harms while providing a means for energy cost savings and green economic development in environmental justice communities, while also reducing the demand for utility-scale fossil energy or polluting renewable energy plants (Outka, 2012).

Beyond the emphasis on distributed renewable energy generation, public participation, and local ownership and control, there exists considerable variation in the ways in which energy democracy has been defined (Farrell, 2017; Sweeney, 2014) and theorized (Burke & Stephens, 2018; Szulecki,

2018). Much in the way that democracy can be viewed as both a process and an outcome, Szulecki (2018) makes a distinction between energy democracy as a process defined by public participation, and energy democracy as an outcome reflected community-owned and controlled distributed renewable energy systems. Invoking notions of technological determinism, Farrell (2017) conceptualizes the transition from ‘energy monopoly’ to ‘energy democracy’ as consisting of four steps: decentralization, distributed energy, local ownership, and disruptive technologies. Together, these steps are viewed as having the “potential to put those users in charge and allow them to reap the economic benefits” of the transition to renewable energy sources (Farrell, 2017). In this framework, it is assumed that a reconfiguration of the technical aspects of the energy system – shifting from a centralized, monopoly-controlled model toward decentralized distributed generation – will produce decentralized and distributed political power.

An alternative, and somewhat more radical framework, frames energy democracy in terms of three key pillars: “(1) resisting the agenda of large energy corporations, (2) reclaiming to the public sphere parts of the energy economy that have been privatized or marketized, and (3) restructuring the global energy system in order to massively scale up renewable and low-carbon energy, aggressively implement energy conservation, ensure job creation and local wealth creation, and assert greater community and democratic control over the energy sector (Sweeney, 2014, p. 218). Beyond energy, a democratically reconfigured energy system has the potential to deliver tangible community benefits such as decent and stable employment, public space and transportation, and new public institutions. In this sense, an energy transition informed by an energy democracy agenda will not only involve a transition from fossil fuels to renewable energy resources, but also a shift in the types and distribution of benefits an energy system can produce. An energy transition informed by an energy democracy agenda thus entails a particular socio-technical reconfiguration

of the prevailing energy system, one that, in addition to shifting to renewable energy resources, is also reflected in a shift in political power toward workers, communities, and the public (Fairchild & Weinrub, 2017). The resist-reclaim-restructure framework views neoliberal energy policy, particularly the privatization and marketization of the global energy sector, as a major barrier to broad-scale energy transition. Like Farrell, Sweeney argues publicly-owned decentralized distributed generation is essential to combatting the prevailing centralized energy regime, which, by virtue of the significant land and capital investment required for large-scale generation projects, severely constrains possibility for local ownership and control. In contrast to Farrell's technologically-determinist energy democracy framework, however, the resist-reclaim-restructure views democratization of the energy system as a necessary precondition for the scale of energy transition required to mitigate climate change (Sweeney, 2014). In this way, energy democracy is viewed as a means of achieving broader social, political, and ecological change as an end, rather than an end in itself.

1.1.4 Toward a theory of financialized energy transitions

Despite the potential for such extensive socio-spatial transformation, and a growing recognition that the barriers to energy transition are not technical or economic but are primarily social and political in nature (Jacobson & Delucchi, 2011; J. McCarthy, 2015), questions of how, where and with what impacts energy transitions are unfolding have received scant empirical attention from a critical geographic perspective (Bridge et al., 2013; Calvert, 2016), let alone from a planning one. Normative accounts of how energy transitions should be governed (Florini & Sovacool, 2009) and where renewable energy development should be located to minimize socio-ecological impacts (R. Hernandez et al., 2014) largely fail to account for the power relations and the broader political economic structures, land use and ecological processes shaping the geography of energy transition and the profound contradictions that result. Further, such accounts typically fail to acknowledge

complex system dynamics (lock in, path dependency, brittleness, etc.) that also work to inhibit or aid processes of transition (Bale et al., 2015). These knowledge gaps – of great importance given the magnitude of change energy transition may invoke – serve as the primary motivation for this dissertation.

A major gap in the literature that this dissertation seeks to address is the inattention to the role of structural factors shaping investment decisions regarding locations, scales, and technologies of renewable energy generation, and the socio-ecological implications such decisions can produce. Drawing on the concepts of energy transition, financialization, energy justice, and energy democracy outlined above, I argue that energy transitions operate as a contested space comprised of multiple and competing discourses producing conflicting and contradictory definitions, objectives, mechanisms, and modes of transition. Dynamics within the solar finance sector, including the availability of particular forms of finance, and the inherent qualities of energy systems in different contexts, both have direct geographical implications in terms of the siting and scale of solar energy projects, which, through particular means of assembling and accumulating land and capital, ultimately affect the people, places and energy systems in which these projects are located. Improved understanding of the underlying logic driving particular energy transitions will offer valuable insight regarding the extent to which the transition to renewable energy in particular context may work to either address or exacerbate the forms of social inequity and environmental harm that have long characterized the fossil fuel era.

While considerable attention has been directed at historical experiences of transition and the means through which to replicate these experiences in the future (Araújo, 2014; Geels, 2002; Jupesta et al., 2011), consideration of the political dimensions of energy transitions is a relatively recent phenomenon (Geels, 2014). From a theoretical standpoint, then, I follow (Lawhon & Murphy,

2012) by seeking to broaden the scope of socio-technical transition theory to encompass broader political concerns from economic geography and political ecology. As energy transition potentially involves significant socio-spatial restructuring of the global energy economy, including redirection of capital from fossil-based to renewable energy investments, reconfiguration of labor markets, and the appropriation and transformation of land, it is likely to result in spatially-uneven distributional outcomes (Newell & Mulvaney, 2013). Given the multiple and competing ideologies and discourses informing mechanisms and modes of energy transition, there is great opportunity for the production of perverse and contradictory outcomes, which are likely amplified or mediated when processes of energy transition interact with varying socio-economic conditions across political contexts. In turn, these contradictions may ultimately work to stymie the potential for energy transition to invoke the kinds of radical and systemic change as advocated for by those who see energy transition as having potential to achieve broader social and political economic objectives.

1.2 Research design and methods

This dissertation has two overarching concerns: (1) the role of finance and financial institutions in shaping the geography of renewable energy generation, and (2) the extent to which the current mode of energy transition, predicated on the risk-return logic of finance, can and will ultimately deliver on its stated environmental and social objectives. In terms of the first concern, a central argument is that financialization – defined as the increasingly dominant role of financial logic in determining renewable energy project viability – is playing an increasingly influential role in shaping the geography and conditions of possibility with regard to what can be expected and achieved from energy transition. This is not to say that private investment is a ‘bad thing’ in and of itself, but that with it comes a particular orientation of the objectives and incentives shaping or limiting potential trajectories of transition. In terms of the second concern, I test the hypothesis

that the articulation between financialization and the complexity of energy systems ultimately narrows the conditions of possibility for a socially- and ecologically-transformative transition to renewable energy.

Chapter 2 provides a theoretical overview of recent trends in the global renewable energy sector, assessing the case for the financialization of the global energy transition by examining the influence of finance and financial the logic on the control, ownership and geographical organization of the solar energy industry. The following two case studies (Chapters 3 and 4) – intended to serve as specific instances of financialized energy transitions – take this argument further, each looking at the ways in which financialization articulates with the social and technical complexity of particular energy systems, and the resulting implications for the people, places and energy systems as they manifest in different scales and different contexts. The two case study sites, Indonesia and California, were selected as means of testing the validity of generalized arguments regarding the implications of a financialized energy transition across vastly different political-economic contexts and geographic scales. Given these stark differences, however, the two sites are not intended to serve as comparisons, but rather intended serve as empirically-grounded illustrations of the specific ways in which global trends in renewable energy and renewable energy finance manifest geographically when mediated by local contexts.

This dissertation is motivated by the following overarching research questions:

- *To what extent and in what specific ways has the global energy transition – particularly the solar energy industry – been subject to financialization?*
- *In what ways has financialization translated into preferences for particular modes of transition (i.e. technologies, finance and governance mechanisms, land use patterns)?*

- *What are the socio-economic and ecological trade-offs and contradictions resulting from a financialized energy transition? What are the implications of these contradictions in terms of (re)shaping social and socio-ecological relations (i.e. flows of capital and land use) and the conditions of possibility for the achievement of alternative energy transition objectives?*

Methodologically, this dissertation relies primarily on institutional and discourse analysis. For all three studies, the analysis was informed by data collected from policy documents, corporate reports, media coverage, and semi-structured interviews with relevant institutional actors. Particular emphasis was directed toward policies and institutions pertaining to energy, land use, and finance as they relate to renewable energy development in the two study sites. Data collected through document and media analysis and interviews was used to construct a picture of the political and institutional landscape as it pertains to renewable energy development in each of the study sites, which I then used to examine relations between institutions and institutional actors, and how these relations have evolved over time in terms of shaping energy transition governance and its particular geographies. Attention to the processes and outcomes of energy transition governance in turn helped to identify contradictions and their implications for social and socio-ecological relations in the case study sites. This analysis was supplemented with attendance at numerous renewable energy webinars and conferences, including the World Renewable Energy Congress in Jakarta, Indonesia in September 2016, the Distributed Solar Summit held in Culver City, California in November 2016, and the SolarPlaza *Unlocking Solar Capital Asia* held in Singapore in September 2017. Attendance at these conferences and analysis of conference materials allowed me to identify dominant discourses across relevant institutions and institutional actors, which will in turn informed identification of relevant policy documents and potential interview subjects.

Across all three studies, analysis of these resources included attention to the discursive and material aspects of financialization, such as the way in which financial logic has gained dominance or been resisted, and the ways in which dominance of or resistance to financial logic has produced particular geographic outcomes with regard to solar development.

1.3 Outline of the dissertation

The remainder of the dissertation is structured as follows.

Chapter 2: *The promise and pitfalls of the global energy ‘transition’*

According to renewable energy advocates, record high additions of installed renewable energy capacity, rapidly falling costs for solar and wind power, and the decoupling of economic growth and energy-related carbon dioxide emissions reveal a “ global energy transition well under way” (REN21, 2017b, p. 7). While the rapid growth of renewable energy generation cannot be disputed, the extent to which the current mode of transition will ultimately deliver on its stated environmental and social objectives warrants closer scrutiny. Through a broad analysis of current trends in the global renewable energy sector, Chapter 2 examines recent innovations in renewable energy development and finance shaping the current trajectory of the ‘global energy transition’, and the potential socio-ecological implications this current trajectory may produce. I argue that the growing influence of private finance favoring safe investments in tested large-scale, land-intensive technologies over less financially-attractive goals of energy efficiency, system resilience and improved energy access, limits the potential for radical, systemic, and democratic transformation of the global energy system. The chapter is intended to serve as a foundation for higher resolution empirical analyses focused on the specific political economic and ecological implications of a global energy transition predicated on the risk-return logic of finance.

Chapter 3: *Indonesia's energy transition and its contradictions: emerging geographies of energy and finance*

Since 2015, the Indonesian solar electricity sector has witnessed unprecedented attention from international investors and developers, with planned solar photovoltaic (PV) projects announced in 2017 set to increase existing installed capacity from 9 megawatts (MW) to over 240MW. Chapter 3 examines the emerging geographies of renewable energy generation resulting from the rapid influx of foreign investment into Indonesia's solar PV sector. While foreign investment may prove successful in increasing the country's solar PV capacity, it may also produce several contradictory outcomes for Indonesia's energy transition. Efforts to reconcile demands of risk-averse, profit-driven investors and developers with the needs of the approximately 25 million Indonesians who currently lack access to electricity has resulted in a geography of renewable energy generation characterized by large-scale centralized generation facilities that constrain opportunities for local ownership and control over the energy system. The result – a major contradiction when viewed through the lens of Indonesia's energy transition development objectives – is not only a flow of economic benefits out of the country and limited improvement in energy access for much of the country, but a missed opportunity in terms of maximizing the socially and politically transformative potential a broader energy transition may entail.

Chapter 4: *Rescaling energy governance and the democratizing potential of 'Community Choice'.*

Community Choice Aggregation (CCA) – an emerging electricity supply model that allows residents and businesses to purchase electricity from local government agencies instead of utilities – is projected to account for 60% of Californian customers currently served by independently-owned utilities by 2020. The rise of CCAs in California has been closely aligned with the concept of energy democracy, which integrates concerns over social and environmental justice with a

transition to a decentralized distributed renewable energy. Through analysis of policy documents, electricity procurement data, and interviews with CCA representatives and policymakers, Chapter 4 examines the relationship between energy democracy objectives, policies, and outcomes in the context of California's three most established CCAs. Rather than promoting a shift to a decentralized distributed energy system, the articulation between local demand for renewable energy and a financialized renewable energy sector has perpetuated the dominance for large-scale, capital- and land-intensive renewable energy technologies that mask the democratizing potential of energy transition. This study is intended to highlight the limits of energy transition as form of radical and systemic change, while clarifying the extent to which localized renewable energy initiatives can influence the democratizing potential of future energy transitions.

Chapter 5: *Conclusion* This final chapter summarizes the empirical and theoretical and empirical contributions of the dissertation, including general findings based on the two case studies. I close with a discussion of the limitations of this study and suggest potential avenues for future research, emphasizing the need for more detailed empirical attention to the explicit linkages between renewable energy finance and particular land use and livelihood transformations.

CHAPTER 2 THE PROMISE AND PITFALLS OF THE GLOBAL ENERGY ‘TRANSITION’

Abstract

According to renewable energy advocates, record high additions of installed renewable energy capacity, rapidly falling costs for solar and wind power, and the decoupling of economic growth and energy-related carbon dioxide emissions reveal a “ global energy transition well under way” (REN21, 2017b, p. 7). While the rapid growth of renewable energy generation cannot be disputed, the extent to which the current mode of transition will ultimately deliver on its stated environmental and social objectives warrants closer scrutiny. Through a broad analysis of current trends in the global renewable energy sector, this chapter examines recent innovations in renewable energy development and finance shaping the current trajectory of the ‘global energy transition’, and the potential socio-ecological implications this current trajectory may produce. I argue that the growing influence of private finance favoring safe investments in tested large-scale, land-intensive technologies over less financially-attractive goals of energy efficiency, system resilience and improved energy access, limits the potential for radical, systemic, and democratic transformation of the global energy system. This chapter is intended to serve as a foundation for higher resolution empirical analyses focused on the specific political economic and ecological implications of a global energy transition predicated on the risk-return logic of finance.

2.1 Introduction

Globally, the development of renewable energy resources such as wind and solar is growing at rapid pace. Driven by a combination of climate- and development-related concerns (Frankfurt School-UNEP Centre/BNEF, 2016; UNEP, 2011) and a growing number of national renewable energy targets (REN21, 2017b), global renewable power generation capacity nearly doubled from 1,037 gigawatts (GW) in 2006 to 1,985 GW in 2015 (IRENA, 2016a). From 2006 to 2015, solar photovoltaic (PV) grew from a little over 6 GW to almost 220 GW of installed capacity (IRENA, 2016a). Over the same period, new investment in renewable energy almost tripled, amounting to a record-breaking USD 312 billion in 2015 alone (Frankfurt School-UNEP Centre/BNEF, 2017).

According to renewable energy advocacy group REN21, record high additions of installed renewable energy capacity, rapidly falling costs for solar PV and wind power, and the decoupling of economic growth and energy-related carbon dioxide emissions reveal a “ global energy transition well under way” (REN21, 2017b, p. 7). As a core pillar of the ‘green economy’ model of sustainable development, the transition to renewable energy is promoted as a means of reducing emissions while driving economic growth through the alleviation of energy poverty, green job growth, and wide-reaching investment opportunities (Frankfurt School-UNEP Centre/BNEF, 2017; UNEP, 2011). Given the centrality of energy to the functioning of human social and economic activity, energy transitions may result in systemic changes in the spatial organization, economic performance and social cohesion of societies (Rutherford & Coutard, 2014), potentially leading to more just (Newell & Mulvaney, 2013) and democratic (Burke & Stephens, 2018) energy systems.

To a large extent, the political and socio-ecological implications of an energy transition are contingent upon the means through which such a transition is achieved (Burke & Stephens, 2017).

Despite the win-win framing of the ‘green economy’, the varied objectives often associated with energy transitions reflect stark differences in the ideologies, discourses, and processes that ultimately shape particular trajectories of transition. While often portrayed as complementary, many energy transition objectives, such as reducing greenhouse gas emissions or improving energy access, are dependent on vastly different forms of political economic and socio-technical organization (Rutherford & Coutard, 2014). So while energy transitions present great potential for radical and systemic change, absent political economic transformation of the energy system, energy transitions also hold potential to reproduce – and even exacerbate – social inequities and forms of ecological harm that have long characterized the fossil fuel era (Bridge et al., 2013; Calvert, 2016; M. Huber, 2015; Mitchell, 2009; Newell & Mulvaney, 2013). As such, the extent to which the current mode of transition will ultimately deliver on the full breadth of its stated environmental and social objectives warrants closer scrutiny.

This chapter examines the extent to which the recent expansion of renewable energy generation will ultimately aid or inhibit radical and systemic socio-ecological change by interrogating prevailing assumptions linking renewable energy to positive social and ecological transformation. Through a broad analysis of current trends in the global renewable energy sector, this chapter examines recent innovations in renewable energy development and finance shaping the current trajectory of the ‘global energy transition’ and the potential socio-ecological implications this current trajectory may produce. Section 2 presents an overview of current trends in the global energy transition, focusing on innovations in renewable energy policy and finance, and the rapid expansion of centralized large-scale generation facilities in favor of decentralized distributed alternatives. Drawing on insights from political economic geography and political ecology, Section 3 attempts to theorize these recent developments, linking existing work on ‘geographies of energy

transition’(Bridge et al., 2013; Calvert, 2016) to recent work on the financialization of green infrastructure (Baker, 2015; Loftus & March, 2016), ‘energy democracy’ (Burke & Stephens, 2018; Fairchild & Weinrub, 2017), and persistent themes in political ecology around land and livelihoods (M. T. Huber & McCarthy, 2017). Section 4 draws on this theoretical foundation to explore potential ways in which the current mode of energy transition may inhibit efforts promoting three common energy transition objectives: the reduction of greenhouse gas emissions; improving energy access; and promoting energy democracy. Section 5 concludes with a discussion of possible avenues for future research. The chapter is intended as a foundation for higher resolution empirical analyses focused on the specific political economic and ecological implications arising from the prevailing mode of energy transition.

2.2 Global trends in renewable energy and renewable energy finance

In 2015, renewable energy – including wind, solar, geothermal, and biomass – accounted for 7.9% of global installed generating capacity² (REN21, 2017b). Behind this seemingly small share, however, has been a rapid and extensive growth of the renewable energy sector, as well as several notable technological, geographic, and financial trends. Since 2000, total installed capacity of renewable energy has grown almost three-fold, from 755 GW in 2000 to over 2,000 GW in 2016 (IRENA, 2017a). While large hydro accounts for approximately half of all installed renewable energy capacity, much of this recent growth can be attributed to solar, particularly solar photovoltaic (PV), which grew from 1,248 MW to over 295,950 MW of installed capacity over the same period (IRENA, 2017a). In 2016, the 71,216 MW of new solar installations accounted for 44% of total new renewable energy generation installations (IRENA, 2017a) – equivalent to the installation of more than 31,000 solar panels every hour (REN21, 2017a). In a ‘world awash

² Including large hydro, renewable energy share of global electricity production at end-2016 was approximately 24.5%

with capital' (Bain & Company, Inc., 2012), low electrification rates, increases in energy demand driven by rapid economic growth, national and international greenhouse gas reduction commitments, and availability of cheap land and labor have made many so-called 'emerging markets' in the Global South lucrative sites for the absorption of abundant finance capital (Donovan, 2015). While China and India have emerged as dominant players in the renewable energy economy, Asia as a whole has been a hotbed of investment activity. In 2015, new investment in the Asia/Oceania region (excluding China and India) totaled USD 47.6 billion, a seven-fold increase from 2004 (Frankfurt School-UNEP Centre/BNEF, 2016).

By and large, the vast majority of new investment has been directed at large-scale generation projects with a capacity greater than 1 MW, and the size of large projects continues to increase. Over 160 solar PV plants of 50 MW or larger now operate in at least 26 countries (REN21, 2017b), and records for the world's largest plants continue to tumble. The 850 MW, 14 km² Longyangxia Dam project in northwest China held the record for only two years before being surpassed by the 1000 MW, 24 km² Kurnool Ultra Mega Solar Park in southeast India in 2017 (Anjali Jaiswal, 2017). While investment in renewable energy megaprojects continues to grow, a widening disparity has emerged between investment in large-scale versus small-scale renewable energy generation such as rooftop and community solar PV. Since 2012, the share of total new investment directed to large-scale projects such as wind farms and solar parks has increased from 66% to 74% (USD 187.1 billion) in 2016, while the share directed to small distributed capacity such as rooftop and other small solar projects of less than 1MW has declined from 28% to less than 17% (USD 39.8 billion) (Frankfurt School-UNEP Centre/BNEF, 2017).

