Identifying Key Development Regions for Rooftop Solar on Multifamily Housing Complexes in the United States

A Bren Group Project Proposal | Winter 2022-Spring 2023

UC SANTA BARBARA
Bren School of Environmental Science & Management

ZNE | CAPITAL

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OBJECTIVES

This group project will identify key regions for rooftop solar on multifamily housing complexes that Zero Net Energy (ZNE) Capital can expand into. ZNE Capital is a real estate platform that acquires multifamily housing, installs solar panels and energy storage, and rents apartments at affordable rates. ZNE Capital is able to front the installation costs and technical hurdles to installing rooftop solar to bring residential solar to the masses. Key regions will be determined based on solar irradiance, demographic trends, utility net metering policies, state landlord policies, historic energy demand and cost. ZNE Capital, develops an internal scorecard based on these and other metrics to evaluate each potential investment property. This group project will focus on gathering and evaluating data for these metrics in order to recommend 10 geographic regions for ZNE Capital to expand into. Skills and knowledge required for this group project include: GIS, data analysis, financial analysis, energy policy, and basic knowledge of rooftop solar systems.

SIGNIFIGANCE

Climate change is one of the greatest challenges of our generation, and we must quickly transition to renewable energy to curb emissions and mitigate the worst effects. Residential buildings, including multifamily housing complexes (apartments, condos, and townhouses), account for 37% of U.S. electricity sales.[1] Installing rooftop solar on multifamily housing increases access to renewable residential energy and reduces strains on the electrical grid by producing electricity where it is consumed. This is in contrast to most residential solar installations, which are currently on wealthy single-family suburban homes; and to solar farms, which are typically located far from population centers. Many traditional landlords of multifamily housing do not see the opportunity and importance of rooftop solar in both lowering operating costs and reducing greenhouse gas emissions. Furthermore, they often do not know how to install rooftop solar or lack the capital to do so. ZNE Capital aims to alleviate this problem by purchasing multifamily housing complexes, installing rooftop solar on them, and renting apartments at affordable rates to tenants. ZNE Capital's expertise in renewable energy financing, rooftop solar installation, and multifamily unit real estate uniquely positions them to solve this problem.

BACKGROUND

Anthropogenic climate change is one of the greatest challenges of our time. Production of energy from burning fossil fuels accounts for 74% of total U.S. greenhouse gas emissions.[2] Transitioning from fossil fuels to renewable energy that emits zero carbon emissions is critical in mitigating climate change. Decentralized renewable energy generation, such as rooftop solar, is an important part of the renewable energy transition because energy is produced and stored where it is consumed, thereby reducing strain on transmission infrastructure and related losses. Furthermore, the price of solar panels has dropped in recent years, shortening the average pay back period and making rooftop solar more economically feasible. As such, big companies, such as Walmart, Costco, Apple, and Ikea, have installed solar panels to power their operations since they have the knowledge, ability, and capital to do so.[3]

However, adoption of small scale commercial and residential rooftop solar systems has been lagging due to lack of widespread knowledge about renewable energy, lack of technical expertise for installation and maintenance, and lack of upfront capital to invest in solar panels. Furthermore,

there are stark disparities in rooftop solar adoption across household income, homeownership status, racial and ethnic demographics.[4] Wealthy, whiter households are more likely to own their homes, plan to stay in their homes long term, and have the upfront capital available to install rooftop solar systems. Meanwhile, unattainable home prices, later settling ages of Millennials, and increased life expectancies are contributing to increased demand for multi-family housing rentals in the U.S.[5]

Despite their growing prevalence, multi-family housing complexes often face "incentive disconnects" in the context of rooftop solar and energy efficiency. Tenants are not incentivized to push for residential solar systems because they do not benefit from increased property values and government tax incentives. Property managers, on the other hand, simply view energy costs as another expense that can be passed on to the tenant and thus have little impetus to install rooftop solar systems. It can be difficult to convince property investors to change their practices, especially when changes require upfront capital and take years to pay back. Both parties face significant incentive, knowledge, ability, and financing hurdles that prevent rooftop solar from being installed even when it is a sound investment that would pay back in a matter of years.

EQUITY

Providing renewable powered multifamily housing options will not only reduce greenhouse gas emissions and strain on the grid, but will also increase energy equity. It will provide an option for low-income households to live in homes powered by renewable energy. This will not only be a source of pride for tenants, but also will ensure steady energy price and improve energy reliability. ZNE Capital strives to increase availability of economical workforce housing and keeps units affordable following HUD's (Department of Housing and Urban Development) definition [less than 30% of income is spent on rent for families earning 80% of area median income].[6]

AVALIABLE DATA

- Solar irradiance: Rooftop solar generates the most energy, is the most reliable, and pays back the fastest in regions with high solar irradiance. Data from the National Solar Radiation Database developed by the National Renewable Energy Laboratory will be used to evaluate solar irradiance for metropolitan regions throughout the U.S., specifically within the Sun Belt states (Southeast and Southwest).
- Regional economic trends: We will target regions of the country with expected economic and demographic growth, because these are the areas multifamily housing will likely be in highest demand. Demographic data will be sourced from Cluster Mapping: a website that provides data records on industry clusters and regional business environments in the U.S. put together by Harvard Business School and the U.S. Department of Commerce.
- Historic energy consumption and costs: Rooftop solar will reduce greenhouse gas emissions and energy costs the most in regions with historically high energy demands and/or high energy prices. State level energy consumption and price data made available by the U.S. Energy Information Administration (EIA) and will be used for these metrics.

