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# Floating Solar in Santa Barbara

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*A Case Study in Municipal Applications of Floating Photovoltaic Systems*



Photo Credit: CBS

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## Proposers

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## Client

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## Faculty Support

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## **Objectives**

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The primary objective of this project is to produce a detailed analysis of potential opportunities, difficulties, and concerns surrounding a proposed project for the City of Santa Barbara to install a floating photovoltaic (FPV) power generation system at the Lauro Canyon Reservoir. This case study will answer the following questions:

1. What combination of system attributes and financial agreements would make the maximum use of the reservoir?
2. What requirements need to be satisfied to gain permitting approval from the Bureau of Reclamation (the federal agency that owns the land) or other environmental agencies?
3. What requirements need to be satisfied for permitting approval from FERC, CAISO, and any other pertinent regulatory agencies? This includes power infrastructure at the site, transmission capability, and potential energy storage requirements.

The team has identified several further paths forward beyond this primary objective of a case study. This flexible scope can be modified depending on project timelines, feedback from the client after the primary objective is complete, or unforeseen issues.

## **Significance**

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Currently, approximately half of California's electricity comes from fossil fuels.<sup>1</sup> The drawbacks of using fossil-fuels to generate electricity are straightforward: greenhouse gas emissions contribute to climate change, and fossil-fuel combustion causes local air pollution.

However, siting renewable energy is difficult in California due to high land costs and concern over habitat loss. One possible solution: floating photovoltaic solar arrays, also known as "floatovoltaics" or "FPVs". FPVs can provide multiple co-benefits for a drinking water reservoir. By reducing the amount of sunlight hitting the water's surface, the panels cool the water, reducing evaporation and algae growth. Additionally, the cooling effect of the water on the solar panels may improve their efficiency.<sup>2,3,4</sup>

The City of Santa Barbara is interested in taking advantage of this new technology, in part due to its commitment to use 100% renewable energy by 2030. Their preliminary research suggests that a system on the surface of Lauro Canyon Reservoir could be a part of that solution, generating about 4 Megawatts (MW) – enough to power over 1,000 homes.<sup>5</sup>

The successful application of this FPV system could serve as an example for other municipalities – the barriers to FPV adoption are no longer economical and instead are often institutional. One recent study conservatively estimated that over 24,000 man-made reservoirs in the US would be suitable for FPVs.<sup>6</sup> A case study or a scalable, repeatable model detailing the considerations for a U.S. city could be very influential in encouraging wider adoption of this newly mature technology. If completed today, a 4 MW FPV system would increase the floating solar capacity of the U.S. by over 28 percent!

## **Background**

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The City of Santa Barbara ("the City") has been interested in local sources of renewable energy for over a decade.<sup>7</sup> In fact, the City has already received a vendor quote for a 1 MW FPV system

located on Lauro Canyon Reservoir, however the proposal only utilized a fraction of the available space. The City did not proceed with the project due to the relatively high cost (due to minimal economies of scale), and a desire to use the full reservoir capacity for power generation. A full-scale project is only possible with an external purchaser of electrical power beyond what the nearby water treatment plant can use.

In recent years, policies have shifted, increasing the likelihood of success for a floating solar project. New financing models have gained traction in California, including a local [Community Choice Energy \(CCE\) program](#) launching in October 2021.<sup>8</sup> This program may enable a larger, more economical system at the reservoir, as power produced in excess of the City's demand could now be feasibly sold to other users. In addition, the City adopted a Strategic Energy Plan, which includes a 100% by 2030 renewable energy goal. This plan even specifically calls out local power development on reservoirs as an important component to achieve the city's goals for local, resilient power.<sup>9,10,11</sup> Finally, FPVs have become a mature technology with 2,600 MW installed globally, although adoption in the United States has so far been limited to 14 MW.<sup>12,13</sup>

The City's historical interest and the recent changes mentioned above reduce the risk of this project and drastically increase the successful adoption of any plan this project proposes.

## **Equity**

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This project has the potential to address environmental justice issues by increasing access to renewable energy in the local community. A community solar project would allow all members of the community to benefit from the energy produced, even if they do not have the space or property or cannot afford to generate their own.

Additionally, the case study we generate for the City of Santa Barbara may be useful to other localities which lack access to this type of analysis. Santa Barbara is unique – it can invest far more in far-sighted projects than most other cities. Thus, the model we generate for Santa Barbara can help those less-wealthy cities propose FPV systems of their own. This can both save money and/or generate revenue while providing clean, local power for those cities.