The expansion of large-scale projects relative to small-scale generation has coincided with a growing share of private sector investment, as well as a shift in the composition of investor types

and investment activity. With the technological feasibility of solar and on-shore wind now firmly established (Jacobson & Delucchi, 2011; J. McCarthy, 2015), attracting the necessary capital to finance new renewable energy projects is now viewed as the major barrier to meeting renewable energy targets. Concerns over the limited nature of public resources has led to widespread acknowledgement among renewable energy advocates and development institutions that most of the new investment in renewables must come from the private sector (Frankfurt School-UNEP Centre/BNEF, 2017; IRENA and CPI, 2018; REN21, 2017b). According to the International Renewable Energy Agency (IRENA), an intergovernmental organization tasked with facilitating renewable energy cooperation and information exchange across its 153 member states, “[m]eeting international climate goals calls for unprecedented mobilisation of finance in the renewable energy sector” (IRENA and CPI, 2018, p. 14). In recent years, efforts to maximize the potential of limited public resources have informed a winding back of traditional support measures such as grants and subsidies toward a focus on creating the enabling conditions to facilitate greater investment from the private sector. Specific examples include innovations in risk management that shift financial and political risks from private to public entities (Castree & Christophers, 2015; Waissbein et al., 2013), and the shift from state-determined feed-in tariffs to competitive reverse auctions as a means of allocating potential projects to private developers (Buckman et al., 2014; D’Monte, 2017; Frankfurt School-UNEP Centre/BNEF, 2017). Under a reverse auction mechanism, developers that meet certain minimum criteria are eligible to submit non-negotiable price bids to complete particular projects, often at a predetermined capacity and location. The buyer – typically a utility – then selects winning developers based on the lowest priced bids and signs non-negotiable standard contracts with the winning developers based on the prices bid by that developer. This approach has experienced rapid uptake globally (Frankfurt School-UNEP Centre/BNEF, 2017),

and at least 67 countries had used auctions for renewable energy contracts by mid-2016, up from less than 10 in 2005 (IRENA, 2017b). Combined, these measures have demonstrated significant success in meeting their stated objectives. In 2016, over 90% of total new investment in renewable energy came from private sources (IRENA and CPI, 2018), while power tariffs in competitive auctions dropped to unprecedented levels, notably in Chile (Parkinson, 2017) and the United Arab Emirates (Shumkov, 2016).

The growing share of private sector investment has been coupled with a shift in the composition of investor types and investment activity. Private sector investment encompasses a wide array of participants, including project developers, corporations, commercial financial institutions, institutional investors, private equity, venture capital and infrastructure funds. While private sector investment in renewable energy in the early 2000s was dominated by venture capital and private equity – investor types willing to accept higher risk in return for higher yields – lower-risk investor types such as insurance companies and pension funds have become a key source of equity finance for projects, particularly in recent years (Frankfurt School-UNEP Centre/BNEF, 2017). In addition to direct investment in the form of project equity, institutional investors have engaged in indirect investment through pooled vehicles such as yield companies or ‘YieldCos’, innovative dividend growth-oriented public companies that bundle renewable and/or conventional energy assets in order to generate predictable cash flows which are then paid as dividends to investors (Urdanick, 2014). According to alternative assets analyst Prequin, of the 948 US-based institutional investors in the company’s online database that invest in the infrastructure asset class, 52% now have a preference for renewable energy investments (Prequin, 2016). In 2016, institutions such as pension funds and insurance companies committed an estimated USD 2.8 billion to European renewable energy projects: more than double the 2015 outturn and nearly 10 times the total in 2010 (Frankfurt

School-UNEP Centre/BNEF, 2017). Given the estimated USD 86 trillion under their control and long-term investment horizons, institutional investors are widely viewed as having an important role to play in financing future renewable energy development (Nelson, 2015).

Despite the recent growth in renewable energy investment, meeting future renewable energy targets is estimated to require a doubling of renewable energy investment, up to USD 500 billion per year by 2020 (IRENA, 2016b). According to some estimates, the envisaged energy transformation will require a total investment of USD 25 trillion in renewables in the period until 2050, implying a tripling of the current annual investments (IRENA, 2017b). Institutional investors, with an estimated USD 6.5 trillion available for long-term investment in energy infrastructure (WEF, 2011), are widely viewed as having an important role to play in financing future renewable energy development (Nelson, 2015), particularly as many look to divest from fossil fuel installations that risk becoming stranded assets (IRENA and CPI, 2018). Given the potential abundance of institutional finance capital, the major challenge in achieving future renewable energy targets, according to renewable energy advocacy and finance organizations, is developing projects that meet yield and risk requirements of this investor class. According to the International Renewable Energy Agency, “[t]here is not a lack of investment finance. There is no lack of capital in the marketplace for good projects; there is, however, a lack of *bankable projects* to attract investment and fulfil today’s appetite for renewable energy projects.” (IRENA Coalition for Action, 2018, p. 3, emphasis added). Efforts to attract institutional investors, a traditionally risk-averse investor class, have increasingly sought to improve the financial viability of renewable energy projects by minimizing technical, political and economic risks that may impact future cashflows. While such risks have traditionally been managed through policy interventions such as resource assessments, grid connection and management, and local workforce development, recent

years have witnessed extensive innovation in financial de-risking instruments. These instruments typically aim to transfer risks from private to public sector actors through the use of loan guarantees, political risk insurance, and public equity co-investments (Waissbein et al., 2013), and have been employed to support financing large-scale wind, geothermal and solar PV projects in the United Kingdom, Indonesia, and Jordan, respectively (IRENA Coalition for Action, 2018).

This broad overview points to an emerging political economic geography of the global energy transition, one in which increasingly large-scale generation projects, predominantly wind and solar, have coincided with unprecedented levels of private sector investment. Broad acceptance that meeting future renewable energy targets is dependent on risk-averse institutional investors has seen risk management emerge as a major focus of renewable energy advocates and policymakers, and in doing so, has reshaped the ways in which public finance has traditionally been used to support the development of renewable energy. While installed capacity of renewable energy has increased, the extent to which this mode of transition will produce radical and systemic environmental and social change warrants closer scrutiny. In the following section, I attempt to theorize these developments and their potential implications by linking existing work on ‘geographies of energy transition’(Bridge et al., 2013; Calvert, 2016) to recent work on the financialization of green infrastructure (Baker, 2015; Loftus & March, 2016), ‘energy democracy’ (Burke & Stephens, 2018; Fairchild & Weinrub, 2017), and core concerns of political ecology, namely land and livelihoods (M. T. Huber & McCarthy, 2017).

2.3 Financialized geographies of energy transition

‘Energy transition’ can be broadly defined as the “radical, systemic and managed change towards ‘more sustainable’ or ‘more effective’ patterns of provision and use of energy” (Rutherford & Coutard, 2014, p. 1354). In recent years the study of energy transitions has witnessed a geographic

turn (Bridge et al., 2013; Calvert, 2016), shifting from a focus on technological innovations driving change in socio-technical systems (Coenen & Truffer, 2012; Geels, 2004; Lawhon & Murphy, 2012) toward a conception of energy transition as a ‘geographical process, involving the reconfiguration of current patterns and scales of economic and social activity (Bridge et al., 2013, p. 331). Taking seriously the spatiality of energy transition directs attention to the specificities of place that position landscapes as sites of extensive renewable energy development, as well as the ways in which these specificities shape and are shaped by the energy regime as it extends vertically and horizontally across multiple scales of governance (Bulkeley, Broto, & Maassen, 2014; Rutherford & Coutard, 2014).

While the processes related to energy transitions operate within and across multiple sites and scales, many of the social and environmental impacts attributed to energy transitions are linked to the scales at which renewable energy projects are employed. Small-scale distributed technologies such as solar PV, for example, are seen as highly desirable in contexts where physical geography largely prohibits centralized models of energy generation (Gunningham, 2013). Off-grid renewable technologies such as solar PV which produce electricity with a very low climate impact have been advocated as an effective means of addressing the low-electrification challenge (Miller & Hope, 2000; Schmidt, Blum, & Sryantoro Wakeling, 2013). Proponents of ‘energy democracy’ view distributed renewable energy resources such as residential- and community-scale as providing greater opportunity for community ownership and control of the energy system (Burke & Stephens, 2018), and are thus seen as having potential to achieve a more equitable distribution of economic and environmental benefits (Fairchild & Weinrub, 2017; Farrell, 2017; Sweeney, 2014). In addition, distributed generation has potential to avoid environmental justice harms while providing a means for energy cost savings and green economic development in environmental

justice communities, while also reducing the demand for utility-scale fossil energy or polluting renewable energy plants (Outka, 2012).

When employed at larger scale (> 1MW), however, many of the advantages associated with distributed generation are diminished, and in extreme cases, completely erased (Frantál, Pasqualetti, & van Der Horst, 2014). Centralized energy systems, whether based on large-scale fossil-fuel or renewable energy generation, typically result in a concentration of benefits and costs, in large part due to the ways in which substantial capital requirements exclude opportunities for distributed ownership and control (Baker, 2015; Burke & Stephens, 2018). While large-scale systems provide cheaper electricity when measured in narrow terms of cents per kilowatt-hour, the land-intensity of both the generating facility and supporting transmission infrastructure often produce serious negative social and environmental impacts (R. R. Hernandez et al., 2014). The higher land intensity of wind, solar, and hydropower relative to conventional fossil fuels (McDonald, Fargione, Kiesecker, Miller, & Powell, 2009; Vaclav Smil, 2008) has generated significant attention toward the potential impacts of renewable expansion on rural land use and livelihoods (Frantál et al., 2014; M. T. Huber & McCarthy, 2017) and the resulting land-use and land-cover change and its implications for biodiversity, soils, water resources and human health (Hernandez et al., 2014). In Morocco and India, the installation of spatially extensive solar power facilities have been linked to the displacement of rural populations and disruption of livelihood strategies (Rignall, 2016; Yenneti et al., 2016).

Despite renewable energy technologies such as wind and solar long being hailed for their ability to negate the need for land- and capital-intensive centralized electricity generation (Kaneff, 1979), large-scale centralized projects represent an increasing share of annual installations (REN21, 2017b). In other contexts, such as water management, the preference for ‘big infrastructure’ has

been closely linked to demands for stable returns from institutional investors (Colven, 2017; Loftus & March, 2016). In this context, the rise of complex and speculative finance structures have meant that investment decisions are increasingly decided less by social or environmental need, but rather, ‘focused on the most effective means to guarantee a range of investment opportunities within an increasingly leveraged set of infrastructural assets’ (Loftus & March, 2016, p. 47). In the context of the global energy transition, the rapid increase in private finance in the global renewable energy sector has led to unprecedented growth of renewable energy generation capacity, at unprecedented scales and at lower tariffs than previously thought possible. At the same time, however, the growing dominance of large-scale renewable energy projects despite the availability of smaller-scale alternatives suggests that private finance, particularly the influence of financial logic in determining project viability, may in fact be producing a particular geography of energy transition that in turn shapes the conditions of possibility for what a broad energy transition may produce.

The relationship between private sector investment and large-scale generation can be understood as a direct reflection of the risk-return logic of finance and the associated concept of ‘bankability’. According to the logic of finance, higher risk is associated with greater probability of higher return, while lower risk with a greater probability of smaller return (Brealey & Myers, 2000). While all investors seek to maximize return and minimize risk where possible, due to the variation in risk-return profile across investor types (i.e. the willingness to accept a certain degree of risk in exchange for a certain rate of return), different investor types are attracted to projects that reflect their particular risk-return profile. Investors seeking high yields, for example, typically favor larger-scale projects which allow for fixed permitting, legal, and other transaction costs to be reduced relative to total investment, which in turn minimizes costs and maximizes return. Institutional investors, a traditionally risk-averse investor class, focus primarily on ensuring stable returns by

minimizing risk. Relatedly, bankability refers to the ability of a project to generate sufficient profit within an acceptable degree of risk to satisfy financier requirements (Baker, 2015; Gupta, 2012). As is common in infrastructure investment more broadly, the source, nature and form of renewable energy finance has direct implications in terms of risk allocation, return expectations, and ownership structures, which in turn shape the logic through which investment decisions are made (Castree & Christophers, 2015). Whether an investor will consider a high-risk/high-yield or a low-risk/low-yield investment as ‘bankable’ depends on the amount and type of risk that an organization is willing to take to meet their strategic objectives. While states and development finance institutions have traditionally been willing to accept higher levels of risk in the pursuit of social or environmental objectives, private finance’s tolerance for risk is often constrained by the short-term demands of private investors (Dickinson, 2008). Similarly, institutional investor such as pension funds and insurance companies for example typically seek attractive, low-risk, long-term investment performance as means of meeting their long-term cashflow requirements (Nelson & Pierpont, 2013).

The broad acceptance that “most of the new investment in renewables must come from the private sector” (IRENA and CPI, 2018, p. 38), coupled with the perceived “lack of bankable projects to attract investment and fulfil today’s appetite for renewable energy projects” (IRENA Coalition for Action, 2018, p. 3), has resulted in project bankability becoming the core metric against which project viability and desirability is judged. By extension, the risk-return logic of finance has thus emerged as a key factor in shaping the geography of the global energy transition. The shifting composition of renewable energy finance in recent years, specifically the growing influence of risk-averse institutional investors, has already manifest as a shift in investment decision outcomes. As the share of private investment has grown, investors have demonstrated preferences for

particular technologies, scales of generation, and locations in which to direct funds based on their particular perceptions and calculations of bankability. Combined, wind and solar accounted for over 93 percent of private investment in 2016, with biofuels, small hydro, geothermal and marine energy each accounting for a negligible share (Frankfurt School-UNEP Centre/BNEF, 2017). While venture capital and private equity have displayed a preference for solar, public markets have displayed a clear preference for wind (Frankfurt School-UNEP Centre/BNEF, 2017). Whereas public investment is more balanced between in-country and international financing, 93% of the private portfolio in 2013-2015 was directed to domestic renewable energy projects (IRENA and CPI, 2018). Due to unfavorable risk-return profiles and small investment volumes associated with small-scale electrification projects, private investors have demonstrated a general preference for larger-scale projects (Malhotra, Schmidt, Haelg, & Waissbein, 2017).

Given the growing influence of risk-averse institutional investors, future expansion of renewable energy generation is likely to favor safe investments in tested large-scale, land-intensive technologies over less financially-attractive alternatives. In the following section, I examine specific ways in which investor preferences, expressed through the notion of bankability, may ultimately impede three common energy transition objectives: reduction of greenhouse gas emissions; improved energy access; and the promotion of energy democracy. While a full discussion of all possible outcomes is beyond the scope of this chapter, I offer a flavor of global trends by drawing on emerging issues in Indonesia and California: two sites at opposite ends of the energy transition yet linked through trans-Pacific flows of technology and finance.

2.4 The limits of a financialized energy transition

2.5.1 Reducing greenhouse gases and improving energy access in Indonesia

Indonesia is one of the world’s highest emitters of greenhouse gases, and one of a growing number of countries to adopt a national renewable energy target (REN21, 2017b). In addition to compliance with international climate agreements (Republic of Indonesia, 2016), an increase in renewable energy generation capacity has been promoted as a means of increasing Indonesia’s electrification rate, which – with over 10% of the population lacking access to electricity – is currently the lowest in Southeast Asia (Chelminski, 2016; IRENA, 2017c; Schmidt et al., 2013). While almost two decades of sustained economic growth have helped boost the national electrification rate from 43% in 1995 to over 84% in 2015 (ADB, 2016), much of this growth has been uneven, and electrification rates, particularly in the country’s eastern islands, remain at or below 50% (Fig. 2.1).

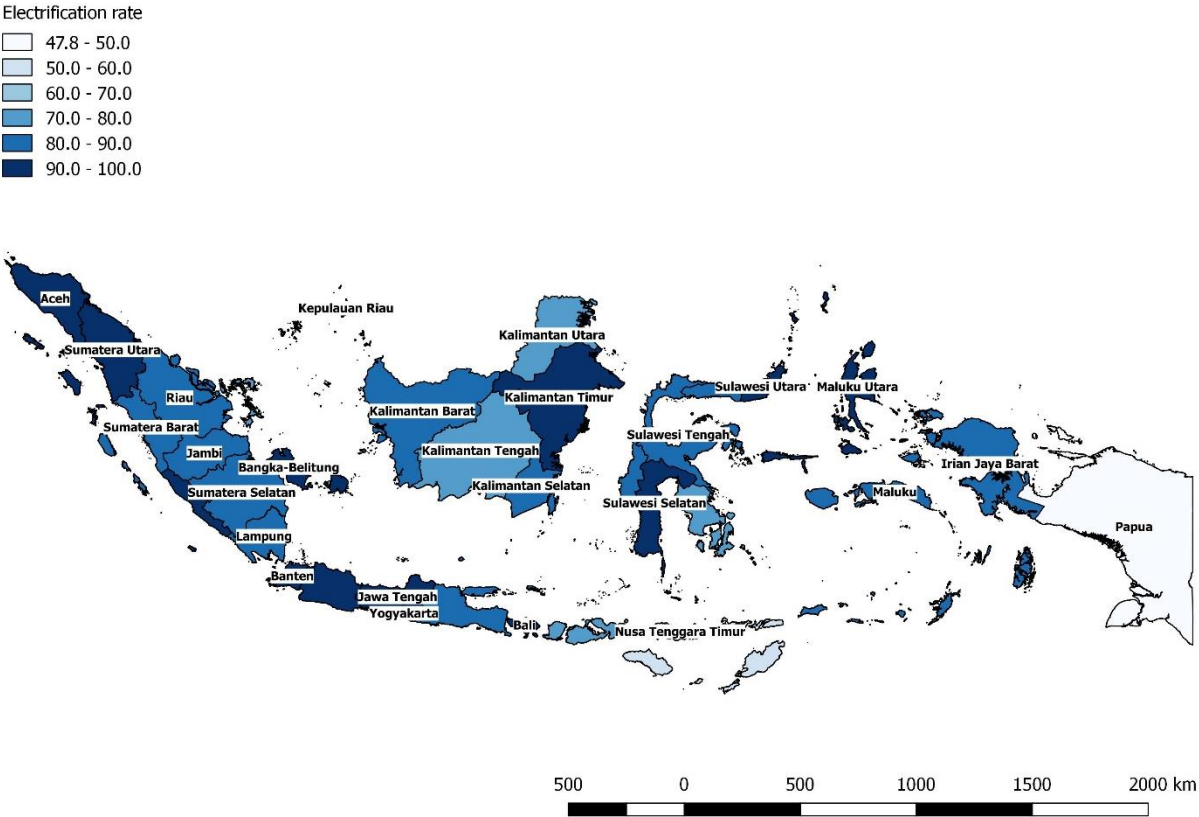


Figure 2.1 Electrification rates in Indonesia (Data source: DGE, 2016)

In response to these energy challenges, the Government of Indonesia has announced numerous electrification and renewable energy targets, the most ambitious of which include an increase in the national electrification rate from 84% to 100% by 2020 and an elevenfold increase in renewable energy use by 2025 (IEA, 2016; IRENA, 2017c). Reflecting the global shift toward greater private sector participation in the renewable energy sector, over the past few years Indonesia has moved away from traditional support mechanisms such as favorable feed-in tariffs, in favor of policies that allocate projects to developers on a competitive basis through reverse auctions (Baker McKenzie, 2017). While developers have been required to meet some minimum requirements, such as prior experience and financial strength, price – specifically dollars per MWh – has become a primary factor in determining project viability (Kennedy, 2018).

Since 2015, the Indonesian solar electricity sector has witnessed unprecedented attention from international investors and developers, with planned solar photovoltaic (PV) projects announced in 2017 alone set to increase existing installed capacity from 9 megawatts (MW) to over 240MW (SolarPlaza, 2017). To date, however, the vast majority of recent investment has been directed at large-scale generation facilities, typically in areas that enjoy reasonably reliable access to electricity such as Sulawesi and Sumatra. Two recent proposals by energy multinationals Equis and ENGIE of 21 MW and 140 MW, respectively, illustrate this point (ENGIE, 2017a; Equis Energy, 2017).

