



# Social equity impacts in Japan's mega-solar siting process

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## ABSTRACT

Japan's energy market has seen the siting and construction of over 2800 new mega-solar power plants since the introduction of the Feed-in Tariff policy in 2012 (Kitamoto, 2017). While scholars have highlighted the potential for community-engaged renewable power development with social benefits for local residents, many major mega-solar projects have instead resulted from industry-led initiatives in locations, largely avoiding community engagement. In this study, we draw from distributive energy justice perspectives to analyze social equity impacts of the mega-solar siting process. We employ qualitative content analysis on 29 survey responses from local officials around Japan's 200 largest mega-solar plants constructed since 2012 and contextualize results through 18 interviews with relevant actors in six case studies. We find that given the existence of the Feed-in Tariff and sufficient solar irradiation, the availability of underutilized land decreases community bargaining power compared to historical power plant siting agreements. This results in primarily land leasing benefits and municipal tax revenue with minimal additional social impacts, such as employment. We outline a model of causation for mega-solar social equity impacts, Japanese policy implications, and directions for future quantitative research.

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## Introduction

Japan's Feed-in Tariff (FiT) policy has provided incentives for the siting and construction of over 2800 new mega-solar power plants ( $\geq 1$  MW) since its introduction in 2012. The FiT has made distributed, low density power generation technologies such as solar major players in land transactions across the rural communities on the land-scarce Japanese archipelago. This surge is helping the country move towards its 7% solar photovoltaic power goal and its 22–24% overall renewable power goal for 2030 (Agency for Natural Resources and Energy, 2016). In just five years, mega-solar has upended Japanese renewable power policy. FiT subsidized guarantees on renewable energy (RE) sales have forced some utilities to stop accepting new project applications lest they overwhelm the grid, which does not prioritize purchasing electricity from RE sources. Meanwhile, some companies have gamed the market by selling pre-constructed, FiT-subsidized mega-solar plants to the highest bidder because of their lucrative potential as subsidized plants (Yumae, 2016).

Scholars have heralded RE projects as a boon for rural economies, speculating that RE can improve social equity at a time when such communities are losing people, income, and social capital. However, Japanese RE lacks the thorough (and at times problematic) compensatory subsidy system provided for siting coal, hydro, and nuclear power plants. This raises questions about the form and degree of impact that

mega-solar developments have on host communities under current Japanese policy. We pursue the following questions in this paper: 1) What are the most important social equity impacts of mega-solar power policy? Furthermore, 2) What causal factors explain the resulting variation in social equity outcomes for host communities?

In this paper, we identify social equity outcomes and their causes in 29 cases selected from Japan's 200 largest mega-solar power plants. We do so by implementing qualitative content analysis (QCA) on survey responses from local government officials in communities hosting these projects along with interview responses from 15 relevant actors in mega-solar host communities in Kagoshima, Hyogo, Aichi, Shizuoka, and Hokkaido Prefectures (see Fig. 1). Finally, we trace the causation process between siting factors and social equity impacts in one representative case study.

We find that despite their diffuse benefits to society through CO<sub>2</sub> reduction, mega-solar power plants generate few concentrated local benefits for communities. Projects provide rent income to local landowners and property tax to local governments with limited employment or population impacts. These occur because companies empowered by the FiT construct plants on underutilized land plots abundant throughout rural Japan. This abundance and lack of additional regulatory processes limit host communities' bargaining power to demand compensation and instead sometimes lead towns to compete to attract companies.

Below, we review existing scholarship on social equity issues in Japanese energy policy, identify QCA outcomes, and clarify causal mechanisms that link specific siting conditions to social equity outcomes.

