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Solar 'power': Socio-political dynamics of infrastructural development in two Western Indian states

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ABSTRACT

The growth and development of solar energy, which is so important in the current global context, is determined by political economic factors, and in turn, has varied implications for energy justice. India's western region presents a complex context within which to examine why these trajectories unfold in particular ways and to what end. This article first situates India's renewable energy policy within the dynamics of its federal politics. It then focusses on the trajectory of renewable energy development in two Western Indian states, Rajasthan and Gujarat, highlighting how regional particularities and path dependence have shaped the emergence of solar energy, often in ways that run counter to both expected and hoped for results. The idea of energy justice is subsequently introduced as a way to evaluate whether solar energy infrastructural growth in its present form is best serving the multi-pronged needs of climate justice, economic development, and social equity. By combining a political economy of renewable energy that accounts for the political and institutional factors conditioning the growth of solar capacity with the normative arguments embedded in the energy justice literature, this study contributes to a growing understanding of the intersection of solar power and development.

1. Introduction

A number of countries have been making advances in the field of solar energy. Wide-ranging examples include solar technologies across scales and innovative adoption models in Italy and Germany [1], large numbers of solar user communities in the UK and the Netherlands [2], various models to increase solar use in Thailand [3], and strong pushes in Morocco and Kenya [4]. Supported by rapid technological innovation and cheaper energy storage options, the sub-national region of Southern Australia, municipalities in the USA, and other global examples from the Gulf states to Chile mark a multi-scalar shift towards more solar uptake. With the USA an uncertain leader in global climate negotiations, countries like India and China have key roles to play in climate leadership alongside the EU's efforts [5]. China recently walked away from several investments in thermal plants and has assumed the mantle of a runaway leader in solar energy uptake [6]. 47% of the 161 GW of total new renewable energy capacity installed globally in 2016 was solar.[1]

Thus, solar is no flash in the pan. This is particularly true of photovoltaic solar, the focus in this paper, which has become extremely affordable at grid-scale and is being installed rapidly in many countries. But as with the trajectories of other renewable energy (RE) sources in socio-technical low-carbon transitions [7], its widespread material uptake is subject to complex negotiation and innovation processes within multi-level governance frameworks. The sheer scale, pace, diversity and spatial spread of deployment are challenging for researchers and policymakers to keep up with while maintaining focus on both persistence and continuity and seeking out balanced, aligned pathways [8]. Indeed, scholars have begun to utilise a variety of approaches to study socio-technical transitions [9]. Notably, a historical institutional approach argues that the very rules that shape how actors interact and are embedded in networks determine whether any actors have sufficient incentive or capacity to make a shift in favour of renewable energy [10]. Here the literature has emphasised the importance of the number of veto players, path dependency and lock-in, endogenous shocks, and power differentials in helping to elucidate both how institutions persist and why and how there might be institutional change. Yet much of this early literature attends to energy transitions in industrially advanced countries. For instance, the approach has been employed to account for divergent energy transitions among advanced industrial economies, focussing on the UK [10]. Cherp et al. [11] combine a focus on political institutions with an analysis of social movements (and broader public

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[1] Renewable Energy Policy Network for the 21st Century (REN21). "Renewables 2017 Global Status Report." http://www.ren21.net/status-of-renewables/global-status-report/.

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sentiments), and the role of technology diffusion to explain differential energy transitions in Germany and Japan.

The conditions facing lower incomes countries, however, are markedly different from what obtains in the majority of the cases examined in the above scholarship. Historical analyses of socio-technical change, such as work on the socio-politics around urban energy infrastructure in European capitals during the 19th [12] and 20th [13] centuries, bring out the pertinence of factors such as political instability and populism. These can help explain energy transitions in developing countries today. Moreover, these issues continue to have pressing relevance for marginalised regions within unevenly developed contexts such as Europe, as a burgeoning literature on energy poverty attests [14]. In the context of low income countries, there is a need to adapt energy transition theories to also take into account the incomplete nature of electrification, low purchasing power of many current and potential consumers, the need for ongoing infrastructure expansion, supply-demand imbalances, and partial or uneven liberalisation that leaves the state in a role of preponderant authority [15]. The sort of ethnography of infrastructure envisaged by Star [16] is feasible for some of these developments – e.g. off-grid solutions in remote communities [17] – but the current juncture necessitates asking what frameworks and emphases research should prioritise. How can we best contribute towards the urgent task of harnessing abundant affordable solar energy through infrastructural development that not only secures clean energy futures but also contributes to greater socio-economic equity? The rise of renewables is perhaps the greatest economic shift that will take place in the current era of economic development; not considering its multivalent potential to effect positive environmental and social change alike would be an opportunity missed (also see [18]).