While boosting the nation's installed renewable energy capacity, these announcements, along with other recently proposed projects, raise a number of questions regarding the extent to which this apparent energy 'transition' will result in positive socio-ecological change. The first concerns the impact on Indonesia's greenhouse gas emissions. The extent to which renewable energy technologies reduce greenhouse gas emissions depends largely on two factors: the displacement

of more emissions-intensive form of generation; and the emissions-intensity of supporting infrastructure used to manage the inherent intermittency of renewable energy resources such as wind and solar. Under its current 10-year electricity procurement business plan, Indonesia plans to have 106 GW of new electricity capacity installed in the next seven years, of which 57.7 GW would come from burning coal and 24.4 GW from renewables (MEMR, 2018). So, while contributing to the 24.4 GW renewable energy target, these recent announcements will only contribute to greenhouse gas emissions reductions if it assumed that that future capacity would otherwise been met by more emissions-intensive electricity generation, such as coal. With regard to intermittency, Indonesia's competitive reverse auction structure incentivizes developers to find the lowest cost means of addressing the variability associated with solar PV. Due to the absence of any incentive for auxiliary measures that support greenhouse gas emissions reduction targets, however, the logic of finance appears to be driving developers to opt for the lowest-cost means of addressing intermittency. French developer Akuo Energy recently announced a 500MW hybrid system in eastern Indonesia which will combine 250MW of solar PV with wind, energy storage, and diesel generation (Tsagas, 2017a). While the specific ratio of wind, energy storage, and diesel generation is yet to be determined, according to an Akuo spokesperson "a small amount of genset is needed to avoid an over-sized storage capacity in order to reach the target PPA price that PLN expects in each particular location." While accurate lifecycle assessment of renewable energy technologies presents numerous challenges (Nugent & Sovacool, 2014), it could be argued that depending on the ratio of solar PV to diesel generation, the project may ultimately result in a net increase of greenhouse gas emissions, rather than a reduction.

The second concern relates to energy access. Given the Indonesia's archipelagic geography, off-grid renewable technologies such as solar PV that produce electricity with a very low climate

impact have been advocated as an effective means of addressing the low-electrification challenge (Miller & Hope, 2000; Schmidt et al., 2013). Echoing experiences in other contexts (Sergi et al., 2018), however, development of solar PV in many of Indonesia's outer islands has been sluggish, with much of the investment in renewable directed at other large-scale centralized technologies such as geothermal and hydro (IRENA, 2017c). Again, the logic of finance offers some insight into this trend. By increasing project size, developers are able, at least in theory, to reduce fixed costs such as legal and permitting fees relative to variable cost, and thus reduce the overall cost of the project measured in terms of cost per unit of output and maximize returns. As developing projects in remote and underdeveloped locations introduces additional project risk (Baker McKenzie, 2017, p. 11), institutional investors looking to minimize risk will likely opt to support projects in locations with existing infrastructure backed by a creditworthy purchaser, such as a corporate or state-owned utility. Given the absence of reliable grid infrastructure in many remote parts of the country, particularly the country's eastern islands, the proposed large-scale development in parts of the country with existing access to relatively affordable electricity is likely to do little to address the country's electrification challenge.

In sum, while foreign investment may prove successful in increasing the country's solar PV capacity, the risk-return logic of finance may produce a particular geography of renewable energy generation that presents limited improvement in terms of greenhouse gas emissions reductions and improvement in energy access, resulting in a missed opportunity in terms of maximizing the socially and politically transformative potential a broader energy transition may entail.

2.5.2 Energy democracy in California

Viewing energy transition as a political opportunity, energy democracy connects the transition to renewable energy with the promotion of social and environmental justice under the assumption

that distributed energy resources enable the distribution of political power (Burke & Stephens, 2018). Being relatively small in capacity (<1 MW) and able to function autonomously from the grid, distributed energy resources such as rooftop and community solar are seen as affording greater opportunity for community ownership and control of the energy system (Farrell, 2017), and are thus seen as an effective means to achieve a more equitable distribution of economic and environmental benefits (Fairchild & Weinrub, 2017; Farrell, 2017; Sweeney, 2014). In addition to the emphasis on decentralized distributed renewable energy resources, energy democracy advocates view resisting the agenda of large energy corporation and reclaiming to the public sphere parts of the energy economy that have been privatized or marketized are viewed as key elements in an effort to restructure the global energy system in a way allows for greater community and democratic control over the energy sector (Sweeney, 2014).

In California, the energy democracy movement has played a key role in the recent fragmentation of the long-dominant utility sector in favor of smaller, county or municipally-based quasi-utilities asserting local control over energy procurement and delivery. Known as Community Choice Aggregation, or CCA, the model places decisions around energy procurement in the hands of the local community, and is viewed by a growing number of local governments and community-based organizations as an attractive – and more democratic – alternative to the utility model (CalCCA, 2018; LEAN, 2017). The CCA movement is positioned as an alternative to the prevailing corporate-driven centralized investor-owned utility (IOU) model of energy governance that has dominated California’s electricity sector for over 100 years. Through local control over electricity procurement, CCA allows local governments to set their own renewable energy targets and thus potentially deliver a greater share of renewable energy and energy-related services to their customers than would be provided by a traditional utility (Outka, 2016). By alleviating the need to

meet investor requirements for stable returns on investment, which are often reflected in IOU preferences for procuring electricity from large-scale generation facilities, CCAs are conceived as able to operate outside the risk-return logic of finance and thus able to procure electricity in a way that allows for a much broader variety and distribution of socio-economic and ecological benefits (Weinrub, 2017). In recent years, the movement has expanded rapidly, and CCAs are now projected to account for 60% of Californian customers currently served by independently-owned utilities by 2020 (CCP, 2016).

Although California's CCAs are still in initial stages of development – the first Californian CCA, MCE Clean Energy, launched in 2010 – recent experience raises significant questions over whether the CCA model can deliver on the socially- and environmentally-just decentralized distributed renewable energy system envisaged by energy democracy advocates. Although advocated as a response to the corporate-focused investor-owned utility model, CCAs have been greatly constrained by the very financial logic many seek to resist. To date, CCAs' ability to procure the specific type (location, scale, energy source) of energy resources that tie to energy democracy objectives has been constrained by CCAs' inability to access capital. In an effort to shield local communities from potential CCA-related liabilities, many CCAs are created as separate legal and financial entities from their associated local governments, and thus commence operations without credit history. Due to a lack of established credit, newly established CCAs have become reliant on the services of third-party power providers, who can use their own credit to enter power purchase agreements directly and then pass this electricity on to the CCA. While the use of third-party providers allows CCA's to meet immediate energy requirements and renewable energy targets in the short-term, the severely limits the potential for community control and ownership over specific renewable energy resources.

In order to deliver greater shares of renewable energy at lower cost than incumbent utilities, many CCAs have resorted to the use of tradable renewable energy certificates, or RECs (Pinkel & Weinrub, 2013). RECs are market-based instruments typically used to represent the rights to the environmental attributes of renewable electricity generation (US EPA, 2016), and are one of the most common mechanisms that states use to ensure that utilities are complying with renewable energy portfolio requirement, including the California renewable portfolio standard, or RPS. RECs are commonly classified in two broad categories (Fig. 3): “bundled”, in which the electricity and the associated REC are sold together; and “unbundled”, in which the REC is sold separately from the underlying energy (Holt et al., 2011). Much like carbon credits (Layfield, 2013), RECs are an innovative financial mechanism that facilitates the separation between an environmental attribute – in this case 1 MWh of renewable energy – and the legal rights to that environmental attribute. The purchase of unbundled RECs thus allows an electricity retailer such as a CCA to claim the legal right to renewable energy, even though the actual energy procured and delivered to its customers is derived from a non-renewable source. While from an economic perspective RECs encourage renewable energy siting in areas with high resource quality and thus offer cost advantages related to market efficiencies and scalability (CRS, 2016), the availability of low-cost renewable energy through RECs potentially crowds-out potential development of local renewable energy projects and associated opportunities for local economic development (Pinkel & Weinrub, 2013). While public opposition has led an increasing number of CCAs moving away from the use of unbundled RECs in recent years (SCP, 2018b), the example serves as a reminder of the challenges in promoting broader energy transition objectives that may not align with the risk-return logic of finance, while suggesting significant limitations to the extent to which localized renewable energy initiatives can influence the democratizing potential of future energy transitions.

2.5 Conclusion: avenues for future research

To date, the ways in which the apparent financialization of the renewable energy sector translates into ownership, control and geographical organization of the renewable energy industry has received limited attention (Baker, 2015). This chapter suggests that financialization may promote a particular *type* of transition, one predicated on ‘bankability’, risk minimization, and short-term profit maximization. The insistence of policymakers and renewable energy advocates to measure success in terms of installed capacity obscures the expansion of ill-suited / ill-fitting infrastructure projects that do little more than serve as means to absorb excess capital held yield-hungry investment funds. As a result, project ‘bankability’ – the ability of a project to generate sufficient profit to satisfy lender requirements (Baker, 2015; Gupta, 2012) – has become the core metric against which project viability and desirability is judged, and thus a core determinant of the types of socio-ecological an energy transition may produce.

The arguments presented in this chapter are based on a broad survey of recent trends in the global renewable energy sector. Understanding the full implications of the increasingly financialized energy transition requires higher resolution empirical analysis focused on the broader political economic and ecological implications of a global energy transition predicated on the risk-return logic of finance. In particular, the argument that innovations in renewable energy finance will simultaneously expand renewable energy generation capacity while reducing in greenhouse gas emissions warrants closer empirical scrutiny. While there is an undeniable correlation between increases in renewable energy investment and installed capacity over the past decade, recent years have witnessed a growing share of renewable investment directed to mergers and acquisitions of existing renewable energy assets (Frankfurt School-UNEP Centre/BNEF, 2017). In addition, recent efforts to manage risk associated with small-scale renewable energy projects have looked to aggregation and securitization as a means of facilitating access to capital markets (IRENA

Coalition for Action, 2018). Combined, these trends potentially recast renewable energy projects as tradable financial assets, creating distance between the original productive assets and the sites in which benefits will ultimately accumulate (Baker, 2015; Bayliss, 2014). Likewise, trade in unbundled renewable energy certificates may not only impact the stability of renewable energy finance markets (Holt et al., 2011), but may ultimately do little to displace existing greenhouse gas emissions-intensive forms of electricity generation (Pinkel & Weinrub, 2013).

While energy transitions may on the surface appear intended to promote energy justice – for instance, by alleviating the need for emissions- and pollution-intensive forms of electricity generation in favor of ‘cleaner’ alternatives – the uneven power dynamics driving such transitions and the broad and variegated constituencies such transitions affect may also give rise to new injustices (Jenkins et al., 2016; Newell & Mulvaney, 2013). Critical attention to the assumed complementarity of different energy transition objectives is needed to better understand this relationship, and the potentially adverse consequences that can result from an unquestioning adherence to the win-win rhetoric of the ‘green economy’. While links between various forms of renewable energy and land use and livelihood transformation have witnessed growing attention (Baka, 2017; M. T. Huber & McCarthy, 2017; Rignall, 2016; Yenneti et al., 2016), explicit links between renewable energy finance and particular land use and livelihood transformations have been largely overlooked, and thus also warrant close attention. Given that meeting 34 percent of global energy demand in 2030 with large-scale solar generation will require over 400,000 km² of land – an area greater than the size of Germany (Jacobson & Delucchi, 2011) – such impacts are likely to intensify under the current energy transition trajectory. Finally, while there is mounting theoretical support for a relationship between energy infrastructure and the distribution of political power (Burke & Stephens, 2018), attention to the underlying logics and political economic

processes that inform particular infrastructure investment decisions will provide a more meaningful approach to understanding the conditions under which a more radical, systemic, and democratic energy transition may arise.

The innovations in renewable energy policy and finance outlined here, particularly those promoting large-scale investment, may ultimately inform particular geographies of renewable energy generation, directing energy transition futures either toward a highly centralized system replicating many of the social and political inequities characteristic of the prevailing fossil-fuel regime (Mitchell, 2009), or towards a more distributed and potentially democratic energy future (Alanne & Saari, 2006). Closer attention to the dynamics laid out in this chapter will not only illuminate the potentially uneven political-ecological implications of energy transitions as they play out at different scales, but should also serve as a guide for policymakers seeking to manage the energy transition in a way that reduces the carbon-intensity of the economy while being attentive to potential contradictions and perverse outcomes that may result from reliance on particular means of achieving energy transition objectives.

CHAPTER 3 INDONESIA'S ENERGY TRANSITION AND ITS CONTRADICTIONS: EMERGING GEOGRAPHIES OF ENERGY AND FINANCE

Abstract

Since 2015, the Indonesian solar electricity sector has witnessed unprecedented attention from international investors and developers, with planned solar photovoltaic (PV) projects announced in 2017 set to increase existing installed capacity from 9 megawatts (MW) to over 240MW. This chapter examines the emerging geographies of renewable energy generation resulting from the rapid influx of foreign investment into Indonesia's solar PV sector. While foreign investment may prove successful in increasing the country's solar PV capacity, it may also produce several contradictory outcomes for Indonesia's energy transition. Efforts to reconcile demands of risk-averse, profit-driven investors and developers with the needs of the approximately 25 million Indonesians who currently lack access to electricity has resulted in a geography of renewable energy generation characterized by large-scale centralized generation facilities that constrain opportunities for local ownership and control over the energy system. The result – a major contradiction when viewed through the lens of Indonesia's energy transition development objectives – is not only a flow of economic benefits out of the country and limited improvement in energy access for much of the country, but a missed opportunity in terms of maximizing the socially and politically transformative potential a broader energy transition may entail.

3.1 Introduction

Despite strong growth across much of Southeast Asia, and abundant renewable energy potential (IRENA, 2017c), investment in renewable energy generation in Indonesia has historically lagged that of other countries in the region (Frankfurt School-UNEP Centre/BNEF, 2017). Since 2015, however, the Indonesian solar electricity sector has witnessed unprecedented attention from international investors and developers, with planned solar photovoltaic (PV) projects announced in 2017 alone set to increase existing installed capacity from 9 megawatts (MW) to over 240MW (SolarPlaza, 2017). While the 240 MW of planned projects falls far short of the country's ambitious target of adding an additional 3.6 gigawatts (GW) of solar PV by 2019, the recent surge in activity nevertheless suggests a significant shift in the political economy of Indonesia's electricity sector, and the potential beginnings of a broader transition from fossil fuels to renewable energy sources.

The sudden surge in foreign investment raises two questions that together form the focus of this chapter. First, why – and why now – has Indonesia attracted such significant attention from international developers and private investors, and at such unprecedented scale? Second, in the event that these proposed projects reach completion, how will the associated benefits and costs be distributed, both now and in the future? In response to calls for greater attention to the geographic aspects of sustainability transitions (Coenen & Truffer, 2012; Lawhon & Murphy, 2012), this chapter approaches these two questions by examining the development of Indonesia's solar PV sector as 'a geographical process, involving the reconfiguration of current patterns and scales of economic and social activity' (Bridge, Bouzarovski, Bradshaw, & Eyre, 2013, p. 331). In doing so, this chapter examines the processes through which the Indonesian solar PV sector has emerged, the ways in which the relationship between renewable energy and finance in Indonesia has evolved

thus far, and the implications of this relationship for the future geographies of Indonesia's energy transition.

This chapter contributes to existing work on the geographies of energy transition (Bridge et al., 2013; Calvert, 2016), as well as recent work the financialization of natural resource management (Loftus & March, 2016; March & Purcell, 2014; Sullivan, 2013) and renewable energy generation (Baker, 2015) by furthering an understanding of the conditions under which an energy transition might emerge, the geographic and political economic characteristics of this apparent transition, and the political ecological implications for Indonesia's energy transition more broadly. Following a brief methodological overview in Section 2, Section 3 presents the theoretical context for the chapter, situating the concept of energy transition within recent work in critical geography and political ecology on the financialization of green infrastructure. Section 4 examines the confluence of domestic policy shifts and investment decisions that have informed the current geography of Indonesia's solar PV sector, focusing in particular on the transformations in project scale, funding sources, and ownership structures that characterize the emerging sector. Following the convention of Indonesia's renewable energy targets, and given the difficulty in projecting future generation, this discussion focuses on capacity installed (i.e. megawatts [MW]) as opposed to actual generation (megawatt-hours [MWh]). While attention to actual generation would provide greater insight, including land required to meet electricity demand (Jacobson & Delucchi, 2011), given that many of the projects discussed have not yet commenced operation such an analysis would require extensive estimation and is thus omitted from this discussion. Section 5 discusses the specific role of finance in shaping the emerging geography of Indonesia's solar PV sector, and examines the implications of the country's increasingly financialized energy transition in terms of immediate

distributional outcomes and for Indonesia's energy transition objectives more broadly. Section 6 concludes.

3.2 Methodology

This chapter is based on policy, document, and media analysis informed by a review of grey and peer-reviewed literature, attendance at renewable energy finance conferences and webinars, and expert interviews. While all major Indonesian electricity-related legislation and regulations were reviewed, particular focus was directed at national-level Indonesian policies with direct relevance to renewable energy in general, and solar PV in particular. Direct analysis of relevant legislation and regulations was supplemented with a review of policy and legal reports produced by non-government and inter-governmental organizations, legal consulting firms, and research organizations including the International Renewable Energy Agency, the ASEAN Centre for Renewable Energy, Baker-McKenzie, PricewaterhouseCoopers, and Bloomberg New Energy Finance. Data relating to planned projects is drawn from publicly available sources including company reports, industry publications, and media articles. 15 semi-structured interviews with Indonesian policymakers, government officials, domestic and foreign renewable energy financiers, and renewable energy developers directly involved in the Indonesia solar PV sector were conducted between September 2016 and October 2017. Interviews were conducted at the World Renewable Energy Congress held in Jakarta, Indonesia from September 19-23, 2016, the SolarPlaza *Unlocking Solar Capital Asia* conference held in Singapore from September 28-29, 2017, at project locations in Java, East Nusa Tenggara, and Papua, and via Skype between September 2016 and October 2017. Where interviews are directly cited, interviewees have been anonymized due to the politically and commercially sensitive nature of the subject matter. These interviews were used to supplement the policy analysis and literature review, while also providing broader context and nuanced viewpoints from a variety of stakeholder perspectives.

3.3 Financialization and the geographies of energy transition

The term ‘energy transition’ can be broadly defined as the “radical, systemic and managed change towards ‘more sustainable’ or ‘more effective’ patterns of provision and use of energy” (Rutherford & Coutard, 2014, p. 1354). In recent years the study of energy transitions has witnessed a geographic turn (Bridge et al., 2013; Calvert, 2016), shifting from a focus on technological innovations driving change in socio-technical systems (Coenen & Truffer, 2012; Geels, 2004; Lawhon & Murphy, 2012) toward a conception of energy transition as a ‘geographical process, involving the reconfiguration of current patterns and scales of economic and social activity (Bridge et al., 2013, p. 331). Under this radical, systemic, and geographic approach to energy transition, energy is conceptualized as more than simply an economic asset or an ecological phenomenon, but, owing to the inseparability of energy production, distribution, and consumption from political-economic and cultural processes, as a social relation (Baker, 2015; Calvert, 2016). Studying energy transitions from this perspective focuses attention on the ways in which drivers and outcomes of energy transitions, through their interplay with existing social relations, play out unevenly across space (Bridge et al., 2013). Normative accounts of how energy transitions should be governed (Florini & Sovacool, 2009) and where renewable energy development should be located to minimize socio-ecological impacts (R. R. Hernandez et al., 2014), while invaluable to planners and policymakers, largely fail to account for the power relations and the broader political economic structures, land use, and ecological processes shaping the geography of renewable energy generation and energy transition and the profound contradictions that may result. Analyzing energy transitions from a geographical perspective emphasizes the study of places in which transition occurs, but also the spatial relations – geographical connections and interactions – within and between that place and other places (Bridge

et al., 2013), and thus provides a more comprehensive picture of the power relations shaping particular transitions (Lawhon & Murphy, 2012) and the resulting distributional outcomes.

One geographic aspect of sustainability transitions that has received mounting attention in the areas of environmental conservation (Sullivan, 2013) and water management (Loftus & March, 2016; March & Purcell, 2014) but limited attention in the context of energy transition, is the role of finance. As with other resource sectors, the global renewable energy sector has been subject to a rapid increase in private sector participation, including a growing influence from private finance. Specific examples include the shift from subsidies and feed-in tariffs to competitive reverse auctions (Buckman et al., 2014; D'Monte, 2017; Frankfurt School-UNEP Centre/BNEF, 2017), innovations in risk management that shift financial and political risks from private to public entities (Castree & Christophers, 2015; Waissbein et al., 2013), and a shift from public to private sources of finance (Frankfurt School-UNEP Centre/BNEF, 2017). In the case of the financialization of water infrastructure, investment decisions have come to be decided less by social or environmental need, but rather, 'focused on the most effective means to guarantee a range of investment opportunities within an increasingly leveraged set of infrastructural assets' (Loftus & March, 2016, p. 47). In this context, project 'bankability' – the ability of a project to generate sufficient profit to satisfy lender requirements (Baker, 2015; Gupta, 2012) – has become the core metric against which project viability and desirability is judged. While the ways in which the apparent financialization of the renewable energy sector translates into ownership, control and geographical organization of the renewable energy industry has received limited attention, recent work suggest that financialization may promote a particular type of transition, one predicated on 'bankability', risk minimization, and short term profit maximization (Baker, 2015).

