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Utility-scale solar and public attitudes toward siting: A critical examination of proximity

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ABSTRACT

Public opinion polls show that the American public strongly supports the development of large-scale solar power facilities. Yet, often with renewable energy development, when specific developments are proposed, they are met with local opposition. In the past, many scholars relied upon explaining such opposition in terms of a NIMBY (Not In My Backyard). However, NIMBYism is criticized as an overly simple, incorrect, and pejorative characterization of opposition. Yet, while some criticize NIMBY explanations, other research demonstrates that distance indeed matters. Research also demonstrates that place attachment, socio-demographic characteristics, and project-related characteristics also matter. Our study integrates these different factors to better understand the nature of support for large-scale solar developments. Specifically, we consider visual impact of large-scale solar facilities and what effects distance between different types of land and the proposed solar facility might have on public support. Therefore, we examine proximity but not just proximity to one's residence but rather to different *types* of land. Our data are from a 2013 telephone survey (N = 695) from six Southern Californian counties (Inyo, Kern, Riverside, San Bernardino, San Luis Obispo, and Ventura), selected based on existing and proposed solar developments in those areas and available suitable land. Findings suggest that the visual impact of large-scale solar facilities does matter for support and that preference for buffer sizes, and thus proximity of proposed large-scale solar facilities, do change depending on the type of land being considered.

1. Introduction

In March 2015, the U.S. Energy Information Administration (EIA) released a report announcing California as the first state to generate more than 5% of its electricity from utility-scale solar (EIA, 2015). Solar power is growing and especially so in California. In fact, in 2014 California generated 9.9 million megawatt-hours (MWh), which was a 6.1 million MWh increase over 2013 figures (EIA, 2015). This growth in solar energy production in California is largely the result of new utility scale facilities including Topaz, Desert Sunlight, Ivanpah, and Genesis. The sheer growth in solar is greatly attributed to state policies including state renewable portfolio standards (RPS) and incentives (rebates and net-metering policies). Both policies and geo-physical conditions have led to the growth in solar production in states other than California. Arizona and Nevada have experienced an increase in solar production due to their obvious solar resources and New Jersey and Massachusetts as a result of their state RPS. More importantly, growth in solar production is not contained to the U.S. With the more recent decrease in the cost of solar system manufacturing, Photovoltaic (PV) systems have experienced considerable growth since 2003, not only in the U.S. but also in China, Japan and Germany, especially.

In terms of renewable energy (RE) resources, while utility-scale solar electricity production trails behind wind, it is still a promising source of energy to help alleviate the growing dependence on fossil fuel-based energy. In fact, the EIA forecasts solar electricity generation to increase by almost ten percent annually through 2035 (EIA, 2012, p. 90). Moreover, the data on public opinion suggests that an overwhelming proportion of Americans support solar energy development (Carlisle et al., 2014, 2015; Farhar, 2003) and the public is even willing to pay more for clean energy production (Farhar, 2003). As well, the 17 solar energy zones in six Southwestern states–California, Nevada, New Mexico, Arizona, Utah, and Colorado (Cart, 2012) demonstrates the Obama administration's

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efforts to deliver on its promise to make renewable energy a larger portion of the nation's energy portfolio.

President Obama has made policy advances regarding the greater use of RE. However, these policies are often met, even among pro-RE groups, with criticism due to the expedited nature of the permitting process. Environmental and conservation groups are concerned about the impact of solar facilities on the ecosystem, and so despite widespread support for RE development in general, including solar, specific projects are often met with strong opposition (Klick and Smith, 2009). While large-scale solar developments are likely to occur away from people's neighborhoods to more remote areas where geographic and solar attributes are enhanced, public opposition still exists. Thus, a fundamental aspect of developing and expanding solar is to understand factors affecting public attitudes toward the resource in general, as well as those specific to place and geography.

This research considers public attitudes toward utility-scale PV solar development.[1] While much of the research on proximity examines distance in terms of distance between a facility and one's home, our research also considers respondents' preferred distance between a proposed large-scale PV solar facility and different land-types. In particular, we consider the effect of socio-demographic and place attachment predictors on support for large-scale solar developments in terms of land-type (e.g. agricultural land, recreation areas, wetlands, wildlife migratory routes, etc.). Our findings demonstrate that support is dependent on several socio-demographic and place-related predictors. Additionally, support is also related to how respondents perceive the solar facility will visually impact the landscape. Finally, we find that preferred buffer distance between a proposed utility scale solar facility changes depending on the proximity between a proposed facility and the type of land. Therefore, [buffer] size does matter.