As we understand it, the big challenge for Global South countries is to ensure that energy transitions advance rather than undermine the ongoing efforts to expand energy security and energy equity. To this end, we find it useful to selectively adapt the literature on energy justice, which has primarily been applied to the global, cross-national negotiations and debates around climate change mitigation efforts, to such country contexts, taking India as an example. This is not to gainsay the rich scholarship on energy poverty, which does employ a justice lens at both urban and national levels; however, this literature has been primarily situated in the Global North so far. Energy justice has a multi-pronged focus on issues of equity, affordability, and procedural fairness (cf. [19]). When combined with a political economy of energy transitions, it helps makes sense not only of how, when, and why energy transitions take place, but provides a useful normative yardstick by which to judge whether energy transitions are contributing meaningfully to energy security and equity [20]. Roadmaps for more comprehensive treatment of energy justice within transitions scholarship are increasingly proliferating [21].

The version of an energy justice framework we propose using here is not dissimilar to that employed by Bickerstaff et al. [22] to unpack climate justice. It features three dimensions to inform decision-making by energy planners [23] and is adapted to the multi-level Indian energy policy and institutional context introduced in the following two sections. The first two dimensions relate to aspects of distributive justice, namely affordability and equity. Considering affordability at multiple levels includes questions of national solar investments and subsidies, state sectoral finances, and incentives for solar uptake including infrastructural investment for businesses, communities and households. Equity includes not only the allocation of both costs and benefits across stakeholders but also issues of energy access, mindful of the universal supply obligation of public electricity distribution companies. The third dimension is concerned with procedural justice, and revolves around issues of inclusion and participation, especially in policymaking and in terms of stakeholders' agency to influence the trajectory of solar energy infrastructure.

Wedding such an energy justice perspective with a historical institutional approach to energy transitions premised on solar energy infrastructure development can lead us to a political economy of energy transitions that attends to the wide range of energy security and access considerations that are closely intertwined with change in developing country contexts. In order to make headway on implications for energy justice, it is crucial to unpack how socio-technical change and regional political economies are recursively modulated within multi-level institutional structures that are themselves witnessing potential reconfiguration. For this purpose, the next section lays out the institutional setup at the national and state level in India, underscoring the relevance of energy federalism for contextualising our analysis of energy transition. We capture the dynamics of India's federal politics that form the larger context in which India's RE policy emerges. The subsequent section builds on this by introducing the two sub-national regions that constitute our cases within India, and explains how their political economies have vital import for regional outcomes pertaining to energy transitions. Our focus on the trajectory of RE development in two western Indian states, Rajasthan and Gujarat, highlights how regional particularities and path dependence have shaped the emergence of RE in those states, often in ways that run counter to both expected and hoped for results. The fourth section briefly apprehends the question of energy justice in the light of these multi-level historical institutional and political economic explanations. We posit that the idea of energy justice constitutes a way to evaluate whether solar power is best serving the multi-pronged needs of climate justice, economic development, and social equity, and use its dimensions to identify some key focus areas for energy security and equity.

A concluding section then reflects on the contribution that integrating an energy justice perspective can make to national and regional energy infrastructure development planning. We argue that such analyses, when done in a manner that is cognisant of multi-level institutional structures and decision-making processes linked with regional political economies, can direct emphasis towards issues pertinent for countries' equitable energy futures. By combining these two perspectives – a political economy of RE that accounts for the political and institutional factors that condition the growth of solar capacity with the normative arguments embedded in the energy justice literature – we hope to contribute to a growing understanding of the intersection of solar power and development. Our cases signal the need to attend to questions of scale and spatial development in order to realise the true potential of solar 'power', not merely as a shift to cleaner sources but as an opportunity to enable more secure and equitable energy futures.

2. Energy federalism

Over the last several years, the Indian central government has become an ever more vocal champion of India's green future, setting ambitious targets and publicising India's accomplishments in international fora: in 2017, it joined the International Energy Agency.[2] The present Indian government, led by Prime Minister Narendra Modi, has made the ambitious pledge to develop 100 GW of solar energy by 2022 [73]. In 2016, installed capacity grew by 5 GW, and growth in 2017 is expected to cross 9 GW. As of the end of 2017, the country had topped 16 GW in total installed solar capacity.[3] These are outstanding figures when one considers that global solar capacity in 2010 was approximately 40 GW. By comparison, China boasted approximately twice that by itself in 2017. Thus, China is moving away from a coal trajectory at great speed, while the Indian power sector has just woken up to this possibility: tens of GW of Indian coal-powered generation were cancelled or became financially unviable in 2017.[4]

[2] Singh, Kartikeya. "India's power surge: A paradox of plenty?" Commentary, Washington DC: Centre for Strategic & International Studies, 16th May 2017. https://www.csis.org/analysis/indias-power-surge-paradox-plenty.

[3] Ministry of New and Renewable Energy, "Tentative State-wise break-up of Renewable Power target to be achieved by the year 2020." http://mnre.gov.in/mission-and-vision-2/achievements/.