Similar to the ways in which financialization has produced contradictory outcomes in the pursuit of poverty alleviation (McAfee, 2012) and ecosystem conservation (Sullivan, 2013) objectives, the development of renewable energy generation underpinned by the risk-return logic of finance is in some cases proving equally problematic, driving a rise in speculative investment decisions and increasingly opaque ownership structures as capital is increasingly distanced from actual productive assets (Baker, 2015; Loftus & March, 2016). As noted by Castree and Christophers, the source, nature and form of infrastructure finance has direct political implications in terms of risk allocation, return expectations, and ownership structures (Castree & Christophers, 2015). By association, the source, nature, and form of infrastructure finance may inform particular geographies of renewable energy generation, thus directing energy transition futures either toward a highly centralized system replicating many of the social and political inequities characteristic of the prevailing fossil-fuel regime (Mitchell, 2009), or towards a more distributed and potentially democratic energy future (Alanne & Saari, 2006).

As this chapter demonstrates, the Indonesian solar PV sector has witnessed unprecedented attention from international investors and developers since 2015. Given experiences in other contexts, it follows that the dominance of financial logic that often accompanies greater private sector participation has the potential to produce serious contradictions as energy transitions move in directions favoring safe investments in tested large-scale, land-intensive technologies, while neglecting less financially attractive goals of energy efficiency, system resilience, improved energy access, and local economic development, thus closing the possibility for alternative energy transition futures.

3.4 Indonesia's 'energy transition'

3.4.1 Electricity governance in Indonesia

With the exception of some brief, largely failed, experiments encouraging private sector participation in the late twentieth century, Indonesia's electricity regime has been almost exclusively a state-run affair, with electricity generation, transmission and distribution largely controlled by the monopoly utility *Perusahaan Listrik Negara* (PLN) since the country's independence in 1945 (Purra, Araral, Jarvis, Ramesh, & Wu, 2011; Setyawan, 2014). As a state-owned utility, PLN is regulated and supervised by the Ministry of Energy & Mineral Resources (MEMR), the Ministry of State-Owned Enterprises (M-SOE), and the Ministry of Finance (MoF). The MEMR is charged with creating and implementing Indonesia's energy policy, including the National Electricity Plan (RUKN) and regulating the power sector through the Directorate General of Electricity (DGE) and the Directorate General of New and Renewable Energy and Energy Conservation ("DGNREEC"). The MEMR is also responsible for preparing and implementing regulations related to electricity, renewable energy and energy conservation and endorsing PLN's business electricity procurement plan. In theory, as a regulated utility, PLN is intended to serve as a primary vehicle for implementing MEMR policy objectives. As a state-owned company, however, PLN faces significant pressure to generate profits, both as a means of generating state revenue but also limit the need for continued government subsidies. The policy-driven motives of MEMR have consistently clashed with the profit-driven focus of PLN, resulting in over four decades policy and regulatory instability and a patchwork of state, quasi-state and private actors who together exert varying degrees of influence over the planning, regulation, development and operation of the country's energy infrastructure (Chelminski, 2016; Schmidt et al., 2013). In this context, the role of the private sector has been anything but clear.

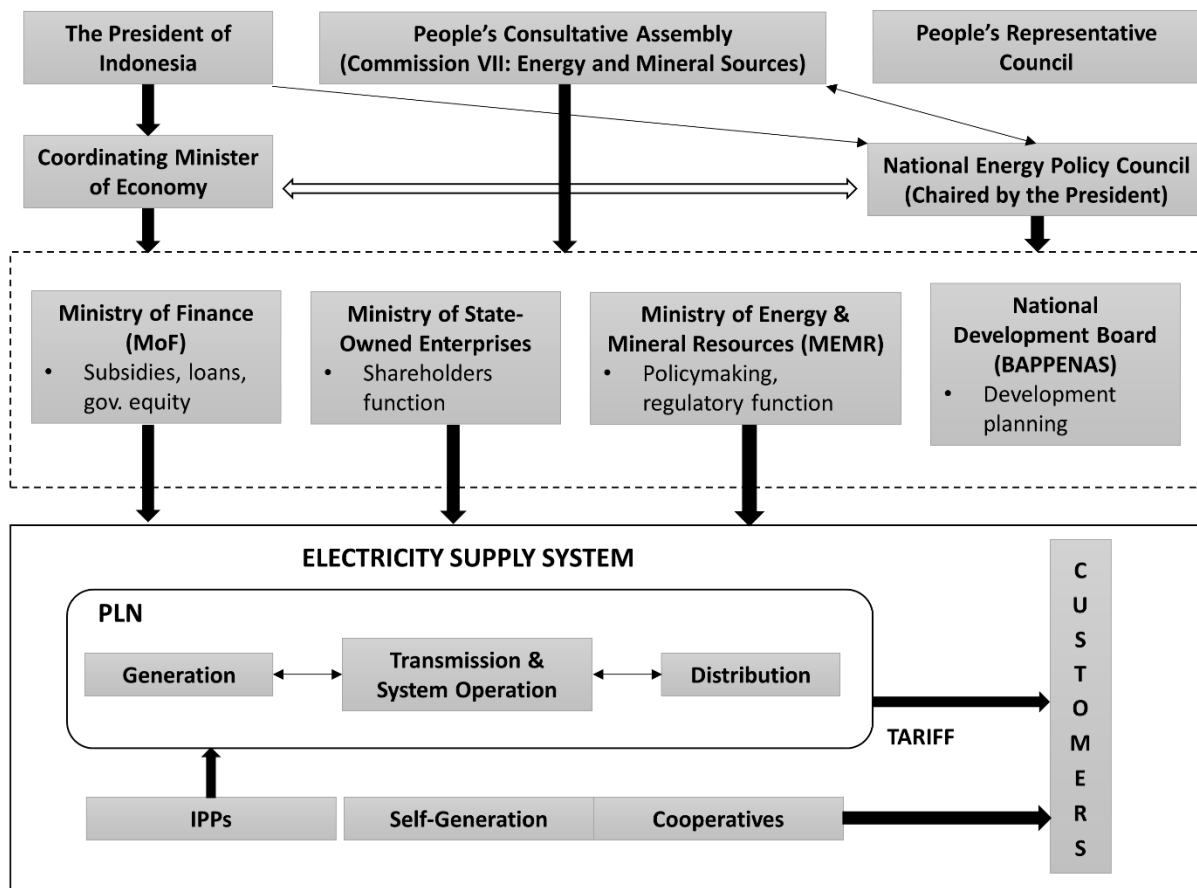


Figure 3.1 Indonesian electricity governance regime (Derived from Purra et al., 2011)

Beginning in the 1980s, a series of reform efforts – each met with varying degrees of success – attempted to allow for greater private sector participation in the Indonesian electricity sector (Table 1). In 1985, under pressure from the World Bank and International Development Agency to allow private sector participation in the electricity generation market or risk non-renewal of existing loan agreements, the Government of Indonesia enacted Law No. 15 Concerning Electricity Business (Purra et al., 2011). Considered the first serious attempt to allow private sector participation in the country’s electricity sector, the law removed PLN’s monopoly on electricity generation by allowing independent power producers (IPPs) and electric cooperatives to sell electricity to PLN on terms set in power purchase agreements (PPAs). The issuance of electricity business permits to

the IPPs and the cooperatives, however, remained under the control of PLN (Purra et al. 2011; PwC 2016). Between 1985 and the mid-1990s, IPPs, largely backed by foreign funds, grew to account for 14% of total electricity generation (Purra et al. 2011).

Year	Measure	Status	Characteristics
1945	Indonesian Constitution – Article 33	Implemented	Authorizes and requires the government as the single provider of electricity for Indonesia state
1985	Electricity Law No. 15/1985	Replaced by Law 20/2002; reinstated in 2004; replaced by Law No. 30/2009	GoI is responsible for regulating the electricity sector through the MEMR and the DGEEU. Allows private companies to participate in electricity generation. PLN is single buyer of electricity and controls both transmission and distribution functions
1995	Small Power Producers Scheme (PSKSK)	Implemented	Scheme available to small power producers up to 30MW per project for the Java-Bali region and up to 15MW per project for regions outside the Java-Bali system.
2002	Electricity Law No. 20/2002	Annulled in 2004	Established a competitive electricity market by restructuring and unbundling the PLN, mechanism for adjusting electricity tariffs, rationalized mechanism for power purchase for the private sector and established a regulatory mechanism for the sector.
2002	MEMR Decree No. 1122/K/30/MEM on Small-Scale Power Purchase Agreement	Implemented	Requires PLN to purchase electricity generated from renewable energy sources by non-PLN producers for projects of up to 1 MW capacity. Institutions eligible to participate are cooperatives, and private and government companies.
2006	MEMR Decree No. 2/2006 on Medium Scale Power Generation using Renewable Energy		Obliges PLN to purchase electricity generated from renewable energy from facilities with a capacity $1 \text{ MW} < \text{Cap} < 10 \text{ MW}$:

2009	Electricity Law No. 30/2009	Implemented	Partial liberalization of the electricity sector to increase generation capacity and reduce capacity deficiencies. Risk-sharing between the state and private Investors
2010	Presidential Decree No. 4	Implemented	2nd Fast-Track Program (FTII) to add 10 000 MW capacity. Aim to increase generation capacity, increase use of RE, and increase participation by IPPs.
2013	MEMR Regulation No. 17/2013	Annulled in 2014	Introduces solar auction program in Indonesia. PLN obliged to purchase electricity generated from solar PV projects on the basis of 20-year Power Purchase Agreements (PPAs).
2016	MEMR Regulation No. 19/2016 on Power Purchase from Solar Photovoltaic Plants by PT PLN (Persero)	Replaced by Reg. No 12/2017	Feed-in Tariff (FiT) policy introduced in July 2016 after the Reg. 17/2013 ruled unconstitutional by the Supreme Court. Targets development of 250 MW of PV capacity in 22 provinces. FiTs are granted for period of 20 years in the range of USD 0.145-0.25/kWh and vary by regions
2017	MEMR Regulation No. 12/2017 on the Utilization of Renewable Energy Resources for Electricity Supply	Implemented	Covers power purchase from all existing renewable energy (RE) types such as solar PV, wind, hydropower, biomass, biogas, municipal waste, and geothermal. It uses the regional PLN's (National Utility Company) main cost electricity supply (biaya penyediaan pokok/BPP) as its new reference price and obligates PLN to purchase power from RE plants.

Table 3.1 Chronology of legislation and regulations and implications for private sector participation

As the majority of PPAs had been negotiated to be paid in US dollars, however, the spectacular devaluation of the Indonesian Rupiah during the 1997 Asian Financial Crisis forced PLN to suspend all existing contracts with independent power producers, bringing the privatization experiment to an abrupt halt. While the majority of contracts were ultimately honored following a renegotiation of financing terms, the crisis ushered a second wave of reforms in the electricity sector, this time in exchange for International Monetary Fund support. In 2002, the Government of Indonesia enacted Law 20/2002 which replaced the 1985 law and allowed even greater private

sector participation in the electricity sector. Under the law, PLN's monopoly on generation, transmission and distribution markets was to be unbundled, with generation now based on full competition while transmission and distribution would remain in the hands of the PLN. The 2002 law sparked fears that electricity prices would rise if state control were relinquished, and resulted in significant controversy in the media and debates in the House of Representatives (DPR) (Butt and Lindsey 2009). Unsurprisingly, the 2002 law was strongly opposed by PLN and its labor union, and in 2004 the Constitutional Court revoked the law on the grounds that opening the electricity market to competition and unbundling PLN's monopoly on generation, transmission and distribution contravened Constitutional provisions requiring public goods to remain under the exclusive control of the state. While the constitutional provision relating to state control of public goods (Article 33(2)) does not explicitly mention electricity, the court's decision to define electricity as a public good has played a significant role in impeding the introduction of competition and independent regulatory measures in Indonesia's electricity market (Butt and Lindsey 2009; Purra et al. 2011).

The court's ruling resulted in the reinstatement of Law 15/1985 until the 2002 law was replaced in 2009. The 2009 law, which is still in effect, worked to decentralize control over tariff-setting by allowing provincial governments to issue regulations on electricity and permits for the supply of electricity to independent power producers and to set regional electricity tariffs. However, the law also confirms the state's control over electricity supply and PLN's role as the sole electricity provider. While promoting a greater scope for private enterprises, cooperatives, and self-reliant community institutions to participate in the electricity supply business, the 2009 law upholds PLN's dominate position, giving the state-owned entity responsibility for much of Indonesia's power generation and exclusive powers over the transmission, distribution and supply of electricity

to the public. Privately owned businesses may be granted a license to provide electricity for public use to, but only in situations in which PLN refuses to undertake supply, in effect maintaining PLN's priority rights over the electricity supply business throughout Indonesia (Purra et al. 2011; PwC 2016).

3.4.2 Indonesia's evolving renewable energy landscape

The case for renewable energy in Indonesia has been framed around a disparate mix of factors, ranging from domestic concerns over rapidly diminishing coal reserves and the environmental impacts of coal extraction and combustion (OECD/IEA, 2015; PwC, 2017), to compliance with international climate agreements (Widodo, 2015). In addition to bolstering energy security, an increase in renewable energy generation capacity has been promoted as a means of increasing Indonesia's electrification rate, which – with over 10% of the population lacking access to electricity – is currently the lowest in Southeast Asia (Chelminski, 2016; IRENA, 2017c; Schmidt et al., 2013). While almost two decades of sustained economic growth have helped boost the national electrification rate from 43% in 1995 to over 84% in 2015 (ADB, 2016), much of this growth has been uneven, and electrification rates, particularly in the country's eastern islands, remain at 50% or lower (ADB, 2016).

In response to these energy challenges, the Government of Indonesia has announced numerous electrification and renewable energy targets, the most ambitious of which include an increase in the national electrification rate from 84% to 100% by 2020 and an elevenfold increase in renewable energy use by 2025 (IEA, 2016; IRENA, 2017c). Despite being home to the world's largest geothermal resource base (ADB, 2015), analysts predict solar PV will comprise over 50% of Indonesia's installed renewable energy capacity by 2025 (ASEAN Centre for Energy, 2017). Given the nation's archipelagic geography, off-grid renewable technologies such as solar PV that

produce electricity with a very low climate impact have been advocated as an effective means of addressing the low-electrification challenge (Miller & Hope, 2000; Schmidt et al., 2013). Echoing experiences in other contexts (Sergi et al., 2018), however, development of solar PV in many of Indonesia's outer islands has been sluggish, with much of the investment in renewable directed at other large-scale centralized technologies such as geothermal and hydro (IRENA, 2017c).

Indonesia is one of the many so-called 'emerging markets' to have implicitly and explicitly embraced the rhetoric of the 'green economy' (Brockington, 2012), particularly with regard to calls for increased private sector participation in the renewable energy sector as a means of improve energy security while promoting economic growth and reducing the greenhouse gas emissions intensity of the country's power mix (IEA, 2016). According to the state-owned utility's 2016 Electricity Supply Business Plan, meeting the Indonesian government's electrification target will require the construction of 80.5 GW of new power plants, 45.7 GW (56.8%) of which will be undertaken by private developers and will require USD 78.2 billion in private investment (PwC, 2016). Wind and solar PV, which combined account for 8.2 GW of the 45 GW of projected renewable energy generation required to meet the Indonesian government target of 23% new and renewable energy by 2025³, will likely be exclusively dependent on private-sector participation (PwC, 2016).

Despite calls for a significant increase in private sector participation, Indonesia has long struggled to attract private investment (PwC, 2016). In addition to active resistance to private sector

³ Under Indonesian Law No. 30/2007 on Energy, a 'new' energy source is 'an energy source that could be produced using new technology, either non-renewable or renewable, including nuclear, hydrogen, coal bed methane, liquefied coal, and gasified coal' (Republic of Indonesia, 2007). Under Law No. 30/2007, renewable energy sources are energy sources which are 'produced from the sustainable energy resources if managed well, among others earth heat, wind, bio-energy, sun ray, water flow and waterfall, as well as the movement and difference of sea layer temperature' (Republic of Indonesia, 2007).

participation from the incumbent state-owned utility PLN, commonly cited barriers to investment include the complex regulatory landscape and persistent policy uncertainty, high upfront costs, project development and technical risks, land acquisition issues, local ownership and content requirements, limited information and awareness, and limited access to transmission and distribution infrastructure (ASEAN Centre for Energy, 2016a; Budiman, Das, Mohammad, Tan, & Tonby, 2014; Chelminski, 2016; Marquardt, 2014; OECD/IEA, 2015). From 2014 to 2015, new investment in renewable energy generation in Indonesia experienced a 100% decline (Frankfurt School-UNEP Centre/BNEF, 2016), and as of 2015, Indonesia had a mere 9 MW of solar PV installed – the lowest among ASEAN member states (ASEAN Centre for Energy, 2016b).

Since 2015, however, the Indonesian solar electricity sector has witnessed unprecedented attention from international investors and developers. Once completed, the 14 new projects announced in 2017 will increase existing installed capacity from 9 MW to over 240 MW (SolarPlaza, 2017). In part, the spike in foreign investment reflects a broader geographic shift in renewable energy finance. As the initial boom in renewable resources in established markets in the Global North has slowed, renewable energy project developers and potential financiers have shifted their attention to so-called ‘emerging markets’ in the Global South. In a ‘world awash with capital’ (Bain & Company, Inc., 2012), low electrification rates, increases in energy demand driven by rapid economic growth, national and international greenhouse gas reduction commitments, and availability of cheap land and labor have made many countries in the Global South – including Indonesia – lucrative sites for the absorption of abundant finance capital (Donovan, 2015; SolarPlaza, 2017).

The rapid surge in foreign investment has coincided with a series of regulatory changes under the MEMR, each of which has attempted to shape the conditions for domestic and foreign private

sector engagement in the country’s solar PV sector (Table 3.1). Prior to 2013, solar PV development in Indonesia was only possible through government project tenders and a small number of auctions by PLN (Susanto, 2016). In 2013, MEMR Regulation No. 17/2013 introduced the first solar auction program in Indonesia covering 140 MW in 80 locations. While the regulation offered favorable tariffs to developers, these tariffs and a lack of support for local industry were opposed by PLN and local manufacturing interests, and the regulation was ultimately rescinded (Allen & Overy, 2016; Aziz & Nabila, 2016). As a result, only two projects were implemented under the regulation, both by state-owned companies. The largest of the two, a 5 MW solar farm built by state-owned company PT. LEN Industri in Kupang, East Nusa Tenggara, remains the largest grid-connected solar PV project in Indonesia to date (Kosasih, 2016). However, the project has been plagued by grid capacity issues resulting in significant curtailment of output since starting operations in December 2015 (Interview, Developer 1, October 7, 2017).

MEMR Reg. 19/2016		MEMR Reg. 12/2017		MEMR Reg. 50/2017	
Procurement Method and Criteria	Tariff Mechanism	Procurement Method and Criteria	Tariff Mechanism	Procurement Method and Criteria	Tariff Mechanism
Direct appointment for electricity purchased by PLN Approval for electricity purchase price from PLN	Feed-in tariff is stipulated based on capacity quota per region	Capacity quota tender for at least 15MW capacity Scattered location for power plant installation	If local generation cost > average national generation cost, up to 85% of local generation cost If local generation cost ≤ average national generation cost, equal to local generation cost	Direct selection with capacity quota Build, own, operate, transfer (BOOT) project	If local generation cost > average national generation cost, up to 85% of local generation cost If local generation cost ≤ average national generation cost, business-to-business

					Tariff requires MEMR approval
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Table 3.2 Summary of recent Ministry of Mineral and Energy Resources (MEMR) solar PV regulatory changes

In 2016, under MEMR Regulation 19/2016, the Government of Indonesia introduced a feed-in tariff to support the development of at least 5,000 MW of new solar projects (Potheary, 2016). While the regulation contained a number of concessions to developers – a streamlined process for project approval, favorable tariffs, and the security of a 20-year power purchase agreement (Allen & Overy, 2016) – the regulation also included limitations on project scale and foreign ownership, both of which were deemed less favorable to international developers (Interview, Directorate General of New Renewable Energy and Energy Conservation representative (EBTKE), Oct 7 2017).

A series of abrupt MEMR leadership changes in 2016 (Arifianto, 2016; Fabi, 2016) marked a significant a shift away from state support of renewable energy toward an approach focused on making renewable power tariffs more competitive, not only in the context of the global solar PV sector, but also in relation to all energy resources, including coal (Interview, ASEAN Center for Renewable Energy, May 1 2017). This sentiment is reflected in a statement by newly-appointed Minister for Energy and Mineral Resources Ignasius Jonan, that “[t]he government supports energy fuel mix in a bid to address climate change issues. However, the price must be affordable” (Oktara, 2016). In early 2017, the feed-in-tariff under Reg. 19/2016 was abandoned in favor of an approach that regulates tariffs renewable energy developers can charge to PLN based on local and national existing average cost of generation. Inspired by record-low tariffs in the United Arab Emirates (Interview, EBTKE representative, Oct. 7, 2017), Reg. 12/2017 mandates that the price payable by PLN for electricity from new solar PV projects cannot exceed 85% of the existing

average cost of generation on the relevant local grid (Fig. 3.1). While the geographically differentiated tariff structure appears intended to incentivize the development of renewable energy resources in parts of the country characterized by high energy costs and low electrification rates, the regulation also put solar in direct competition with coal, making solar development potentially unviable in locations with readily available low-cost energy, whatever the source (Baker McKenzie, 2017).