2. Previous research

Many scholars have measured public attitudes towards energy development in the U.S. and Western Europe (Ansolabehere 2007; Ansolabehere and Konisky 2009; Sovacool 2009; Van der Horst 2007; Walker 1995; Wüstenhagen et al., 2007; Wolsink and Bürer, 2007), much of it with regard wind energy projects and controversies (see Bell et al., 2005; Ladenburg, 2008; Klick and Smith, 2010; Krohn and Damborg, 1999; Swofford and Slattery, 2010; Wolsink 2000, 2007; Warren et al., 2005; Warren and McFadyen, 2010). Overall, research demonstrates that respondents generally support RE development (Bell et al., 2005; Devine-Wright, 2005; Klick and Smith, 2010; Warren et al., 2005; Wolsink, 2000), especially when compared to other energy sources such as nuclear (McGowan and Sauter, 2005). While support for renewable energy tends to ebb and flow with fluctuations in gas prices (increased support for RE increase with upticks in gas prices), it has remained relatively stable (Gallup, 2013; McGowan and Sauter, 2005; Smith, 2002), except for a recent dip in overall support between 2011 and 2013 (Gallup, 2013). In addition, public support for government funding of alternative energy projects has recently declined, especially among Republicans (Pew, 2012). Among different RE types, solar tends to be the most positively regarded (Gallup, 2013; Greenberg, 2009); and wind to be the most polarizing (DTI Scottish Executive et al., 2003). However, few studies in any countries examine public attitudes towards utility scale solar energy development by itself, although work by Carlisle et al. (2014, 2015) has certainly made a contribution in this area.

In terms of local planning and development, research demonstrates that while general support for RE is often widespread, opposition to specific facility proposals exists. Resistance to the Cape Wind Project, which was proposed for construction on Horseshoe Shoals in Nantucket Sound near Cape Cod, Massachusetts, is a notable example. Notwithstanding, scholars have begun to move away from the NIMBY explanation, due to criticisms that NIMBY is pejorative, oversimplified, and tends to consider opposition in selfish or irrational terms or the result of ignorance. Rather, scholars have found that opposition can be both very informed (Michaud et al., 2008; Petts, 1997) and rational (Gross, 2007). In particular, more recent literature looks beyond NIMBY and considers a variety of other explanations built upon a psychological environmental theoretical framework, finding that variation in support and opposition for specific facility proposals is quite nuanced. Thus, such research considers the relationship between support and opposition to RE 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).

Recent research indicates that support and opposition toward RE varies according to demographic variables including age, income, education, and gender (Firestone and Kempton, 2007; Ladenburg, 2009). Devine-Wright (2008) cites several studies conducted in the UK that demonstrate the significant impact of age on support for RE, 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 RE than younger individuals (MORI Social Research Institute for Regen SW, 2003; see also Ottman and Herbert, 1993; Vorkinn and Riese, 2001; Zarnikau, 2003) while other studies find a U-shaped relationship where both younger and older respondents are less opposed to RE than are middle-aged cohorts. Still other studies find older respondents are less opposed to nuclear energy than are younger respondents (Populus, 2005). Similarly, research considering the impact of sex on support for RE projects is mixed. While some research finds women to be more environmentally concerned (Mohai, 1992) and supportive of renewables than men, men tend to demonstrate greater awareness and greater support for solar, nuclear, and wind (Brody, 1984; Corner et al., 2011; Department of Trade and Industry, 2003DTI Scottish Executive et al., 2003; Klick and Smith, 2010). Income and class have both been found to be positively correlated with support for renewable, nuclear, and wind energy (Corner et al., 2011; Firestone and Kempton, 2007; MORI Social Research for Regen SW, 2004).

Place attachment is a collective orientation that describes the process of becoming attached to an environmental setting (Vorkinn and Riese, 2001). Moreover, place attachment allows that this orientation need not be exclusively positive. Manzo (2003, 2005) characterizes place attachment as a positive connection with what is familiar, such as home or neighborhood, and others link place attachment to length of residence (Ahlbrandt, 1984; Taylor, 1996). For environmental psychologists, place-identity relates to the dimensions of self that develop through interaction with the environment via beliefs, preferences, feelings, values, etc. (Proshansky et al., 1983). When change is proposed to a place, it can be perceived as a "disruption" or "threat" and can be met with action in order to preserve the community or neighborhood to which individuals are likely closely attached. Threats or disruptions to place attachment can result from development, crime, neighborhood decline, and even natural disasters (Brown and Perkins, 1992). Individuals develop a sense of place from the environmental experiences

[1] 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.