## **Available Data**

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- Blueprints and documents pertaining to the site, available from the City of Santa Barbara
- Additional data provided by the Santa Barbara Sustainability & Resilience Department pertaining to utility rates, economic and legal considerations, and permitting details
- Public datasets on electricity grid concerns, including [CPUC electricity rates](#), [CEC Transmission maps](#), etc.
- NREL-produced [trends on CCA solar adoption](#) and [solar LCOE and IRR rates](#)

## **Possible Approaches**

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1. Examine and report on the feasibility of implementing a FPV system at Lauro Canyon Reservoir, including some or all of the following: engineering concerns, economics, equity issues, legal considerations, regulatory issues, water quality concerns, and environmental tradeoffs and co-benefits.
  - o Engineering concerns include system size, features, & supporting infrastructure

- Economic considerations will include allocation of city resources and a cost benefit analysis with regards to electricity rate structures, including Power Purchase Agreements (PPAs) and Community Choice Energy.
  - Regulatory issues will be directed towards permitting approval requirements, environmental impact review, and drinking quality concerns.
2. Create a repeatable model for FPV evaluation for other municipalities or agencies including a guide to necessary considerations (economic, technical, political, regulatory, legal, etc).
    - The model could include details on how to proceed through the Bureau of Reclamation permitting process, or incorporate a calculator where system size, PPA cost, or other metrics could be entered.
  3. Create a 'programmatic permit' template for FPV systems on Bureau of Reclamation owned reservoirs and offer this permit to the agency and policymakers.
  4. Create a detailed budget and project implementation plan for city planners in Santa Barbara by laying out precise steps required to bring the project to completion. This would increase the likelihood that the city undertakes the project.
  5. Examine the feasibility of installing electrical storage infrastructure at abandoned urban reservoirs throughout the City, addressing similar considerations as in #1 and #2.

## **Deliverables**

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- A feasibility study for this proposed FPV system, including auxiliary needs such as storage or transmission lines, as well as economic considerations such as the required cost per kWh and maintenance costs
- A case-study report based on this feasibility study, intended for a broader audience of municipal managers and policymakers
- A poster and oral presentation of the results of this case study
- *Other possible deliverables:*
  - *A scalable model to determine feasibility of FPV projects, intended for use by other municipalities*
  - *A 'programmatic permit' template for FPV projects on Bureau of Reclamation reservoirs (a common landowner of water supply reservoirs)*
  - *A calculator that allows Santa Barbara city planners to test assumptions of feasibility given different PPA rates and project costs*
  - *A detailed project plan & budget for this project to allow rapid adoption of the plan by the City of Santa Barbara*

## **Internships**

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The City of Santa Barbara will provide \$2,500 for an internship to enable one student to advance the objectives of the project over the summer. The internship will either be remote or in Santa Barbara depending on the state of the COVID-19 pandemic. See attached client letter of support.

## Budget

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The budget for this project is not expected to exceed the \$1,300 provided by the Bren School of Environmental Science & Management.