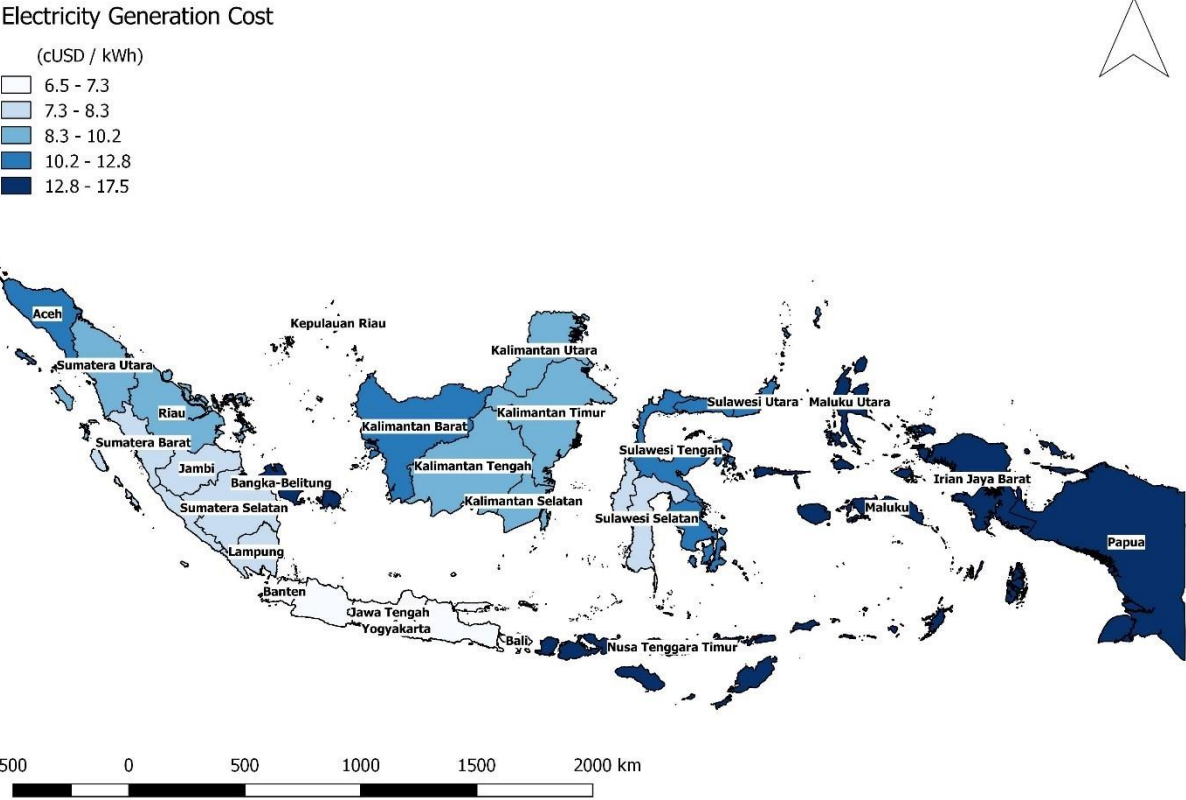


Figure 3.2 Geography of tariffs under MEMR Reg. 12/2017 (Data source: MEMR 2017)

Reg. 12/2017 represents the first attempt to drive private renewable energy investment without a state-based support mechanism. While Reg. 19/2016 offered subsidized tariffs and awarded capacity to developers on a ‘first-come first-served’ basis’, Reg. 12/2017 required capacity quota packages to be awarded through a competitive reverse auction mechanism, forcing solar PV

developers to compete on price for the award of allocated capacity (Baker McKenzie, 2017). In addition, Reg. 12/2017 limited subsidies in favor of a range of tax cuts including tax holidays, tax allowances including corporate income tax reductions and accelerated depreciation, and import duty and VAT exemption (Tapparan, 2017). The regulation also included restrictions that limit foreign ownership to 49% for projects between 1 and 10 MW while allowing 95% foreign ownership for projects over 10 MW.

In contrast to Reg. 19/2016, Reg. 12/2017 received a mostly negative reception from industry stakeholders (Soraya, Bernarto, Hasan, & Nathania, 2017). This response was attributed to MEMR's failure to consult industry (Interview, US government official, May 1, 2017), and the strict limitations on tariffs that were viewed as impediments to investment (Interview EBTKE October 7, 2017.) After being amended in July 2017, Reg. 12/2017 was eventually revoked and replaced by MEMR Reg. 50/2017. Reg. 50/2017 retains many features of Reg. 12/2017 yet introduced a requirement for developers to transfer ownership of the project facility to PLN upon completion of the contract. While Reg. 12/2017 gave developers the option of retaining ownership of the asset upon contract completion, in the absence of any additional state support, Reg. 50/2017 will force developers to either lower costs or raise tariffs to recover costs over the project period prior to transfer. Given the limits on tariffs, it is likely this stipulation will further discourage private investment (Interview, Developer 1, September 21, 2017).

While Reg 12/2017 motivated some investor and developer interest in areas of Indonesia with high local generation costs and low electrification rates (Singgih, 2017a; Tsagas, 2017b), overwhelmingly the emphasis has been on large-scale development in parts of the country with existing access to relatively affordable electricity, particularly the islands of Sumatra and Sulawesi (Table 3.3). In early 2017, PLN signed agreements for the development of 5 solar power plants

with a combined installed capacity of 30 MW in Sulawesi and eastern Indonesia (RambuEnergy, 2017). In March 2017, French multinational electric utility company ENGIE Group signed three partnership agreements to co-finance and develop microgrid and other renewable energy projects in various parts of Indonesia for a total value of USD 1.25 billion over five years, including a 140MW solar PV installation in southern Sumatra (ENGIE, 2017a; Kenning, 2017). In May 2017, PLN opened a tender process for 168MW of solar power plants across Sumatera, attracting interest from over 100 developers (Singgih, 2017b). In August 2017, Singapore-based investor and developer Equis signed a series of agreements with PLN, including three 7 MW sites on the island of Lombok and a single 21 MW site in North Sulawesi, the latter of which will be the largest solar installation in the country upon completion (Equis Energy, 2017). Adding Equis’s plans to develop an additional 337 MW of solar PV projects (Equis Energy, 2017), Indonesia appears set to dwarf the 9 MW of installed solar PV capacity as of 2015 (MEMR, 2016).

SIZE	PROJECT DEVELOPER	DEVELOPER ORIGIN	PROVINCE	SOURCE
1 MW	PT Global Karya Mandiri	Indonesia	East Nusa Tenggara	(Tempo, 2016)
2 MW	PT Indo Solusi Utama	Indonesia	East Nusa Tenggara	(Tempo, 2016)
5 MW	PT Infrastruktur Terbarukan Adhiguna	Indonesia	West Nusa Tenggara	(Publicover, 2017)
5 MW	PT Infrastruktur Terbarukan Cemerlang	Indonesia	West Nusa Tenggara	(Publicover, 2017)
5 MW	PT Infrastruktur Terbarukan Buana	Indonesia	West Nusa Tenggara	(Publicover, 2017)
5 MW	PT Delapan Menit Energi	Indonesia	West Nusa Tenggara	(Publicover, 2017)
7 MW	Equis Energy	Singapore	West Nusa Tenggara	(Equis Energy, 2017)
7 MW	Equis Energy	Singapore	West Nusa Tenggara	(Equis Energy, 2017)
7 MW	Equis Energy	Singapore	West Nusa Tenggara	(Equis Energy, 2017)
10 MW	PT Quantum Energy	Indonesia	Gorontalo	(Publicover, 2017)
10 MW	ENGIE / PT Arya Watala Capital	France / Indonesia	East Nusa Tenggara	(ENGIE, 2017a)

15 MW	PT Infrastruktur Terbarukan Lestari	Indonesia	North Sulawesi	(Publicover, 2017)
21 MW	Equis Energy	Singapore	North Sulawesi	(Equis Energy, 2017)
140 MW	ENGIE / PT Sugar Group	France / Indonesia	Lampung	(ENGIE, 2017a)

Table 3.3 Solar PV projects announced since January 2016

The most striking feature of these announcements is the increase in the size of the proposed projects relative to what has been proven feasible in the country to date. While the preference for large-scale projects reflects a global trend in which the number and size of large-scale plants has grown rapidly over the past decade (REN21, 2017b), the proposed Equis project in Sulawesi will be more than four times larger than the country’s largest project, while ENGIE’s proposal for a 140 MW installation in Lampung represents a staggering 28-fold increase. In addition, the announcements mark a move away from simple state-owned company structures towards structures that are increasingly complex and opaque.

According to the company’s website, ENGIE is currently the largest independent electricity producer in the world, with a power generation capacity of 115.3 gigawatts and operations in over 60 countries (ENGIE, 2018). As a public company, ENGIE’s ownership structure is split across a number of entities, including the French State (24.1%), employee shareholders (2.69%), French public sector financial institution Groupe CDC (1.88%), and French insurance corporation CNP Assurances (1.75%) (ENGIE, 2017b). 67.6% of ENGIE shares are publicly held by a mix of institutional and individual investors (ENGIE, 2017b). Of these institutional investors, privately owned investment manager Capital Research and Management Company holds the largest share, with 4.21% of total shares (Morningstar, 2018). Wealth funds are another major shareholder, with Virginia’s CollegeAmerica, the largest 529 college savings plan in the United States, holding a 3.73% share (American Funds, 2018; Morningstar, 2018).

The other major developer operating in Indonesia, Equis Energy, is a subsidiary of investment firm Equis Fund Group which specializes in growth capital investment across a range of sectors including infrastructure, energy transmission and distribution, waste and water treatment, and renewable and conventional power generation (Bloomberg, 2018). Based in Singapore, Equis Energy is the largest renewable energy independent power producer in the Asia-Pacific region, with over 180 renewable energy assets across Australia, Japan, India, Indonesia, the Philippines, and Thailand (Equis / GIP, 2017). While ENGIE's status as a publicly listed entity allows for some transparency in terms of underlying ownership structure, as a private equity firm, Equis's ownership structure is even more opaque. In October 2017, a group of private equity investors including New York-based Global Infrastructure Partners (GIP), China's sovereign wealth fund CIC Capital, and the Canadian Public Sector Pension Investment Board struck a deal to buy Equis Energy – a portfolio of Asian and Australian wind and solar energy projects – from Equis for USD 3.7bn (Weinland & Wildau, 2017). According to a joint statement by Equis and GIP, '[t]he transaction is the largest renewable energy generation acquisition in history' (Equis / GIP, 2017).

As these examples demonstrate, the rapid surge in foreign investment in the Indonesian solar PV sector has been accompanied by a massive increase in the scale of proposed projects, as well as shift toward more complex and opaque corporate ownership structures comprised of a growing share of private financial institutions. The following section discusses the specific role of finance in shaping the emerging geography of Indonesia's solar PV sector, and examines the implications of the country's increasingly financialized energy transition, both in terms of immediate distributional outcomes and for Indonesia's energy transition objectives more broadly.

3.5 Implications for Indonesia's energy transition

As the recent solar PV announcements indicate, foreign investment may prove successful in increasing Indonesia's solar PV capacity. However, while the geographically differentiated tariff structures under Reg. 12/2017 and Reg. 50/2017 aim to encourage development in remote locations in which electrification rates are significantly lower than the national average (Baker McKenzie, 2017), these regulations have resulted in larger scale generation in sites with existing infrastructure and electricity access. While the correlation between large-scale centralized projects and foreign investors may be attributable in part to foreign ownership restrictions under Reg. 50/2017, the increase in project scale can also be explained by the complexity and opacity of ownership and financial structures underpinning the recent surge of private foreign investment, which have brought a shift from investment decisions predicated on social and environmental need in favor of the risk-return logic of finance.

According to the risk-return logic of finance, higher risk is associated with greater probability of higher return, while lower risk with a greater probability of smaller return (Investopedia, 2018). Whether an investor will pursue a high-risk/high-yield or a low-risk/low-yield investment depends on the amount and type of risk that an organization is willing to take to meet their strategic objectives. While states and development finance institutions have traditionally been willing to accept higher levels of risk in the pursuit of social or environmental objectives, private finance tolerance for risk is often constrained by the short-term demands of private investors (Dickinson, 2008). Institutional investors, such as pension funds and insurance companies, typically seek attractive, low-risk, long-term investment performance as means of meeting their long-term cashflow requirements (Nelson & Pierpont, 2013). In Indonesia – and globally – the shift away from development finance institutions toward institutional investors has thus become a significant

factor in determining whether a particular project at a particular scale will be financed (Donovan, 2015; Frankfurt School-UNEP Centre/BNEF, 2017)).

While project financing costs and associated economies of scale lead investors toward larger-scale projects or bundles of projects (Tan, 2017), investor willingness to accept risk also informs decisions around the location of renewable energy generation. By increasing project size, developers are able, at least in theory, to reduce fixed costs such as legal and permitting fees relative to variable cost, and thus reduce the overall cost of the project measured in terms of cost per unit of output and maximize returns. As developing projects in remote and underdeveloped locations introduces additional project risk (Baker McKenzie, 2017, p. 11), institutional investors will aim to minimize this risk by supporting projects in locations with existing infrastructure backed by a creditworthy purchaser. As such, despite the profit constraints imposed through restrictions of maximum tariffs, developers prefer to enter into contracts with large buyers such as utilities than engage with the high perceived risk associated with smaller off-grid projects (Interview, Developer 1, June 15, 2017). Lastly, due to the variable nature of solar PV generation, developers typically prefer to insert solar PV into existing grids where it can be supplemented by coal-fired and diesel generation as a means of managing intermittency at low cost (Interview, Developer 1, 9/21/2017).

The articulation between recent regulatory developments and the logic of finance has produced direct geographic implications in terms of the scale, location, and broader function of new solar PV projects. By pegging the feed-in-tariff to the cost of local generation, MEMR Reg 12/2017 forces developers who wish to pursue projects in lower-cost regions of Indonesia to do so at significant scale in order to access economies of scale and bring costs under the regulated tariff (Developer email correspondence, June 5, 2017). The project proposals by Equis and ENGIE, 21

MW and 140 MW, respectively, both illustrate this point. In addition, the competitive reverse auction structure proposed under Reg. 12/2017 incentivizes developers to find the lowest cost means of addressing the variability associated with solar PV. A recently announced 500 MW project in eastern Indonesia will combine 250 MW of solar PV with 250MW of diesel generation (Tsagas, 2017a). This decision reflects the higher cost of low-emissions battery storage relative to emissions-intensive diesel generation but may result in a net increase in greenhouse gas emissions. Finally, in the absence of measures to deal with intermittency, the output from solar PV generating facilities may have to be curtailed, as was the case with the 5MW Kupang project that was forced to limit output for several years following its commercial operational date until the completion of a large reciprocating gas engine power plant (Susanto, 2017).

While the lack of investment in distributed solar PV generation limits opportunities to improve energy access, the resource requirements of large scale projects present another set of challenges. Although large-scale systems provide cheaper electricity when measured in narrow terms of cents per kilowatt-hour, larger-scale projects have considerable land and capital requirements, require significant additional investment in transmission infrastructure, and often generate serious negative social and environmental impacts (R. R. Hernandez et al., 2014). In addition, large-scale generation misses the main advantage of solar PV technology, which is the potential to be broadly distributed and thus avoid the socio-ecological disruption and financial cost associated with transmission and distribution infrastructure (Frantál et al., 2014). Finally, the emphasis on large-scale projects, particularly when dominated by foreign entities, provides little opportunity for local capacity building or for the process to be fine-tuned to cater to local conditions (Interview, GIZ representative, September 23, 2016).

The land intensity of the recently announced projects raises other concerns, which are amplified by the complexities of Indonesia's highly-fragmented tenure system (J. F. McCarthy, Vel, & Afiff, 2012). Larger projects require partnerships with larger local interests with access to sufficient land to site the facility. ENGIE's announcement to develop a 140 MW solar park in south Sumatra involved a partnership with Indonesian sugar conglomerate PT Sugar Group, which has significant land holdings in Lampung province, the site of the proposed project (Interview, Developer 1, June 5, 2017). Developers of future projects will either be forced to engage with large domestic corporate interests with access to sufficient land holdings, or otherwise engage in land accumulation from smallholders.

Given Indonesia's archipelagic geography, off-grid renewable technologies such as solar PV that produce electricity with a very low climate impact could be an effective means of addressing the low-electrification challenge, while also reducing reliance on expensive emissions-intensive diesel generation (Gunningham, 2013; Miller & Hope, 2000; Schmidt et al., 2013). However, as reflected in the recent solar PV announcements, high perceptions of risk and limited opportunities for developers to exploit economies of scale from distributed energy projects have produced a geography of renewable energy generation dominated by large-scale centralized projects that may boost overall solar PV capacity, but do little to address the needs of the approximately 25 million Indonesians who currently lack access to affordable electricity.

3.6 Conclusion

This chapter has examined the emerging geographies of renewable energy generation resulting from the recent influx of foreign investment into Indonesia's solar PV sector. While foreign investment may prove successful in increasing the country's solar PV capacity, the risk-return logic of finance, mediated by the differing risk appetites of different investor types, appears to be

driving a particular geography of renewable energy generation characterized by large-scale projects in locations such as Sumatra and Sulawesi that typically already enjoy reliable access to electricity. The result – a major contradiction when viewed through the lens of Indonesia’s energy transition development objectives – is not only a flow of economic benefits out of the country and limited improvement in energy access for much of the country, but a missed opportunity in terms of maximizing the socially and politically transformative potential a broader energy transition may entail.

These findings support a growing body of research on the institutional barriers to distributed energy generation in the global South (Sergi et al., 2018; Siddharth Saree & Sunila Kale, 2018), while pointing to serious limitations of the increasingly dominant model of private sector-led energy transitions. According to one international financier, private finance may not be the best way to finance small projects (Interview, International financier, September 28, 2017). As such, Indonesia’s approach of trying to achieve rural electrification through private international finance, as opposed to state or development finance institutions, is unlikely to achieve results beyond a simple increase in installed capacity. While Indonesia’s solar PV sector is very much in its infancy, the geographical implications of the Indonesian government’s reliance on private investment to meet its energy and energy transition objectives suggest Indonesia has a way to go if it is to bring about a “radical, systemic and managed change towards ‘more sustainable’ or ‘more effective’ patterns of provision and use of energy” (Rutherford & Coutard, 2014, p. 1354).

CHAPTER 4 RESCALING ENERGY GOVERNANCE AND THE DEMOCRATIZING POTENTIAL OF ‘COMMUNITY CHOICE’

Abstract

Community Choice Aggregation (CCA) – an emerging electricity supply model that allows residents and businesses to purchase electricity from local government agencies instead of utilities – is projected to account for 60% of Californian customers currently served by independently-owned utilities by 2020. The rise of CCAs in California has been closely aligned with the concept of energy democracy, which integrates concerns over social and environmental justice with a transition to a decentralized distributed renewable energy. Through analysis of policy documents, electricity procurement data, and interviews with CCA representatives and policymakers, this chapter examines the relationship between energy democracy objectives, policies, and outcomes in the context of California’s three most established CCAs. Rather than promoting a shift to a decentralized distributed energy system, the articulation between local demand for renewable energy and a financialized renewable energy sector has perpetuated the dominance for large-scale, capital- and land-intensive renewable energy technologies that mask the democratizing potential of energy transition. This study is intended to highlight the limits of energy transition as form of radical and systemic change, while clarifying the extent to which localized renewable energy initiatives can influence the democratizing potential of future energy transitions.

4.1 Introduction

The United States is undergoing dramatic changes in energy generation and governance, with different trends emerging in different states (Boyd & Carlson, 2016; Outka, 2016). Under the banner of ‘energy democracy’, an array of climate justice activists, trade unions, academics, and political parties have sought to reconfigure the prevailing centralized fossil fuel-based model of energy governance through a range of project-level, municipal, regional and national experiments (Burke & Stephens, 2017). Referred to variously as a concept (Farrell, 2014), an agenda (Burke & Stephens, 2018), and a movement (Fairchild & Weinrub, 2017), energy democracy typically concerns the integration of social justice, economic equity, and renewable energy transitions. Viewing decentralized energy-related decision-making and distributed renewable energy generation as key steps in facilitating a more democratic model of energy governance (Becker & Naumann, 2017; Farrell, 2016; Szulecki, 2018), energy democracy entails not only a shift to alternative energy sources, but a transformation of energy system predicated on local ownership and control, participatory governance, and decentralized distributed renewable energy resources (Burke & Stephens, 2017; Farrell, 2014).

