Exploring Attitudes Towards Industrial Solar with Undergraduate Researchers in the Mojave Desert

Jennifer Bernstein; jennifer.bernstein@gmail.com
Texas Tech University, Lubbock, TX, USA

Abstract: This research project engaged undergraduate students in examining attitudes towards solar development in the Mojave Desert, integrating spatial analysis with surveys, interviews, and field observations. Findings suggested the need for further systematic data collection on solar attitudes in the Mojave, especially is it relates to proximity. The project highlights the value of an interdisciplinary approach in fostering an authentic and meaningful learning experience.

Keywords: Solar energy; Mojave Desert; Environmental attitudes; Undergraduate research; Interdisciplinary research

1. Introduction

In the United States, solar energy has evolved from an early-stage technology to a continually growing, economically viable industry. Almost 50 GW of solar capacity was installed in 2024 (SEIA 2024), and 69% of adults surveyed favored the expansion of clean energy over further development of the fossil fuel industry (Kennedy et. al 2023). Despite current political circumstances, solar's trajectory indicates that it will constitute an increasingly significant component of the U.S. energy portfolio (DOE 2021).

Developers identify promising locations for solar installations through site suitability analyses[1]. This process overlays elements such as slope, aspect, and zoning, on a base map, narrowing down feasible locations. However once sites are deemed technically optimal and their development has been initiated, they often face resistance, delays, and abandonment by residents and other stakeholders (Hunold 2013). Concerns include property values, noise, traffic, economic impacts, and the character of the desert landscape, all of which cannot be written off as NIMBY("Not in my backward")ism. Thus, siting industrial solar developments will include both technical analysis of the site itself, as well as understanding the attitudes and motivations of local residents and other relevant stakeholders.

For industrial solar siting projects to be truly successful, they must generate electricity responsibly while addressing the concerns of residents and other relevant stakeholders, including flora and fauna. To achieve this, there must be scholars and practitioners who can integrate landscape assessment with social analysis. To that end, undergraduate researchers, selected through the University of Southern California's Undergraduate Research Associates Program (URAP), engaged in interdisciplinary inquiry, integrating

[1] This research applies to both utility- and industrial-scale solar. Utility-scale projects supply power to the grid, while industrial-scale systems serve large facilities. As the focus of the research is *not* the attitudinal differences towards each, "solar installations" serves a stand-in for both.

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spatial analysis, surveys, interviews, and participatory mapping. Students were encouraged to link ecological, social, and technical considerations to better understand why stakeholders held the positions they did, as well as identify points of contention. After the project was completed, both students went on to receive awards, present at conferences, and successfully apply to graduate school. But most importantly, their own personal accounts demonstrated that this had been an authentic and meaningful learning experience.

2. Background

The Mojave Desert, located primarily in southeastern California, is ecologically defined by the range of the Joshua tree (*Yucca brevifolia*). Despite its aridity, it supports more than 2,000 plant species and up to 700 animal species. Species of special concern include the Mojave Desert tortoise (*Gopherus agassizii*), threatened by habitat loss, predation, disease, and drought, and the Joshua tree, which is highly vulnerable to climate change due to its lack of fire adaptation, temperature-sensitive seeds, and dependence on large, contiguous habitats. These species, and many others, underscore the ecological distinctiveness and fragility of the Mojave Desert.

Given the susceptibility of the region to climate change, one macro-level solution is to transition to low-carbon energy sources. Solar power plays a central role in this shift, with 895 utility-scale facilities currently operating in California (Weaver 2015). And while many solar installations have been developed with limited opposition, others have been delayed or blocked due to public resistance. Despite abundant anecdotal evidence, there has been relatively little systematic academic social science research on stakeholder attitudes toward solar development in the Mojave Desert (exceptions include Honold 2013, Bernstein et. al 2021). Findings from other research projects suggest that public support for solar development is influenced by visual impacts, proximity to surrounding land uses, and the type of land nearby (e.g., residential areas, recreation spaces, or sensitive habitats) (Carlisle 2016). There is a need for further research examining these attitudes to support a more equitable and transparent solar siting process in the context of the Mojave.