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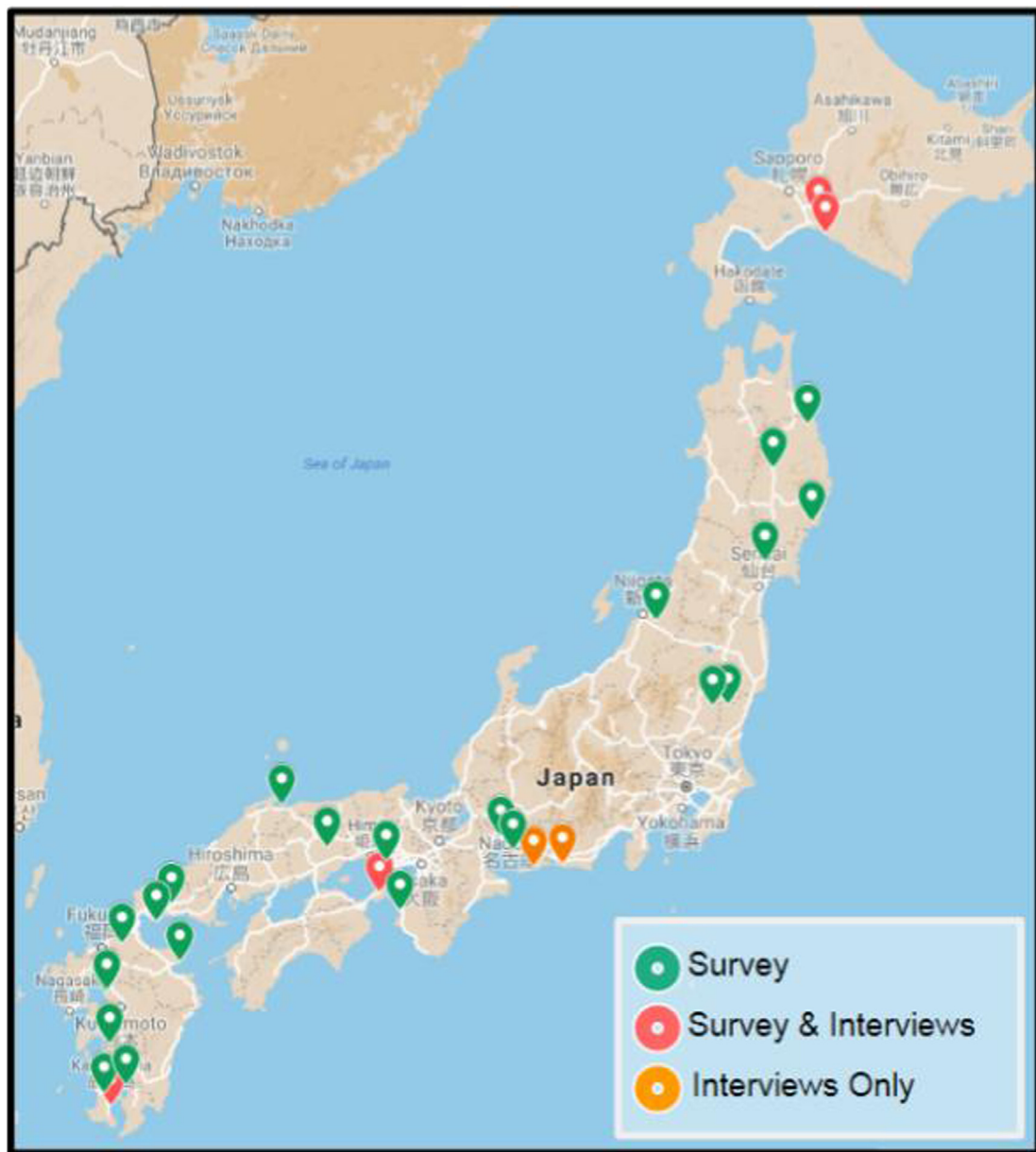


Fig. 1. Mega-solar power plant host communities assessed.

### Literature review: social equity impacts

This paper focuses on social equity impacts of Japanese mega-solar siting. Social equity refers to the degree to which a municipality evenly distributes the benefits and burdens of urban planning policies (such as power generation), respects human rights, and does not put anyone's health at risk (Campbell, 1996: 297). Social equity remains an important aspect of energy transitions and energy policy sustainability, however, when compared to environmental and economic aspects it remains the least investigated and the least well understood (Ikeme, 2003; Tol, 2001). Traditionally, although environmental and economic evaluations within sustainability have been of a quantitative nature, social aspects have largely been evaluated from a qualitative point of view (Chapman et al., 2016a) making the evaluations non-fungible with their environmental and economic counterparts (Fthenakis and Kim, 2009; Hernandez et al., 2014). Recent academic research has made significant headway in resolving this issue, both in addressing issues in energy between the factors of sustainability and policy (Heffron, McCauley, & Sovacool, 2015) and notably through the development of a quantitative,

holistic energy policy sustainability evaluation framework (Chapman et al., 2016a) which accounts for the environmental, economic and social aspects of sustainability across a variety of evaluative scales (national, regional, local etc.). This research builds on the ideals of the quantitative incorporation of social aspects into the energy policy debate through the identification of important common social equity impacts and their importance, through multiple methods including survey, field work, interviews and subsequent analysis. In addition, the positive societal impacts engendered through proactive energy policy sustainability assessment are recognized in the design of this research (Chapman et al., 2016b).

We ground our study of social equity in the growing social science research agenda of energy justice. Past scholarship of energy transitions internationally has employed energy justice as an analytical and decision-making tool for assessing competing demands between energy finance, energy security, and climate change mitigation efforts in energy supply chains and security (Heffron et al., 2015; Heffron & McCauley, 2014) and for identifying problematic values in energy consumption patterns (Sovacool & Dworkin, 2015). Our approach

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