In California, the energy democracy movement has played a key role in the recent fragmentation of the long-dominant utility sector in favor of smaller, county or municipally-based quasi-utilities asserting local control over energy procurement and delivery. Known as Community Choice Aggregation, or CCA, the model places decisions around energy procurement in the hands of the local community, and is viewed by a growing number of local governments and community-based organizations as an attractive – and more democratic – alternative to the utility model (CalCCA, 2018; LEAN, 2017). The CCA model allows cities and counties, or collections of cities and counties, to combine the electricity demand of customers in their jurisdictions and procure electricity on their behalf, either through their own generation or through the market (Welton,

2017). Localized control over energy procurement is intended to better reflect the needs of the local community, as decision-making power is transferred to local elected officials beholden to the interests of their constituents rather than independently-owned utility (IOU) shareholders (Gattaciececa, DeShazo, & Trumbull, 2017). CCA allows local governments to set their own renewable energy targets and thus potentially deliver a greater share of renewable energy and energy-related services to their customers than would be provided by a traditional utility. In California CCAs are projected to account for 60% of Californian customers currently served by independently-owned utilities by 2020 (CCP, 2016). Once operational, East Bay Community Energy and the Los Angeles region Clean Power Alliance are projected to each serve approximately 1.5 million customers (County of Los Angeles, 2016).

According to CCA advocate group Clean Power Exchange, “Community Choice fosters *Energy Democracy* by empowering community stakeholders to weigh in on energy issues that affect their lives” (Clean Power Exchange, 2018). The benefits commonly associated with CCA – broadly characterized as a redistribution of private to public benefits by way of a community-controlled and/or operated distributed energy system derived from renewable sources – reflect many of those commonly associated with energy democracy. The CCA movement thus represents an opportunity to examine the opportunities and constraints of energy democracy in practice. To date, however, the extent to which CCA control over energy procurement actually produces a more democratic alternative to the utility model of energy governance has not been subject to rigorous analysis. Building on the work of Burke & Stephens (2017) on the links between goals and policy instruments in the context of the energy democracy movement, this chapter critically evaluates the relationship between CCAs and energy democracy, broadly defined. Drawing connections between local control over energy procurement and energy democracy, I examine the energy and

energy-related policies employed by California's three most established CCAs to illustrate different ways in which energy democracy is employed, and the different forms of energy democracy the CCA movement may produce. Rather than rank specific CCA policy instruments or policy mixes along a continuum of weak to strong democracy (Hoffman & High-Pippert, 2005), I argue that different energy procurement strategies reflect distinctive forms of energy democracy, each involving different degrees of public participation, ownership, control, and, given the financialized nature of the energy transition, distribution of risk.

Following an overview of the methods and limitations of the study (Section 2), Section 3 reviews the literature on energy democracy and its relation to emergence of community choice, with an emphasis on California. Section 4 presents an analysis of the energy procurement strategies and energy-related policies employed by California's three most-established CCAs. In addition to evaluating the performance of the three CCAs' procurement strategies in promoting energy democracy, this analysis highlights broader structural factors shaping CCA procurement strategies, including the limitations to achieving more ambitious energy democracy outcomes through localized energy governance in the context of California's financialized renewable energy sector. Section 5 concludes with a discussion of coming opportunities and challenges that may further influence the democratizing potential of the community choice movement.

4.2 Methods

This chapter draws on a range of sources including policy and media analysis, interviews with CCA representatives and policymakers, participant observation at CCA conferences and webinars, and analysis of utility and CCA electricity procurement data derived from the California Energy Commission's Power Content Label program. Due to reporting deadlines, detailed procurement analysis is limited to those CCAs that have formally submitted Power Content Label reports to the

California Energy Commission as of January 2017 – namely, Marin Clean Energy (MCE), Sonoma Clean Power (SCP), and Lancaster Choice Energy (LCE). While reliance on the Power Content Label reporting limits the breadth of the analysis, this historical data is considered a more accurate indicator of CCA procurement than forecasts contained in CCA integrated resource plans. Quantitative procurement data is supplemented with qualitative data obtained through a variety of policy documents, including California state legislation, California Public Utilities Commission (CPUC) decisions, CCA implementation and integrated resource plans, and interviews with CCA and utility representatives and local and state government officials.

The limited number of cases available for analysis represents a major limitation of this study. All three CCAs are at very different stages of development, with MCE, SCP and LCE established in 2010, 2014 and 2015, respectively. This not only makes it difficult to compare across CCAs, but also limits the potential for meaningful comparison with investor-owned and publicly-owned utilities, which, as well-established entities, vary greatly in their customer bases, broader political clout, and ability to negotiate favorable procurement contracts and finance arrangements. This study thus is intended as a preliminary assessment, providing a baseline analysis which can be built upon in future years as the presence of mature CCAs expands across the state and the nation.

4.3 Energy transition, energy democracy, and the rise of community choice

The term ‘energy transition’ can be broadly defined as the “radical, systemic and managed change towards ‘more sustainable’ or ‘more effective’ patterns of provision and use of energy” (Rutherford & Coutard, 2014, p. 1354). In recent years the study of energy transitions has witnessed a geographic turn (Bridge et al., 2013; Calvert, 2016), shifting from a focus on technological innovations driving change in socio-technical systems (Geels, 2004; Hughes, 1987)

toward a conception of energy transition as a ‘geographical process, involving the reconfiguration of current patterns and scales of economic and social activity’ (Bridge et al., 2013, p. 331).

Attention to the geographic unevenness of energy transitions has motivated analyses of the relationships between the configuration of energy systems and political power (Burke & Stephens, 2018; M. Huber, 2015), and inspired a growing literature on the concepts of ‘energy justice’ (Jenkins et al., 2016; Sovacool & Dworkin, 2015), ‘just transition’ (Newell & Mulvaney, 2013), and recent years, ‘energy democracy’ (Burke & Stephens, 2018; Szulecki, 2018). At its core, energy democracy emphasizes the integration of the transition to 100% renewable energy sources with the promotion of social justice and economic equity (Fairchild & Weinrub, 2017). Energy democracy advocates seek to advance democratization and participation through democratically-planned and public- and community-owned and -operated renewable energy systems that serve the public interest (Burke & Stephens, 2018). The integration of social and technical concerns underpinning the energy democracy movement translates into a preference for particular energy system configurations in which decentralized distributed renewable energy generation plays a vital role in driving systemic social and economic transformation (Burke & Stephens, 2018). In this way, energy democracy can be viewed as a response to prevailing modes of energy transition that, through reliance on centralized renewable energy generation, perpetuate patterns of exploitation and dispossession that have long characterized the fossil fuel economy (Weinrub & Giancattarino, 2015). Energy democracy advocates argue that a reconfiguration of the technical aspects of the energy system – shifting from a centralized, monopoly-controlled model toward decentralized distributed generation – will produce decentralized and distributed political power (Farrell, 2017). The transition from fossil fuels to renewable energy sources is thus viewed as a political

opportunity in which a more distributed energy system may allow for more distributed, and thus democratic, political power (Burke & Stephens, 2018; Szulecki, 2018).

Beyond the emphasis on distributed renewable energy generation, public participation, and local ownership and control, there exists considerable variation in the ways in which energy democracy has been defined (Farrell, 2017; Sweeney, 2014) and theorized (Burke & Stephens, 2018; Szulecki, 2018). Much in the way that democracy can be viewed as both a process and an outcome, Szulecki (2018) distinguishes between energy democracy as a process involving public participation, and energy democracy as an outcome reflected in community-owned and controlled distributed renewable energy systems. Within the energy democracy movement, there also exist a range of perspectives regarding the causal relations between social and technical aspects of energy systems and the potential benefits a democratic energy transition can produce. Invoking notions of technological determinism, Farrell (2017) conceptualizes the transition from ‘energy monopoly’ to ‘energy democracy’ as consisting of four ‘dimensions or ‘steps’: decentralization, distributed energy, local ownership, and disruptive technologies. Promoting these ‘four Ds of energy democracy’ has the potential to transfer energy system control to local residents and thus facilitates greater accumulation of energy system economic benefits at the local level (Farrell, 2017).

Offering an alternative and somewhat more radical approach, Sweeney (2014) frames energy democracy in terms of three key pillars: “(1) resisting the agenda of large energy corporations, (2) reclaiming to the public sphere parts of the energy economy that have been privatized or marketized, and (3) restructuring the global energy system in order to massively scale up renewable and low-carbon energy, aggressively implement energy conservation, ensure job creation and local wealth creation, and assert greater community and democratic control over the energy sector” (Sweeney, 2014, p. 218). The resist-reclaim-restructure framework views

neoliberal energy policy, particularly the privatization and marketization of the global energy sector, as a major barrier to broad-scale energy transition. Like Farrell, Sweeney argues publicly-owned decentralized distributed generation is essential to combatting the prevailing centralized energy regime, which, by virtue of the significant land and capital investment required for large-scale generation projects, severely constrains possibility for local ownership and control. In contrast to Farrell's technologically-determinist energy democracy framework, however, the resist-reclaim-restructure views democratization of the energy system as a necessary precondition for the scale of energy transition required to mitigate climate change (Sweeney, 2014). Similarly, Fairchild & Weinrub (2017) argue that an energy transition informed by an energy democracy agenda will not only involve a transition from fossil fuels to renewable energy resources, but also a result in a more equitable and socially-just distribution of energy-related benefits and costs. An energy transition informed by an energy democracy agenda thus entails a particular socio-technical reconfiguration of the prevailing energy system, one that, in addition to shifting to renewable energy resources, also entails a shift in political power toward workers, communities, and the public (Fairchild & Weinrub, 2017). In this way, public deliberation and participation inherent in energy democracy is viewed as a process through which broader social, political, and ecological change can be achieved, as opposed to an end in itself.

4.4.1 The Promise of Community Choice

For over a century, decisions regarding the source, location, and price of electricity procurement in the United States have rested in the hands of monopoly utilities. In the majority of states, utilities are subject to regulation by state public utilities commissions (PUCs): independent commissions staffed with experts and tasked with ensuring rates are just, reasonable, and nondiscriminatory in order to strike the appropriate balance between ratepayers and investors (Boyd & Carlson, 2016). The regulated monopoly structure, however, which provides no option for the majority of

electricity customers to procure electricity from alternative sources, has meant that these entities have faced limited market-based pressure to meet customer demands in terms of electricity rates and energy sources.

In recent years, growing demand for retail choice has driven a gradual fragmentation of the utility sector and an increasing number of smaller, county or municipally-based quasi-utilities asserting local control over energy procurement and delivery. Community choice aggregation (CCA), also known as community choice energy (CCE), is a model of energy supply whereby local governments combine their energy loads in order to purchase energy independently instead of from a utility. The CCA model affords local governments the authority to deliver a greater range of renewable energy to their customers than would be provided by a traditional utility. Control over energy procurement allows CCAs to pursue their own renewable energy targets, and to administer programs focused on energy efficiency, demand response, or incentives to encourage distributed energy generation (Welton, 2017). While typically emphasizing local control over electricity procurement, CCAs reflect a diverse range of community preferences and have been associated with a range of benefits including consumer rate savings, greenhouse gas reductions, generating revenue for local energy programs, utility reform, and job creation (Welton, 2017).

CCA currently exists by law in seven states— Illinois, Massachusetts, New York, New Jersey, Ohio, Rhode Island, and California—and a number of other states are currently considering enacting CCA laws. As of June 2017, there are five CCAs operating in California: Marin Clean Energy (est. 2010), serving Marin County, Napa County, and surrounding cities; Sonoma Clean Power (est. 2014), serving Sonoma and Mendocino Counties; Lancaster Choice Energy (est. 2015), serving the City of Lancaster in Los Angeles County; CleanPowerSF, (est. 2016), serving the City and County of San Francisco; and Peninsula Clean Energy (est. 2016), serving San Mateo

County and eligible cities within the county. A further 10 CCAs are anticipated to launch in 2017-18, and an additional 17 local governments are in the exploration phase (Fig. 4.1.1).

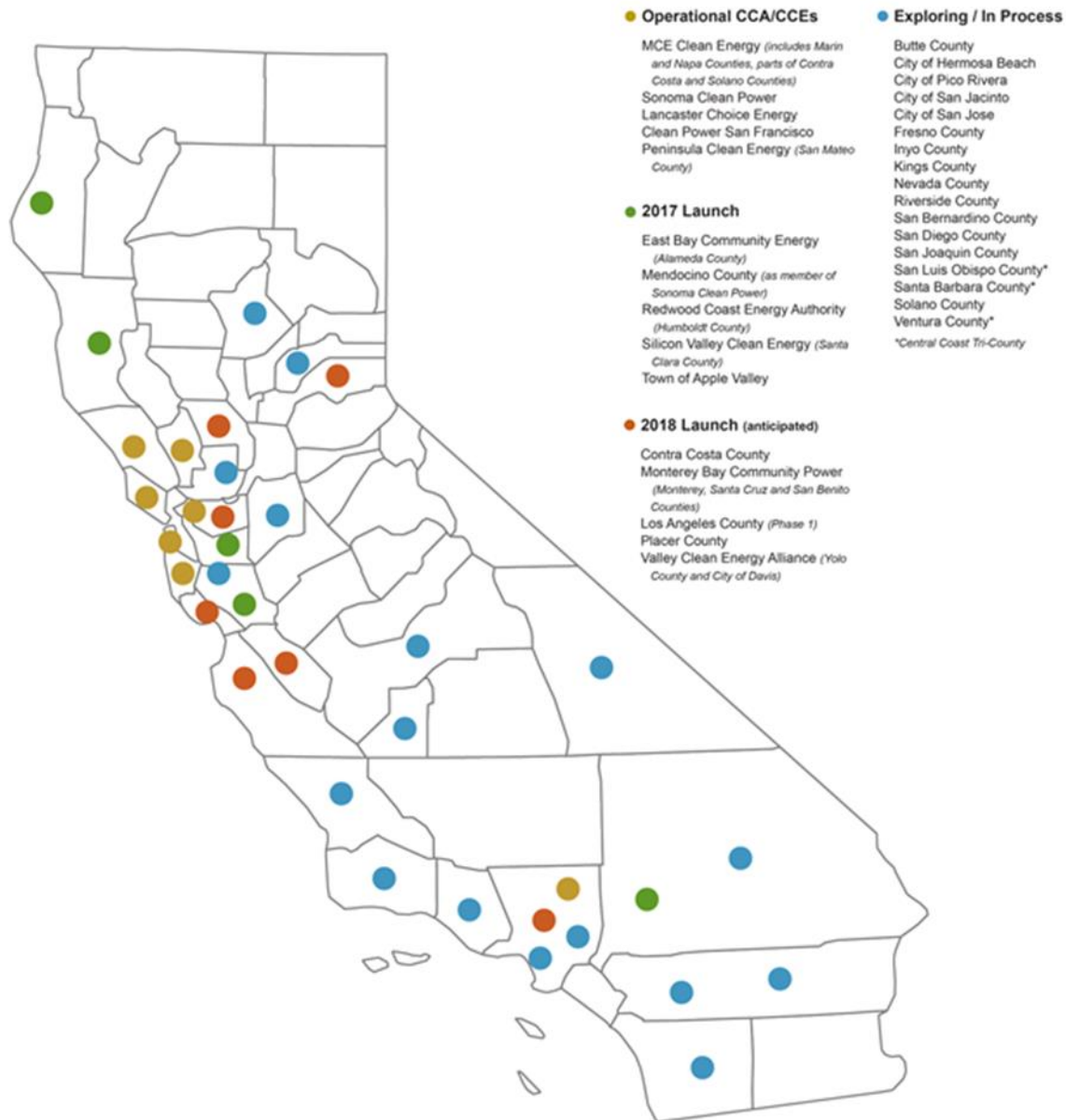


Figure 4.1 California CCAs (Source: www.leanenergy.org)

CCAs differ from investor- and publicly-owned utilities in a number of important ways (Table 4.1). In contrast to publicly-owned utilities such as the Los Angeles Department of Water & Power, whereby electric systems are owned and operated by the communities they serve,

ownership of energy infrastructure under the CCA model is limited to energy generation and storage. This distinction reduces initial capital investment requirements for CCAs but requires CCAs to work in close partnership with incumbent utilities. While responsibility for energy procurement shifts to the CCAs, transmission and distribution infrastructure remains under the ownership and control of the incumbent utility, which continues to deliver power, maintain the grid, provide consolidated billing and other customer services (LEAN, 2017). Unlike utilities, for which maximizing returns to stakeholders is a primary concern, CCAs are not-for-profit public agencies that operate under a much wider range of objectives. CCAs can be formed and operated under one of three governance structures. The most common structure in California is the Joint Powers Authority (JPA) model, under which member municipalities agree to establish an independent public agency tasked with operating the CCA on their behalf. Single jurisdictions establishing a CCA may do so through an ‘enterprise fund’, which allows for the CCA to be managed as a separate program/fund within existing municipal operations. Under the single jurisdiction model, which has been employed by Lancaster Choice Energy and Clean Power SF, the municipality retains full program autonomy and all revenue. The third approach, under which municipalities enlist the services of a commercial third party to manage CCA operations, has not yet been implemented in California. When operating under a single jurisdiction model, CCAs may be able to utilize close association with local governments to make use of local land-use planning, permitting, code enforcement, and other local government tools not available to IOUs.

	Investor-owned utility	Publicly-owned utility	Community Choice Aggregation (Joint Powers Authority)	Community Choice Aggregation (Single jurisdiction)
Examples	Pacific Gas & Electric (PG&E); Southern California Edison (SCE)	Los Angeles Department of Water & Power (LADWP); Sacramento Municipal Utility District (SMUD)	MCE Clean Energy (MCE); Sonoma Clean Power (SCP)	Lancaster Choice Energy (LCE)
Mission/Goals	Optimize shareholder return on investment	Optimize benefits for local customer owners, usually in the form of lower energy rates.	Optimize benefits for local customer owners, usually in the form of access to renewable energy or lower energy rates.	Optimize benefits for local customer owners, usually in the form of access to renewable energy or lower energy rates.
Ownership	Shareholders or investors. Not limited to the service area.	Local government body and/or utility customers. Usually limited to the service area.	Local government body and/or CCA customers. Usually limited to the service area.	Local government body and/or CCA customers. Usually limited to the service area.
Structure/ Management/	Management appointed by shareholder-elected board	Non-profit public entity managed by locally elected officials/ public employees.	Board of Directors comprised of elected city and county officials representing each of the communities CCA serves.	Board of Directors comprised of elected city or county officials representing the specific community CCA serves.
Rate Setting	Customer rates are set and regulated by CPUC through public process that includes some customer participation.	Customer rates are set by each utility's governing body-board or city council in a public forum.	Customer rates are set by CCA governing body in a public forum.	Customer rates are set by CCA governing body in a public forum.
Additional Regulations	CPUC Resource Adequacy Program; Renewable Portfolio Standard; Net Energy Metering; Ten-year procurement plans subject to CPUC approval.	CPUC Resource Adequacy Program; Renewable Portfolio Standard; Net Energy Metering	CPUC Resource Adequacy Program; Renewable Portfolio Standard; Net Energy Metering	CPUC Resource Adequacy Program; Renewable Portfolio Standard; Net Energy Metering

Financing	Stockholders (investors), the sale of bonds and bank borrowing help finance the utility's operations.	Tax-free bonds and low-interest loans usually at the local level.	Revenues based on customer electricity consumption; government and commercial loans. No use of tax dollars	Revenues based on customer electricity consumption; government and commercial loans. No use of tax dollars
Profit/Net Revenue	Rates set to recover costs and earn reasonable return as profits for investors in return for investment risk.	Rates are set to recover costs and earn additional return to maintain bond ratings and invest in new facilities.	Rates are set to recover costs and earn additional return to maintain bond ratings and invest in new facilities.	Rates are set to recover costs and earn additional return to maintain bond ratings and invest in new facilities.

Table 4.1 Comparison of investor-owned utilities, publicly-owned utilities, and community choice aggregation

While ownership of energy infrastructure under the CCA model is restricted to energy generation and storage, under the current Californian regulatory framework, CCAs have considerable freedom to pursue a range of policies and programs that may work to facilitate public and cooperative ownership of energy infrastructures. These include, but are not limited to, community-based energy initiatives such as behind-the-meter installations, energy cooperatives, shared renewable systems, and microgrids (Weinrub, 2017). Although contingent upon available utility-owned infrastructure, virtual net metering can work to reclaim energy systems for public benefit by allowing those lacking access to a suitable generating site to participate in sharing the output from a single renewable energy facility (Burke & Stephens, 2017). Finally, depending on state PUC regulations, microgrids can be employed to promote equal access to the grid and coordinate resources from decentralized renewable generation under distributed ownership (Burke & Stephens, 2018).