While the topic of solar siting is of critical importance, the central goal of this project was to train students to approach issues like solar installations through an interdisciplinary lens. The approach to research emphasized the value of integrating methods across fields, since addressing complex, real-world environmental problems often requires more than specialization alone (Hicks et. al 2010). While the project provided preliminary suggestions for further research, it focused less on formal social science data collection and more as a vehicle for undergraduate research training.

3. Methods & Approach

From 2019 to 2021, this project was conducted through USC's Undergraduate Research Associates Program (URAP) via the Spatial Science Institute (SSI). From 2019 to 2021, students in USC's URAP conducted spatial analysis with ArcGIS, interviews (n = 9) via phone and videoconference, and an online convenience survey (n

= 106) on perceptions of solar development in the Mojave Desert. Field activities included site visits to energy installations in 2019–2020, and virtual engagement during COVID-19. At the completion of the project, both students completed open-ended questions designed by the Primary Investigator to reflect on their experiences. Our effort to assess representative county-level attitudes toward industrial-scale solar was unsuccessful. Conducting a demographically representative survey was cost-prohibitive, so we attempted to interview county representatives as a proxy for their constituents. Despite repeated follow-ups over several months, only one response was received. This was likely due to limited bandwidth, incomplete knowledge as to their constituency's perspectives on solar, and other constraints.

4. Results

4.1 Solar attitudes

The survey results indicated that acceptance of solar installations at varying proximities depends on the proposed land use for the site, a pattern consistent with previous research (Carlisle 2016). Survey responses indicated that residential solar was generally acceptable near homes, while industrial-scale projects faced more opposition when close to residences. Respondents also highlighted the importance of avoiding ecologically or socially sensitive areas, including wetlands, wildlife habitats, migration corridors, and recreation sites. Spatial analysis by zip code showed higher favorability for solar in geographically distant, less urbanized areas and lower support in urban regions. Detailed results can be found in Bernstein et. al 2021.

4.2 Student learning

Each student developed their own perspective by the conclusion of the project. One student became highly skeptical of industrial-scale solar development due to its impacts on local flora and fauna, namely the desert tortoise, while the other focused on how residents were often more concerned about corporate influence than solar projects themselves.

Both students reported improvements in critical thinking and interdisciplinary skills, stating that using multiple methods improved their ability to integrate knowledge across disciplines. They also reported strengthening their understanding of social science research methods, including survey and interview design, and one student highlighted improving science communication skills through conference presentations and engaging with stakeholders. Although the effort to assess county-level attitudes toward solar did not achieve its intended goal, it offered students a valuable lesson in methodological design, pilot testing, and troubleshooting, while highlighting how seemingly feasible data collection approaches can face unanticipated barriers.

Project-related accolades received by the undergraduates included the USC Discovery Scholar award, a USC Schwarzenegger Institute prize, and a USC SSI undergraduate research award. Both students were accepted to leading academic conferences and prestigious graduate programs.

5. Conclusions

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Understanding attitudes toward industrial-scale solar is essential for addressing climate change, not only in the Mojave but in any region attempting to balance clean energy expansion with ecological and social concerns. The attitudinal data collected in this project was limited, largely relying on convenience samples or pre-existing datasets and thus constraining generalizability. Future work should prioritize systematically collecting demographically representative data, which would be possible with more funding and support. Despite the limitations of the collected data, the project successfully cultivated the students skill sets, including interdisciplinary thinking, troubleshooting, and critical observation. Even without the accolades received by the student researchers, it is clear that this project provided meaningful and authentic educational outcomes, and could perhaps achieve similar goals elsewhere.

This project demonstrated the value of training students in the skills needed to collect and interpret social science data for environmental problem solving. While the attitudinal data was limited, students gained hands-on experience with data collection, interpretation, and stakeholder engagement. Programs like the USC URAP equip undergraduates with interdisciplinary expertise and social awareness that are transferable across academic, governmental, and private sector contexts. Supporting and expanding projects of this kind will help prepare the next generation to address complex environmental challenges, especially those related to clean energy development.

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