## Citations

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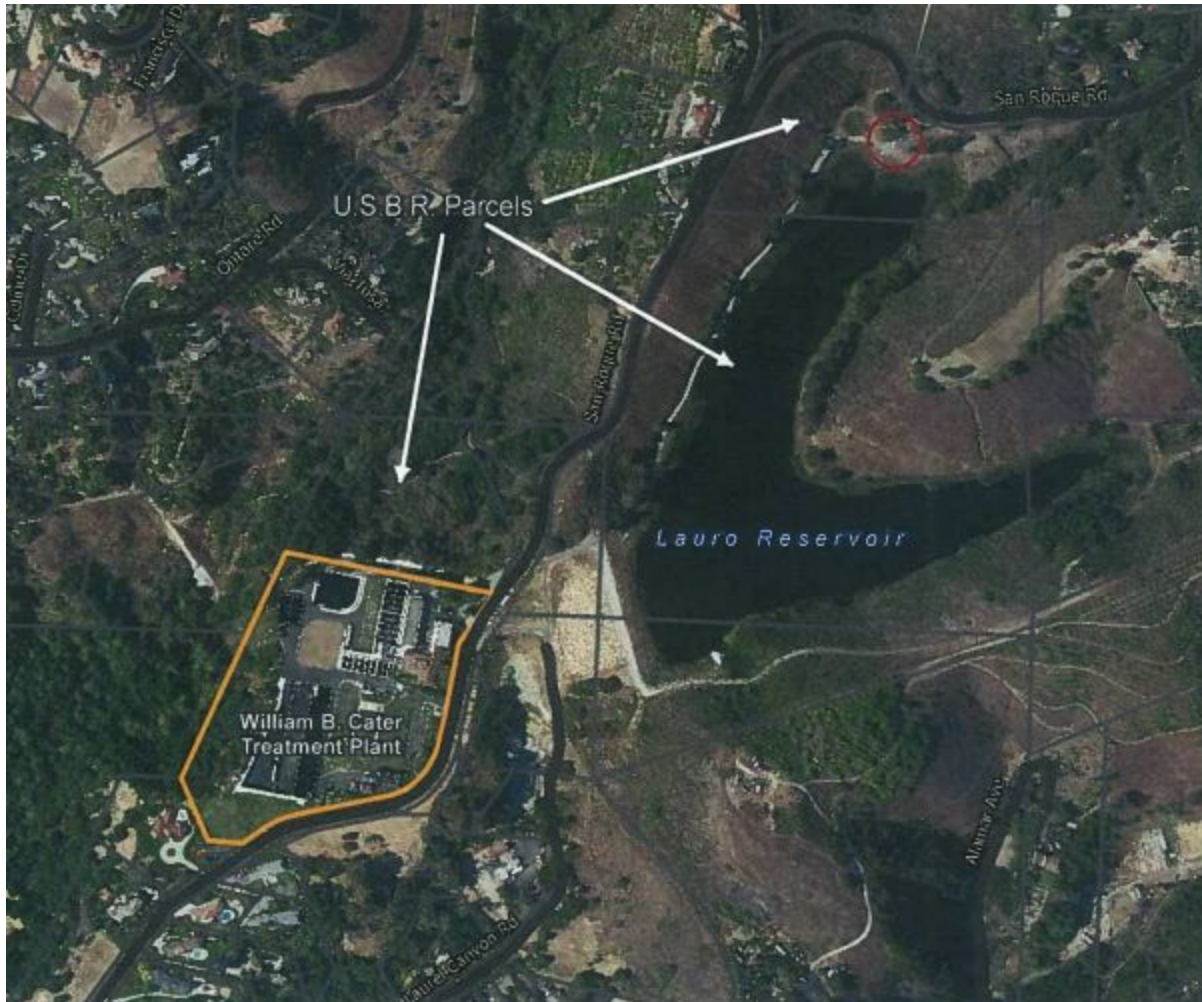
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## Supplemental Material

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### Site Map





# City of Santa Barbara

Sustainability & Resilience Department

[SantaBarbaraCA.gov](http://SantaBarbaraCA.gov)

## Group Project Selection Committee

### Energy & Climate

616 Laguna St.  
Santa Barbara, CA 93101  
(805) 564-5474

Bren School of Environmental Science and Management

2400 Bren Hall

UC Santa Barbara, CA 93106-5131

### Environmental Services

1221 Anacapa St.  
Santa Barbara, CA 93102  
(805) 564-5631

**January 20, 2021**

**To:** Group Project Selection Committee

**Re:** Floating Solar in Santa Barbara

We are writing to express our support for the group project Floating Solar in Santa Barbara. The City has adopted a 100% renewable energy goal for the entire community and that requires deploying renewable generation assets wherever possible. Achieving a better understanding of the potential to develop local reservoirs and other infrastructure will help the City plan for future renewable energy assets.

There are many questions associated with the development of renewable assets on various water structures and how the City might pursue the most economic value in each development. This project will require thorough consideration of possible hurdles and opportunities that come from renewable asset development on a variety of water-related structures. Ultimately, process recommendations can be presented to the City for consideration.

We believe that this group project can identify solutions in to renewable energy development hurdles that could lead to successful completion of new energy generation assets in Santa Barbara. The results from this project will allow us to provide project recommendations to the City and the involved stakeholders.

As part of our support we are prepared to offer a summer internship, remotely or in-person depending on the state of the COVID-19 pandemic, of up to \$2,500. We would provide the funds to UCSB's Bren School, who would then be responsible for hiring the intern and paying directly the internship.

Sincerely,

Alelia Parenteau

Energy & Climate Manager, City of Santa Barbara