In sum, while the extent of regulatory oversight to which IOUs are subject makes it difficult to claim that the prevailing utility model is *undemocratic*, CCA advocates argue that the CCA model, through its emphasis on community participation and decision making, represents a more democratic alternative (Interview, Center for Climate Protection representative, 2/26/18). As non-

profit entities predicated on local choice and control over the energy system, CCA is viewed as an important vehicle through which to pursue energy democracy objectives (Weinrub, 2017). By alleviating the need to meet investor requirements for stable returns on investment, which are often reflected in IOU preferences for procuring electricity from large-scale generation facilities, CCAs are free to procure electricity in a way that allows for a much broader variety and distribution of socio-economic and ecological benefits. As such, CCAs are viewed as uniquely positioned to accelerate the deployment of local distributed renewable energy resources at a higher rate than incumbent utilities, in turn allowing for a more democratic alternative to what would otherwise be a utility-driven energy transition.

The following analysis interrogates these claims through an examination of relationship between energy-related policies and energy democracy outcomes based on the experience of California's three most established CCAs: MCE Clean Energy (MCE), Sonoma Clean Power (SCP, and Lancaster Clean Energy (LCE).

4.4 Delivering energy democracy

Energy democracy discourse is grounded in a distributed energy-politics that posits that distributed energy sources and technologies enable and organize distributed political power and vice versa (Burke & Stephens, 2018). While CCAs can offer a range of energy-related products and services to their customers, including energy efficiency (MCE Clean Energy, 2015) and electric vehicle incentive programs (SCP, 2018a), it is through energy procurement decisions that a CCA can meet broader objectives such as providing a greater share of renewable energy, decreasing greenhouse gas emissions, lowering energy costs, or promoting local economic development. As such, energy procurement – particularly the ability of a CCA to procure electricity from local distributed

renewable energy resources – serves as an integral means through which CCAs may fulfill their democratizing potential.

Each of the three CCAs in this analysis (Fig. 4.2) offer their consumers at least two energy portfolio options: a default option that offers a higher renewable energy mix at a rate competitive with that of the utility, and one with significantly higher renewable energy content mix (anywhere from 50% to 100%) at a slightly more expensive rate than the default option. Based on these portfolio options, each of the three CCAs claim to provide a greater share of renewables to their customers than has historically been provided by utilities. A cursory comparison of CCA and utility power content labels – a Californian regulatory requirement and the primary means through which electricity providers communicate details of their energy mix to consumers – supports this claim (Appendices A & B).



Figure 4.2 CCA Case studies

While the power content label provides general information on the types of energy sources that comprise an energy provider’s overall energy mix, the label fails to provide information regarding the specific location, age and size of the generating facilities or the nature of the agreements between energy providers and generators. The specific ways in which CCAs approach procurement in terms of the type, location and vintage of generation facilities has potentially

serious implications for other CCA objectives such as driving new generation and economic development, many of which have direct impacts for energy democracy.

Analysis of the specific facilities and contract types constituting MCE's early procurement mix illustrates this point. While MCE's default resource mix in 2013 comprised 52% eligible renewable energy sources, procurement from within California was limited to small hydro (7%), biogas (3%), and large hydro (10%), the latter of which is ineligible under the California renewable portfolio standard (RPS). More than half of MCE's renewable energy procurement consisted of Green-e certified renewable energy certificate (REC) purchases tied to small hydro and wind projects in Oregon, Washington, Wyoming, and Idaho. RECs are market-based instruments typically used to represent the rights to the environmental attributes of renewable electricity generation (US EPA, 2016). RECs are commonly classified in two broad categories (Fig. 4.3): "bundled", in which the electricity and the associated REC are sold together; and "unbundled", in which the REC is sold separately from the underlying energy (Holt et al., 2011). Unbundled RECs are widely considered a low quality source, as they not only negate the need for new generation but also introduce increased risk for project finance, particularly in the absence of long-term contracts (Holt et al., 2011; Pinkel & Weinrub, 2013). This view is reflected in the California RPS, which over the life of the RPS has increased the allowable amount of in-state procurement while decreasing the allowable amount of procurement from unbundled RECs (CPUC, 2018).

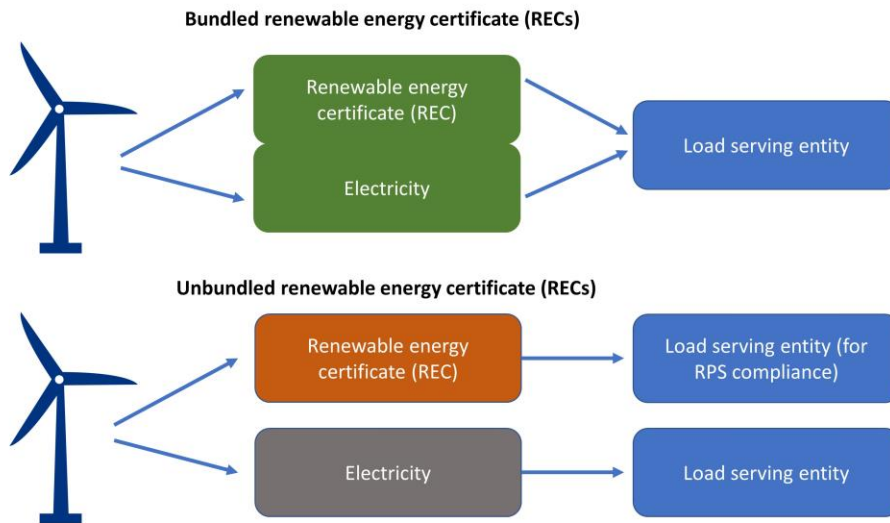


Figure 4.3 Bundled vs. unbundled renewable energy certificates (RECs)

While unbundled RECs from out-of-state generation may reduce or possibly negate the need for new in-state generation, key ways in which CCAs may produce a more democratic alternative to incumbent utilities, such as the promotion of local economic development, are largely contingent upon the development of new localized energy resources (Mormann, 2015). Heavy criticism of MCE’s reliance on unbundled RECs⁴ led to a recent and rapid shift away from this procurement strategy, with the share of unbundled RECs declining from 26% of total procurement in 2013 to around 15% in 2015. While RECs still feature heavily in procurement mixes of more recently-established CCAs such as LCE, others, such as SCP have made an explicit decision to avoid the use of renewable energy certificates as part of its procurement strategy.

A comparison of MCE procurement strategies with those of its incumbent utility Pacific Gas & Electric (PG&E) reveals some stark differences, as well as some notable similarities (Table 4.2.1). The most striking difference is the share of the overall energy mix from renewable sources: 54%

⁴ See, for example, (Halstead, 2015)

for MCE yet only 26% for PG&E. This difference is largely explained, however, by MCE's use of unbundled RECs (15% of total procurement), and out-of-state wind (12%).

Generation type (state)	MCE	SCP	PG&E	LCE	SCE
Eligible renewables	54%	36%	26%	37%	22%
Biogas CA	3%				1%
Biogas OR					
Biomass CA			4%		1%
Biomass OR	2%				
Biomass WA				14%	1%
Geothermal CA	2%	8%	4%		8%
Geothermal OR		1%			
Small hydro CA	4%		1%		
<i>Small hydro (REC only)</i>				<i>19%</i>	
Solar PV AZ			1%		
Solar PV CA	6%		6%		6%
Solar PV NV			1%		
Solar Thermal CA			2%		
Wind AB			2%		
Wind CA	10%	2%	4%		5%
Wind CO	3%	3%			
Wind OR	1%	9%	1%	4%	2%
Wind WA	8%	4%			
Wind WY		9%			
<i>Wind (REC only)</i>	<i>15%</i>				
Hydro CA	1%		6%		1%
Hydro NV					2%
Hydro WA	10%	41%			
Natural gas CA	11%		25%		27%
Nuclear CA			23%		
Nuclear AZ					6%
Unspecified	24%	23%	21%	63%	42%
Total procurement (GWh)	1,695	1,987	79,279	134	81,578

Table 4.2.1 California CCA and IOU procurement sources, 2015 (Data source: California Power Content Label Program)

A major impetus for the formation of CCAs from an energy democracy perspective has been the provision of a greater share of local distributed renewable energy resources at lower cost than that provided by the incumbent utility. Overall, CCAs have been able to compete with their associated IOUs on price while providing a greater share of renewable energy to their customers. However, while proving successful in procuring renewable energy resources, the fact that all three CCAs have been largely reliant on utility-scale generation outside their local jurisdictions suggests CCAs have largely yet failed to drive the transition to a localized distributed energy system that advocates view as essential to achieving energy democracy. The mix of renewable resources – consisting of out-of-state wind and small hydro renewable energy certificates – provided by CCAs is considerably less diverse than that of the IOUs, which may reflect minimum volume requirements for competitively priced power purchase agreements that CCAs struggle to meet. While difficult to compare due to the large share of unspecified power procured by both CCAs and IOUs, this analysis suggests IOUs, which procure between 14 and 19% of their electricity from relatively-recently constructed California solar and wind projects, are making a much greater contribution to the development of in-state – and thus more localized – renewable energy resources than CCAs, despite having a lower overall share of renewables.

While procurement decisions are driven largely by the specific objectives a CCA may be wishing to pursue, CCAs' ability to procure the resources necessary to achieve these objectives is often constrained by factors beyond the immediate control of the CCA and the community it is intended to represent. In early years of operation, a CCA's ability to pursue procurement objectives is constrained by lack of credit rating, as well as the challenges in balancing renewable energy targets with other potentially competing objectives such as lowering electricity rates for consumers while promoting local economic development. A CCA's ability to offer lower rates than IOUs is

predicated on CCAs investing directly in generation facilities, thereby eliminating the return on equity requirements and associated taxes that are typically recovered through utility rates (CEC, 2009). In practice, however, the ability of a CCA to invest directly in generation is constrained by the nature of the governance structure, which, by seeking to limit the municipalities exposure to CCA-related financial risks, effectively limits the CCAs credit-rating and access to capital. Both the JPA and single jurisdiction approaches create a degree of separation between the future liabilities of the CCA and the assets of its member cities and towns. Separating the CCA from the finances of the affiliated municipalities is considered ‘best practice’ as it protects municipal finances in the wake of potential CCA bankruptcy. While financial institutions are becoming increasingly comfortable with the CCA model, a drawback of this fiscal separation has been that CCAs commence operations with no credit, and have thus been reliant on member cities to provide loans or loan guarantees until the CCA can establish an agency credit rating, which typically occurs five years after operations commence (SCP, 2015).

A lack of credit history has had direct implications for CCA’s ability to procure energy from local decentralized sources, particularly in the early years. Newly established CCAs are typically initially reliant on the services of a third-party power provider, who can use their own credit to enter power purchase agreements directly and then pass this electricity on to the CCA. While the use of third-party providers allows for the CCA to meet immediate energy requirements and renewable energy targets in the short-term, the approach results in a level of opacity when seeking to identify specific generation sources, and severely limits the potential for community control and ownership over specific renewable energy resources. In addition, a lack of credit greatly hinders a CCA’s ability to enter competitive power purchase agreements. In some cases, perceived risk associated with a lack of credit history has made lenders reluctant to finance projects in which a

CCA will be the primary energy purchaser. Where lenders have been willing to finance such projects, perceived risk is often hedged through a premium on the contract price, making CCAs less competitive than incumbent utilities. In this way, private financing, which often serves as the basis for renewable energy generation projects, may serve to preclude access to green economic development strategies or reduce investor accountability for environmental justice harms in the communities in which such projects are located (Outka, 2012).

While presenting significant barriers to procurement of local energy resources in the early years of operations, the financial constraints facing CCAs appear to be resolved as the entities mature. Over time, growing acceptance of the viability of the CCA model among lenders and developers has allowed CCAs to increase the number of longer-term local generation contracts in their procurement portfolio. The share of total MCE procurement derived from California-based solar PV increased from around 0.16% in 2013 to 6.6% in 2015, suggesting CCAs may shift from unbundled REC s to local generation sources as they mature. MCE's 2017 Integrated Resource Plan points to a continuing shift away from the use of third-party providers and unbundled RECs toward a greater share of local generation. As of February 2017, MCE had entered 26 medium-to-long term contracts with developers of new and existing RPS eligible renewable energy projects in California (MCE, 2017a). In addition to the default "Light Green" option of 50% renewables and "Deep Green" 100% California-based renewable plan, MCE now offers a "Local Sol" option consisting of electricity derived entirely of solar projects within MCE's service territory. MCE also offers a feed-in tariff for up to 15 MW of small-scale renewables, and now has 9,600 net metering patrons—about 4% of its customers—who collectively own 77 MW of solar capacity and get paid full retail rate plus 1¢/kWh for surplus energy. Given that public and cooperative ownership of energy infrastructures is viewed as an important means of facilitating a more

equitable distribution of energy system benefits (Becker & Naumann, 2017), the promotion of local small-scale renewable and support of rooftop solar through favorable feed-in tariff suggest CCAs are making some tangible progress towards their energy democracy objectives.

MCE's emphasis on local distributed generation demonstrates significant overlap between CCA operations and energy democracy objectives, yet is by no means shared by all CCAs. Like MCE and SCP, LCE offers a default product comprised of 37% RPS eligible renewable sources, as well as a 100% renewable option. Despite providing a similar share of renewable sources, however, LCE's energy mix is by far the least diverse of the three CCA's examined in this analysis. While attributable in part to LCE's relative youth, the lack of diversity and reliance on out-of-state RECs reflects the primary motivations behind the establishment of LCE, which themselves reflect the demographic and socio-economic composition of the community. In 2016, the City of Lancaster had median household income of USD 47,684, compared to USD 66,833 in Sonoma County and USD 100,310 in Marin County (U.S Census Bureau, 2016). As such, LCE has emphasized low-cost energy over issues such as GHG reductions or promotion of local generation that have served as core elements of both MCE and SCP. Paradoxically, Lancaster is now home to over 600MW of either operational or approved utility-scale solar PV projects, yet to date, LCE has only signed one 10MW power purchase agreements with a local developer.

As CCAs mature and grow, issues around access to capital appear to improve. In 2017, MCE's board of directors approved a USD 25 million line of credit with River City Bank (MCE, 2017b), a commercial bank for successful mid-sized businesses and affluent individuals in California (RCB, 2018), to be used as credit support for MCE's forward purchases of energy. As CCAs mature, however, the nature of procurement appears to more closely resemble that of financialized investor-owned utilities than the energy democracy ideals of local ownership and control of

decentralized renewable energy generation. In 2016, MCE began construction on a 10-MW solar project on a 60-acre brownfield site owned by the Chevron oil refinery in Richmond, CA – the largest such project in the Bay Area. While pre-development costs were covered in part by customers participating in MCE’s Deep Green 100% renewable energy service, in May 2017 the project was sold to Utah-based developer sPower (MCE Clean Energy, 2017), the largest private owner of operating solar assets in the United States (sPower, 2018). Through a Delaware limited liability company MCE Solar One, a financial arrangement that minimizes corporate tax liability in California (Dyrenge, Lindsey, & Thornock, 2013), sPower now operates the project and sells power to MCE under a 20-year power purchase agreement. Despite being hailed as a manifestation of CCA’s ability to promote local renewable energy generation (MCE, 2018), in actuality, the project represents a flow of capital outside the community which MCE is intended to serve, very little of which – if any – flows back in the form of California taxes.

While renewable energy procurement has been the primary focus of the CCAs analyzed in this chapter, CCAs are beginning to make progress in energy efficiency, demand response, electric vehicle charging, battery storage, and transportation⁵. MCE and SCP have both undertaken pilot programs providing financial incentives for electric vehicle drivers, yet to date, only LCE has implemented supporting infrastructure such as charging stations at multi-unit dwellings, workplaces, or public interest destinations, although not to the scale as a have Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric. All three CCAs assessed in this chapter discuss the importance of energy storage in their resource plans, and while MCE and LCE have both moved forward with some level of storage procurement (2.4MW and 0.3MW, respectively) it remains to be seen whether these efforts can be brought to the requisite scale to

⁵ The role of LCE in the local transit agency’s conversion to a completely electric bus fleet is one example.

manage the increased penetration of intermittent renewable energy resources such as solar and wind. As noted in SCP's resource plan, "storage is currently expensive compared with other resources that have similar operating characteristics, and as a technology category is still in the early stages of large-scale commercialization" (SCP, 2015, p. 15). Finally, while, alternative financial institutions such as green public service banks can facilitate community ownership through the provision of inexpensive, accessible credit to cooperatives and other community-based projects (Burke & Stephens, 2017), to date, none of the CCAs evaluated in this study have pursued this approach.

4.5 Conclusion: the future of CCA democracy

Although still in initial stages of development, the three CCAs discussed in this analysis raise significant questions over whether the CCA model can deliver on the socially- and environmentally-just decentralized distributed renewable energy system envisaged by energy democracy advocates. While the ability to procure energy resources on behalf of the community may create the potential for a more democratic energy system, this potential is greatly constrained by the CCA's ability to procure the specific type (location, scale, energy source) of energy resources that tie to energy democracy objectives. Paradoxically, improved access to capital as CCAs mature may actually result in a reversion to the centralized, corporate-based model of energy procurement that energy democracy advocates have long resisted. While decentralization, public and cooperative ownership, and participatory governance are widely accepted as core aspects of the community choice movement, and thus link closely to notions of energy democracy, the three CCAs exhibit considerable variation in the extent to which they have been able to translate energy democracy goals into procurement strategies specific and policy instruments. Social, political, and economic variation across CCA contexts may result in the pursuit of divergent objectives, each with differing consequences for the promotion of energy democracy.

Drawing on Szulecki's, (2018) distinction between energy democracy as process and energy democracy outcomes, this analysis suggests that, when translating energy democracy goals into specific policies and programs, CCAs in California have emphasized energy democracy processes over outcomes. While all three CCAs discussed in this chapter allow for greater public participation in energy planning and procurement than incumbent utilities, this participation is largely limited to the ability to attend public meetings and vote for elected officials, who may then in some capacity work to influence the design and operation of the CCA. As such, public participation in the three CCAs discussed here is ultimately indirect and limited at best. In addition, public ownership and favorable redistribution of the economic benefits associated with the energy system remain extremely limited, if not absent entirely. As Szulecki argues, “While it is certain that participation and procedural issues are fundamental for making sustainability governance, in energy and beyond, more just..., fair and ultimately democratic, it is a mistake to limit democracy to public participation alone (Szulecki, 2018, p. 27).

The gap between energy democracy goals as conceptualized in the literature and energy democracy in practice raises two concerns regarding the perceived value of an energy future grounded in the concept of energy democracy. First, it is worth considering the value of public participation in the energy planning process. While public participation in decision making regarding energy generation facilities has long been considered a necessary element in the promotion of environmental justice (Been, 1992), whether citizens require or desire such close involvement in the overall design and operation highly complex energy systems is disputed (Szulecki, 2018). Although energy democracy advocates view local ownership as a core aspect of energy democracy, the CCA model, in contrast to energy system energy system municipalization, restricts ownership of energy infrastructure to energy generation and storage. In addition, it bears

considering whether community ownership of energy resources is ultimately in a community's best interests, or is necessarily 'democratic'. As recent experience in the California retail electricity sector has shown, energy assets can prove to be highly volatile in the context of rapid technological and policy developments (Deng & Oren, 2006). Just as the logic of private finance can inform CCAs' abilities to procure energy on their own terms, so too may this logic result in unfavorable distributions of risk.

As CCA's continue to develop in California they will likely face a number of challenges to their economic viability, which could have serious implications for the distribution of risk, and ultimately, energy democracy. As noted previously, CCAs in California operate largely outside the regulatory purview of the state's PUC. Efforts to extend the existing state-level regulation of IOUs to CCAs have been met with fierce opposition from CCA advocacy groups (Hastings, 2018), many of whom view the freedom from such regulatory constraints as a core mechanism through which CCAs can exercise their democratic potential. However, whether such autonomy is desirable when viewing energy democracy from a regional or state perspective warrants much closer scrutiny. Policy uncertainty about future cost allocations between utility and CCA customers and increased competition in increasingly crowded retail electricity sector are just two factors that could determine the ultimate success of the CCA model. As such, public engagement in decisions regarding how such risk is ultimately distributed may be considered a more democratic outcome, as opposed to the largely unavoidable burden of risk associated with direct community ownership of energy assets.

It would be naïve, however, to suggest that CCA is viewed by its supporters as a guaranteed means of achieving energy democracy. In fact, the limitations of the CCA model, and the importance of designing CCA governance processes and policy mixes in a way that advances democratic

outcomes has been the subject of recent research (Weinrub, 2017). If CCAs are to promote energy democracy in a broader sense, however, the focus must shift from a myopic pursuit of renewable electricity toward a more holistic model that is attentive to the technical feasibility and environmental desirability of decentralized distributed generation. This requires greater attention to future energy storage requirements while also electrifying transportation and natural gas applications, which combined account for 70% of California's emissions. While MCE, SCP and LCE have engaged in some electric vehicle pilot projects and rebate programs, a question mark looms over whether CCAs can promote such a shift at the scale required for the type of systemic energy transition championed by more radical energy transition advocates. Energy transition may do little to address patterns of exploitation and dispossession that have long characterized the fossil fuel economy unless the social and environmental consequences of the transition are taken into account (Newell & Mulvaney, 2013). Despite the shift toward localized electricity governance, the articulation between local demand for renewable energy development and a financialized renewable energy sector has resulted in the continued dominance of large-scale, capital- and land-intensive renewable energy technologies that mask the democratizing potential of energy transition while reinforcing capitalist social relations that have characterized the previous energy era dominated by fossil fuels.