POSSIBLE APPROACHES

Solar irradiance, demographic trends, energy consumption and costs data from above sources will be used to create a GIS map with layers corresponding to each criterion. Categorical data (net metering policies by utility, landlord policies by state) will be sought out for preliminary regions of interest identified by these maps. Our goal is to identify and rank 10 regions that satisfy the most criteria to recommend as locations for ZNE Capital to invest in. Steps further outlined below:

1. A literature review will be conducted for the team to familiarize themselves with: solar potential by region, rooftop solar systems on multifamily housing complexes, historic energy demands and pricing by region, demographic trends and demand for multifamily housing, multifamily housing real estate management constraints (ZNE Capital targets 100+ housing units per complex, master metered complexes, class B &C complexes with room for value-add opportunity, in landlord friendly states).
2. Create a GIS map with layers corresponding to energy and property criteria listed in available data section (solar irradiance, economic growth, energy consumption and costs) and identify promising regions based on the overlap of these criteria
3. Investigate categorical data (favorable net metering policies, landlord friendly state policies) in promising regions from GIS map to rank regions of priority

DELIVERABLES

- Ranked list of 10 regions recommended for multifamily housing rooftop solar systems based on solar irradiance, demographic trends, net metering policies and building energy metering for ZNE Capital to prioritize expanding into
- Data visualization (GIS map) with layers corresponding to each metric. Map will be critical in visualizing data distribution, trends, and overlap between criteria
- Written report and oral presentation summarizing methods, findings, recommendations, and rational for promising areas for ZNE Capital to invest in
- Well documented and reproducible code used for data analysis for future project growth and data reanalysis (with updated datasets)

INTERNSHIPS

As ZNE Capital is a relatively new and small company, ZNE Capital is able to provide unpaid remote summer internship opportunities for one or two students. Interns will conduct research to further project goals and will be mentored by Owen Barrett (MESM 2012): founder and president of ZNE Capital.

CITATIONS

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2. U.S. Energy Information Administration . (2021, May 21). *U.S. Energy Information Administration - EIA - independent statistics and analysis*. Where greenhouse gases come from - U.S. Energy Information Administration (EIA). Retrieved November 23, 2021, from https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php.
3. Frangoul, A. (2018, May 28). *10 massive corporations going big on Solar Power*. CNBC. Retrieved November 23, 2021, from https://www.cnbc.com/2018/05/28/10-massive-corporations-going-big-on-solar-power.html.
4. Reames, T. G. (2021). Exploring residential rooftop solar potential in the United States by race and ethnicity. *Frontiers in Sustainable Cities*, *3*. https://doi.org/10.3389/frsc.2021.666411
5. Khleif, R. (2020, March 4). *Council post: Why demographic trends support continued multifamily growth*. Forbes. Retrieved November 20, 2021, from https://www.forbes.com/sites/forbesrealestatecouncil/2020/03/04/why-demographic-trends-support-continued-multifamily-growth/?sh=4b50c8e56844.
6. ZNE Capital: Impact. ZNE Capital. (2020). Retrieved December 11, 2021, from https://www.znecapital.com/impact.

BUDGET

At this moment, there are no anticipated expenses for this group project and all expenses should be covered by the $1,300 allocated by Bren.

CLIENT LETTER OF SUPPORT

Please see attached letter of support from ZNE Capital.

To: **Group Project Selection Committee**
Bren School of Environmental Science & Management
University of California, Santa Barbara
From: Owen Barrett
Zero Net Energy (ZNE) Capital
Date: January 21, 2022
Re: **Client Letter of Support for Bren Group Project:**
Identifying Key Development Regions for Rooftop Solar on Multifamily Housing Complexes in the United States

ZNE Capital is excited to express our support for the proposed Bren Group Project. ZNE Capital is dedicated to furthering renewable energy goals by installing rooftop solar on multifamily housing complexes. We believe in investing in our planet by leveraging the capital that comes with financially sound investment opportunities. Having identified the multi-family housing market as ripe with under-appreciated opportunities for renewable energy impact investing, we are constantly searching for the most promising investment regions and properties. As such, we are deeply committed to the success of the proposed group project for its educational, environmental, social, and financial merits: the same merits that make up our own core mission statement.

If selected, ZNE Capital commits to providing close mentorship and professional development. Students working with us will have access to our collective experience in solar, real estate, and finance. Through the course of the project, we anticipate that students will gain the knowledge and skills, including learning both tangible and intangible aspects of real estate, necessary to rigorously evaluate renewable investment opportunities.

As part of our support, ZNE Capital will offer an unpaid summer internship under the mentorship of Owen Barrett, Founder & President. While we are unable to commit additional funding at this time, we may evaluate as needed should there be a requirement beyond the $1300 provided by the Bren School. Students will have timely access to any databases we subscribe to. We openly permit and encourage publications for educational purposes, subject to review for personally sensitive information.

Thank you for your time and consideration, and we look forward to answering any additional questions you may have.

Best,