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Public attitudes regarding large-scale solar energy development in the U.S.

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ABSTRACT

Using data collected from both a National sample as well as an oversample in U.S. Southwest, we examine public attitudes toward the construction of utility-scale solar facilities in the U.S. as well as development in one's own county. Our multivariate analyses assess demographic and socio-psychological factors as well as context in terms of proximity of proposed project by considering the effect of predictors for respondents living in the Southwest versus those from a National sample. We find that the predictors, and impact of the predictors, related to support and opposition to solar development vary in terms of psychological and physical distance. Overall, for respondents living in the U.S. Southwest we find that environmentalism, belief that developers receive too many incentives, and trust in project developers to be significantly related to support and opposition to solar development, in general. When Southwest respondents consider large-scale solar development in their county, the influence of these variables changes so that property value, race, and age only yield influence. Differential effects occur for respondents of our National sample. We believe our findings to be relevant for those outside the U.S. due to the considerable growth PV solar has experienced in the last decade, especially in China, Japan, Germany, and the U.S.

Contents

1. Introduction

The need for sustainable energy production has become increasingly apparent in recent years. The U.S. ranks 11th in energy

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use per capita and 2nd in overall energy use (World Bank)[1]. With the majority of U.S. energy derived from fossil fuels and the majority of greenhouse gases coming from the burning of fossil fuels for energy, the possibility that renewable resources may help meet our energy needs and simultaneously mitigate climate change is increasingly salient. Rising levels of greenhouse gases and subsequent impacts on climate hasten the necessity for renewable energy technologies such as solar energy to replace CO_2 emitting ones. However, public concern over the environment has fallen, reaching a 20-year low in 2010 [35], though a majority of the public still believes that global warming is real, imminent, and the result of human behavior [66].

While utility-scale solar electricity generating facilities are not yet widespread in the U.S., solar energy is a promising source of energy to help alleviate the growing dependence on fossil fuel-based energy. The U.S. Energy Information Administration forecasts solar electricity generation to increase by almost ten percent annually through 2035 ([28], p. 90). Studies suggest that most of the American public supports solar energy development and the public is willing to pay more for clean energy production in order to decrease the production of energy from fossil fuels [31]. The Obama administration has vowed to make renewable energy a larger portion of the nation's energy portfolio, as evidenced by its work to establish 17 solar energy zones in six Southwestern states —California, Nevada, New Mexico, Arizona, Utah, and Colorado [16]. Still, even with widespread and growing support toward solar, development of utility-scale solar is often stymied due to a variety of obstacles including cost, efficiency, and regulations [58].

The President's renewable energy policies are not without controversy, mostly due to the expedited nature of the permitting process. Many environmental and conservation groups worry about the impacts of solar facilities on rare desert plants and animals [16]. In the San Luis Valley of Colorado, local residents sided with environmental groups to oppose a concentrated solar power (CSP) facility due to the impact the project would have on the local ecosystem, especially with regards to transmission line siting, and despite recognizing other benefits of solar power for the environment [30]. This example is not an isolated case; despite widespread support for renewable energy, including solar, specific projects are often met with strong opposition (Klick and Smith [50]). As Devine-Wright states, "It is widely recognized that public acceptability often poses a barrier towards renewable energy development" (2005, p. 125). Thus, a fundamental aspect of developing and expanding renewable energy such as solar is to understand factors affecting public attitudes toward the resource in general, as well as those perhaps specific to place and geography.

This research focuses specifically on the public's attitudes toward utility-scale[2] solar energy development in the U.S. First, we consider the level of support for utility-scale solar energy development both generally and in terms of proximity between the proposed project and the location of the respondents. Second, we discuss and assess the factors associated with greater support or opposition to large-scale solar development, again considering proximity of proposed project and geographic location of the respondents. We utilize data from both a U.S. National telephone survey with an oversample of residents in five southwestern states (Utah, Arizona, California, New Mexico, and Nevada). These states were selected because they are likely to have large-scale solar facilities due to the sheer abundance of sunlight as well as the specific topographic requirements (flat terrain, low foliage cover) of utility-scale solar facilities.

2. Previous research

Scholarly attention regarding public attitudes towards energy development is not new, especially in the U.S. and Western Europe ([3,4,69,74,77,84]). Moreover, scholarly attention on public attitudes toward wind and wind siting controversies, more specifically, has grown in recent years ([6,53,50,51,73,82,81,78,79]). Overall, studies demonstrate that respondents generally support renewable energy development ([6,20,44,75,79]), especially when compared to other energy sources such as nuclear [55]. While the public's support of renewable energy has been found to increase with upticks in gas prices, support for renewable energy has been mostly stable, except for a recent dip in overall support between 2011 and 2013 ([34,55,67]) as well as a drop in support for government funding towards alternative energy, especially among Republicans [62]. Among different renewable energy types, solar tends to be the most positively regarded ([34,36]); and wind to be the most polarizing [21]. However, few studies in any countries examine public attitudes towards utility scale solar energy development by itself [10,15].

Much of the existing scholarly research considering support or opposition to energy sources focuses on support for that energy source in a specific location [10,15]. As a result, there is a great deal of literature that considers opposition to nuclear, wind, or coal in terms of a NIMBY (Not In My Backyard) framework. Dear [19] defines NIMBYs as "residents who want to protect their turf. More formally, NIMBY refers to the protectionist attitudes of and oppositional tactics adopted by community groups facing an unwelcome development in their neighborhood" (p. 288). However, the NIMBY approach is not without critics. Current scholars consider it a pejorative and rather simplistic label that homogenizes opposition. In fact, the NIMBY theory suggests that opposition is based on ignorance or irrationality but scholars have actually found that opposition can be both very informed [61] and rational [37]. Moreover, NIMBY fails to explain opposition for projects by locals based simply on proximity [47]. More recent literature on support and opposition of renewable energy looks beyond NIMBY and considers a variety of other explanations built upon a psychological environmental theoretical framework. Thus, such research considers the relationship between support and opposition to renewable energy and demographic factors, socio-psychological factors (knowledge, direct experience, environmental and political beliefs, place attachment); and contextual factors (technology type and scale, institutional structure, and incentives). Specifically, research results show support and opposition toward renewable energy vary according to demographic variables such as age, income, education, and gender ([33,52,87]). Devine-Wright [23] cites several studies conducted in the UK that demonstrate the significant impact of age on support for renewable energy, although there are contradictory findings regarding the nature of the relationship. For example, older individuals are more opposed to or less willing to pay for renewable energy than younger individuals ([59]; see also [60,75,85]) while other studies find a U-shaped relationship where both younger and older respondents as less opposed to renewable energy than are middle-aged cohorts. Still others show older respondents are less opposed to nuclear energy than are younger respondents ([64]; ICM Research for BBC Newsnight 2005). Research considering the impact of sex also produces mixed results. While some research finds women to be more environmentally concerned [57] and supportive of renewables than men, men tend to demonstrate greater awareness and greater support for solar, nuclear, and wind ([12,17]; Department

[1] World Bank data are from 2012 as 2013 data are incomplete.

[2] Large-scale solar facilities or utility-scale solar facilities are different from residential rooftop solar, solar panels on commercial or public buildings, and widespread installation of panels on public infrastructure such as utility poles. For the purposes of this study, each large-scale solar facility is intended to power thousands of homes and businesses, requiring significant land-coverage in the hundreds or thousands of acres per project, depending on specific installation size.