In closing, it should be stressed that it is still early days for the CCA model in California, and there are thus significant dangers in making comparisons between relatively recent innovations in energy governance and utilities that evolved over a century or more. With these limitations in mind, the study is intended as a preliminary assessment, providing a baseline analysis which can be built upon in future years as the both the energy democracy movement and the presence of mature CCAs expands across the state. The variety of CCA approaches represents significant

degree of contention over who defines energy democracy, on what terms, and to what end. Given the growing variation in constituencies CCAs represent – from affluent coastal communities to less wealthy inland areas – policymakers should attend to the ways in which these dynamics may either alleviate or exacerbate existing inequalities. This study is intended to highlight potential limits of the energy democracy concept when put into practice through CCA, and thus provides some clarification on the extent to which localized renewable energy initiatives can influence the democratizing potential of future energy transitions.

CHAPTER 5 CONCLUSION

5.1 Geographies of financialized energy transition

While generally referring to a transition from a carbon-intensive to a low-carbon economy, this dissertation has demonstrated that energy transitions are in fact driven by multiple and often competing motivations and objectives, many of which vary considerably across the socio-economic contexts and political scales in which such a transition takes place. As demonstrated in Indonesia and California, the processes of energy transition can work to reproduce political power and shape political outcomes in highly variegated ways. To date, questions of how, where, and with what impacts energy transitions are unfolding have received scant empirical attention from a critical geographic perspective (Bridge et al., 2013; Calvert, 2016). Normative accounts of how energy transition should be governed (Florini & Sovacool, 2009) and where renewable energy development should be located to minimize socio-ecological impacts (R. R. Hernandez et al., 2014) have largely failed to account for the power relations and the broader political economic structures and ecological processes shaping the geography of energy transition, and the profound contradictions that result. Further, such accounts typically fail to acknowledge complex system dynamics (lock in, path dependency, brittleness, etc.) that also work to inhibit or aid processes of energy transition (Bale et al., 2015).

The three studies contained in this dissertation aim to address these gaps by highlighting the social and political limitations to what is increasingly cast as a technically and economically feasible renewable transition. In doing so, this work has aimed to inform a better understanding of the discursive and material linkages shaping the uneven geographies of energy transition, its contradictions and their implications. The three studies serve to highlight the limits of energy transition as form of radical and systemic change, while clarifying the extent to which localized renewable energy initiatives can influence the democratizing potential of future energy transitions.

This understanding builds on existing knowledge regarding the uneven political-ecological implications of the energy transition (Bridge et al., 2013; Calvert, 2016), while serving as a guide for policymakers seeking to manage the energy transition in a way that reduces the carbon-intensity of the economy while being attentive to potential contradictions and perverse outcomes that may result from reliance on particular means of achieving energy transition objectives.

This dissertation produced two major empirical findings. First, while foreign investment may prove successful in increasing a country's solar PV capacity, as was the case in Indonesia, the risk-return logic of finance may produce a particular geography of renewable energy generation characterized by large-scale projects in locations that already enjoy reliable access to electricity. This outcome – a major contradiction when viewed through the lens of Indonesia's energy transition development objectives – is not only a flow of economic benefits out of the country and limited improvement in energy access for much of the country, but a missed opportunity in terms of maximizing the socially and politically transformative potential a broader energy transition may entail. As demonstrated in Chapter 3, Indonesia's efforts to achieve rural electrification through private international finance, as opposed to state or development finance institutions, appears unlikely to achieve results beyond a simple increase in installed capacity. While Indonesia's solar PV sector is very much in its infancy, the geographical implications of the Indonesian government's reliance on private investment to meet its energy and energy transition objectives suggest Indonesia has a way to go if it is to bring about a “radical, systemic and managed change towards ‘more sustainable’ or ‘more effective’ patterns of provision and use of energy” (Rutherford & Coutard, 2014, p. 1354).

Second, while rescaling energy governance and affording local communities the ability to control their own energy procurement may create the potential for a more democratic energy system, this

potential can be greatly constrained by the local organization's ability to procure the specific type (location, scale, energy source) of energy resources that tie to energy democracy objectives. Although still in initial stages of development, the three community choice aggregators (CCAs) discussed in Chapter 4 raise significant questions over whether the CCA model can deliver on the socially- and environmentally-just decentralized distributed renewable energy system envisaged by energy democracy advocates. Paradoxically, improved access to capital as CCAs mature may actually result in a reversion to the centralized, corporate-based model of energy procurement that energy democracy advocates have long resisted. While decentralization, public and cooperative ownership, and participatory governance are widely accepted as core aspects of the community choice movement, and thus link closely to notions of energy democracy, the three CCAs discussed in Chapter 4 exhibit considerable variation in the extent to which they have been able to translate energy democracy goals into procurement strategies specific and policy instruments. Ultimately, social, political, and economic variation across CCA contexts may result in the pursuit of divergent objectives, each with differing consequences for the promotion of energy democracy. In addition, this analysis found that although the three CCAs allow for greater public participation in energy planning and procurement than incumbent utilities, this participation is largely limited to the ability to attend public meetings and vote for elected officials, who may then in some capacity work to influence the design and operation of the CCA. As such, public participation in the three CCAs discussed in this dissertation is ultimately indirect and limited at best. Finally, public ownership and favorable redistribution of the economic benefits associated with the energy system remain extremely limited, if not absent entirely.

5.2 Answering the research questions

As outlined in Chapter 1, this dissertation was motivated by three overarching research questions:

- *To what extent and in what specific ways has the global energy transition – particularly the solar energy industry – been subject to financialization? (Chapter 2)*

Through a broad analysis of current trends in the global renewable energy sector, Chapter 2 examined recent innovations in renewable energy development and finance shaping the current trajectory of the ‘global energy transition’, and the potential socio-ecological implications this current trajectory may produce. A major finding of this analysis is that the broad acceptance that “most of the new investment in renewables must come from the private sector” (IRENA and CPI, 2018, p. 38), coupled with the perceived “lack of bankable projects to attract investment and fulfil today’s appetite for renewable energy projects” (IRENA Coalition for Action, 2018, p. 3), has resulted in project bankability becoming the core metric against which project viability and desirability is judged. By extension, the risk-return logic of finance has emerged as a key factor in shaping the geography of the global energy transition. The growing influence of risk-averse institutional investors has already manifest as a shift in investment decision outcomes, reflected in the demonstrated preferences of this investor class for large-scale projects that allow for the generation of stable returns and are subject to minimal risk. Given the growing influence of risk-averse institutional investors, future expansion of renewable energy generation is likely to favor safe investments in tested large-scale, land-intensive technologies over less financially-attractive alternatives.

- *In what ways has financialization translated into preferences for particular modes of transition (i.e. technologies, finance and governance mechanisms, land use patterns)? (Chapters 3 & 4)*

As discussed in Chapter 2, the shift away from development finance institutions toward institutional investors has become a significant factor in determining whether a particular project at a particular scale will be financed (Donovan, 2015; Frankfurt School-UNEP Centre/BNEF, 2017). In Indonesia, the articulation between recent regulatory developments and the logic of finance has manifest geographically in terms of the scale, location, and broader function of new solar PV projects. By pegging feed-in tariffs to the cost of local generation, recent regulatory developments in Indonesia have effectively forced developers wishing to pursue projects in lower-cost regions of the country to do so at significant scale in order to access economies of scale and bring costs under the regulated tariff. The recent project proposals by multinational energy firms Equis and ENGIE of 21 MW and 140 MW, respectively, serve to illustrate this point. In addition, the competitive reverse auction structure proposed under Indonesia's recent solar PV regulations has incentivized developers to find the lowest cost means of addressing the variability associated with solar PV. A recently announced 500 MW project in eastern Indonesia will combine 250 MW of solar PV with 250MW of diesel generation (Tsagas, 2017a). This decision reflects the higher cost of low-emissions battery storage relative to emissions-intensive diesel generation and may ultimately result in a net increase in greenhouse gas emissions.

The relationship between financialization and the mode of energy transition in California, discussed in Chapter 4, is more complex. On the one hand, the financialized Californian renewable energy sector, largely dominated by private developers and commercial financiers who base investment decisions largely on the basis of credit history, have severely limited the ability of community choice aggregators to pursue the types energy procurement strategies advocated by the energy democracy movement more broadly. On the other hand, innovative financial mechanisms, namely unbundled renewable energy certificates, have enabled CCAs to deliver on their promises,

at least from an accounting perspective, of providing a greater share of renewable energy to their customers at lower rates than the incumbent utilities. Overall however, and in spite of the shift toward localized electricity governance, the articulation between local demand for renewable energy development and a financialized renewable energy sector has resulted in the continued dominance of large-scale, capital- and land-intensive renewable energy technologies that mask the democratizing potential of energy transition while reinforcing capitalist social relations that have characterized the previous energy era dominated by fossil fuels.

- *What are the socio-economic and ecological trade-offs and contradictions resulting from a financialized energy transition? What are the implications of these contradictions in terms of (re)shaping social and socio-ecological relations (i.e. flows of capital and land use) and the conditions of possibility for the achievement of alternative energy transition objectives? (Chapters 3 & 4)*

In Indonesia, efforts to reconcile the demands of risk-averse, profit-driven investors and developers with the needs of the approximately 25 million Indonesians who currently lack access to electricity has resulted in a geography of renewable energy generation characterized by large-scale centralized generation facilities that constrain opportunities for local ownership and control over the energy system. The result – a major contradiction when viewed through the lens of Indonesia’s energy transition development objectives – is not only a flow of economic benefits out of the country and limited improvement in energy access for much of the country, but a missed opportunity in terms of maximizing the socially and politically transformative potential a broader energy transition may entail.

Despite the vastly different political economic and geographic contexts, the case of community choice in California yielded similar findings. Although still in initial stages of development, the

three CCAs discussed in Chapter 4 raise significant questions over whether the CCA model can deliver on the socially- and environmentally-just decentralized distributed renewable energy system envisaged by energy democracy advocates. While this is largely a result of the limitations imposed by the financialized renewable energy sector, the analysis also suggests that over-emphasis on technological determinism (in this case the ability of decentralized distributed energy resources to produce distributed political power) may actually result in a narrow vision of energy transition and its potential benefits.

Most importantly, the California study points to the potential incompatibility of different energy transition objectives. As noted in Chapter 1, while often portrayed as complementary, many energy transition objectives such as reducing greenhouse gas emissions or improving energy access, are dependent on vastly different forms of political economic and socio-technical organization (Rutherford & Coutard, 2014). Echoing the assumed complementarity of different energy transition objectives, CCAs have been promoted as a means of simultaneously increasing access to local renewable energy sources, lowering consumer rates, and providing opportunities for local economic development. As analysis of CCAs indicated, however, such conditions of possibility are narrowed through the articulation between local energy governance and a financialized energy system. As such, while CCAs have proven successful in delivering low cost renewable energy to their customers, this has occurred within the bounds of the prevailing system. As a result, more transformative objectives – redistribution of energy system benefits, local ownership of energy assets – have been largely unmet.

5.3 Theoretical contributions

A major objective of this dissertation was to theorize the specific ways in which renewable energy finance manifests geographically. Specifically, this dissertation aimed to contribute to existing

work on the geographies of energy transition (Bridge et al., 2013; Calvert, 2016), as well as recent work the financialization of natural resource management (Loftus & March, 2016; March & Purcell, 2014; Sullivan, 2013) and renewable energy generation (Baker, 2015) by furthering an understanding of the conditions under which an energy transition might emerge, the geographic and political economic characteristics of this apparent transition, and the political ecological implications for energy transitions in Indonesia and California, as well as more broadly.

In a development context, significant attention has been directed at designing particular incentive structures to make small-scale generation more appealing to investors (Schmidt et al., 2013). Much of the recent work on risk mitigation places much of the onus on ‘creating the enabling conditions’ for investment on local governments and institutions, follows a similar logic (see, for example, IRENA, 2016b). This work, however, tends to view private capital as a passive player in the context of energy transitions, and thus views the logic of finance as fixed and something that governments must adjust, rather than acknowledging that calculations ‘bankability’, risk, and required rates of return are in fact arbitrary and subject to significant variation. In contrast, I argue that the risk-return logic of finance, and particularly the increasingly prevalent notion of ‘bankability’ are fluid, adaptable, and context-specific. Shifting the responsibility for creating ‘bankable’ projects away from host governments toward private investors holds the potential to alter the prevailing logic of the global energy transition, which to date has rather myopically emphasized new and ever-larger renewable energy generation over the broader social and ecological benefits an energy transition may otherwise entail.

By theorizing the relationship between forms and sources of renewable energy finance and the physical manifestation of renewable energy infrastructure, this dissertation offers a valuable counter-argument to the prevailing eco-modernist perspective that currently dominates global

energy transition discourse, exemplified by the commonly-cited belief that “most of the new investment in renewables must come from the private sector” (IRENA and CPI, 2018, p. 38).

5.4 Study limitations

This dissertation has attempted to theorize the processes and potential implications of a global energy transition increasingly predicated on the risk-return logic of finance. The breadth and scope of this line of inquiry, which is of great importance given the uneven socio-ecological implications a transition to renewable energy will likely produce, is necessarily going to lack specificity. While I have attempted to address this gap through two detailed empirical studies, each of which is focused on vastly political economic and geographic contexts, this approach nevertheless results in little more than a snapshot of what increasingly appears to a highly variegated and dynamic process.

A major limitation of the work on Indonesia presented Chapter 3 is that none of the proposed projects included in the analysis have commenced operations. As such, many of the findings, while grounded in existing empirical studies within Indonesia and other contexts, are inherently speculative. In my defense, however, this study provides a valuable launching point for more site-specific empirical work once – or perhaps *if* – these projects come to fruition. In addition, the commercial and political sensitivity, typical of many energy infrastructure projects across the Global South, created significant challenges in terms of access to sites of proposed construction and to key documents, such as power purchase agreements between developers and Indonesia’s monopoly utility PLN. While these barriers did not preclude rigorous analysis, improved access would certainly have provided additional nuance to my arguments.

In terms of the analysis of the community choice movement in California presented in Chapter 4, the limited number of cases available for analysis represents a major limitation of this study. All

three CCAs are at very different stages of development, with MCE Clean Energy, Sonoma Clean Power and Lancaster Choice Energy established in 2010, 2014 and 2015, respectively. This not only makes it difficult to compare across CCAs, but also limits the potential for meaningful comparison with investor-owned and publicly-owned utilities, which, as well-established entities, vary greatly in their customer bases, broader political clout, and ability to negotiate favorable procurement contracts and finance arrangements. As such, the study is best viewed as a preliminary assessment, providing a baseline analysis which can be built upon in future years as the presence of mature CCAs expands across California and the United States more broadly.

5.5 Avenues for future research

The arguments presented in this dissertation are based on a broad survey of recent trends in the global renewable energy sector and two empirical case studies. As noted, however, understanding the full implications of the increasingly financialized energy transition requires higher resolution empirical analysis focused on the specific political economic and ecological implications of a global energy transition predicated on the risk-return logic of finance. In particular, the argument that innovations in renewable energy finance will simultaneously expand renewable energy generation capacity while reducing in greenhouse gas emissions warrants closer empirical scrutiny. While there is an undeniable correlation between increases in renewable energy investment and installed capacity over the past decade, recent years have witnessed a growing share of renewable investment directed to mergers and acquisitions of existing renewable energy assets (Frankfurt School-UNEP Centre/BNEF, 2017). In addition, recent efforts to manage risk associated with small-scale renewable energy projects have looked to aggregation and securitization as a means of facilitating access to capital markets (IRENA Coalition for Action, 2018). Combined, these trends potentially recast renewable energy projects as tradable financial assets, creating distance between the original productive assets and the sites in which benefits will

ultimately accumulate (Baker, 2015; Bayliss, 2014). Likewise, trade in unbundled renewable energy certificates may not only impact the stability of renewable energy finance markets (Holt et al., 2011), but may ultimately do little to displace existing greenhouse gas emissions-intensive forms of electricity generation (Pinkel & Weinrub, 2013).

While energy transitions may on the surface appear intended to promote energy justice – for instance, by alleviating the need for emissions- and pollution-intensive forms of electricity generation in favor of ‘cleaner’ alternatives – the uneven power dynamics driving such transitions and the broad and variegated constituencies such transitions affect may also give rise to new injustices (Jenkins et al., 2016; Newell & Mulvaney, 2013). Further attention to the assumed complementarity of different energy transition objectives is needed to better understand this relationship, and the potentially adverse consequences that can result from an unquestioning adherence to the win-win rhetoric of the ‘green economy’. While links between various forms of renewable energy and land use and livelihood transformation have witnessed growing attention (Baka, 2017; M. T. Huber & McCarthy, 2017; Rignall, 2016; Yenneti et al., 2016), explicit links between renewable energy finance and particular land use and livelihood transformations have been largely overlooked, and thus also warrant close attention. Given that meeting 34 percent of global energy demand in 2030 with large-scale solar generation will require over 400,000 km² of land – an area greater than the size of Germany (Jacobson & Delucchi, 2011) – such impacts are likely to intensify under the current energy transition trajectory. Finally, while there is mounting theoretical support for a relationship between energy infrastructure and the distribution of political power (Burke & Stephens, 2018), attention to the underlying logics and political economic processes that inform particular infrastructure investment decisions will provide a more

meaningful approach to understanding the conditions under which a more radical, systemic, and democratic energy transition may arise.

The innovations in renewable energy policy and finance outlined in Chapter 2, particularly those promoting large-scale investment, may ultimately inform particular geographies of renewable energy generation, directing energy transition futures either toward a highly centralized system replicating many of the social and political inequities characteristic of the prevailing fossil-fuel regime (Mitchell, 2009), or towards a more distributed and potentially democratic energy future (Alanne & Saari, 2006). Closer attention to the dynamics laid out in this dissertation will not only illuminate the potentially uneven political-ecological implications of the energy transition, but should also serve as a guide for policymakers seeking to manage the energy transition in a way that reduces the carbon-intensity of the economy while being attentive to potential contradictions and perverse outcomes that may result from reliance on particular means of achieving energy transition objectives.

APPENDIX A: MAJOR INDEPENDENTLY-OWNED AND PUBLICLY-OWNED UTILITY POWER CONTENT LABELS, 2015 (CEC, 2017)

	California	LADWP		SCE	PG&E	SDG&E
Power Mix	Statewide Power Mix	Default	Green Power	Default	Default	Default
Eligible Renewable	22%	21%	100%	25%	30%	35%
Biomass & waste	3%	4%	100%	1%	4%	2%
Geothermal	4%	2%		9%	5%	0%
Small hydroelectric	1%	1%		0%	1%	0%
Solar	6%	3%		7%	11%	18%
Wind	8%	11%		8%	8%	15%
Coal	6%	37%		0%	0%	0%
Large hydroelectric	5%	3%		2%	6%	0%
Natural gas	44%	25%		26%	25%	54%
Nuclear	9%	10%		6%	23%	0%
Other	0%	0%		0%	0%	0%
Unspecified sources of power*	14%	4%		41%	17%	11%
TOTAL*	100%	100%	100%	100%	100%	100%

*Column may not sum to 100 due to rounding

**“Unspecified sources of power” means electricity that is not traceable to specific generation sources by any auditable contract trail or equivalent, including a tradable commodity system, that provides commercial verification that the electricity source claimed has been sold once and only once.

APPENDIX B: COMMUNITY CHOICE AGGREGATOR POWER CONTENT LABELS, 2015 (CEC, 2017)

	California	Marin Clean Energy	Clean	Sonoma Clean Power	Ever-Green	Lancaster Choice Energy	
Power Mix	Statewide Power Mix	Light Green	Deep Green	Clean Start	Ever-Green	Clear Choice	Smart Choice
Eligible Renewable	22%	52%	100%	37%	100%	35%	100%
Biomass & waste	3%	5%				14%	
Geothermal	4%	2%		9%	100%	0%	
Small hydroelectric	1%	4%				19%	
Solar	6%	5%	25%			0%	
Wind	8%	36%	75%	28%		2%	100%
Coal	6%						
Large hydroelectric	5%	12%		41%			
Natural gas	44%	12%					
Nuclear	9%						
Other	0%						
Unspecified sources of power**	14%	25%		23%		65%	
TOTAL*	100%	100%	100%	100%	100%	100%	100%

*Column may not sum to 100 due to rounding

**“Unspecified sources of power” means electricity that is not traceable to specific generation sources by any auditable contract trail or equivalent, including a tradable commodity system, that provides commercial verification that the electricity source claimed has been sold once and only once.

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