Leveraging California's Aqueduct to Catalyze Solar Deployment

Executive Summary

In the face of limited resources to develop large-scale clean energy projects and the growing demand for both clean water and energy, California (CA) should prioritize solar projects that are constructed above CA's aqueduct. This brief analyzes new cutting-edge research that suggests placing solar panels over water canals has significantly more benefits than traditional solar deployment and can substantially reduce the amount of water that evaporates during transportation.

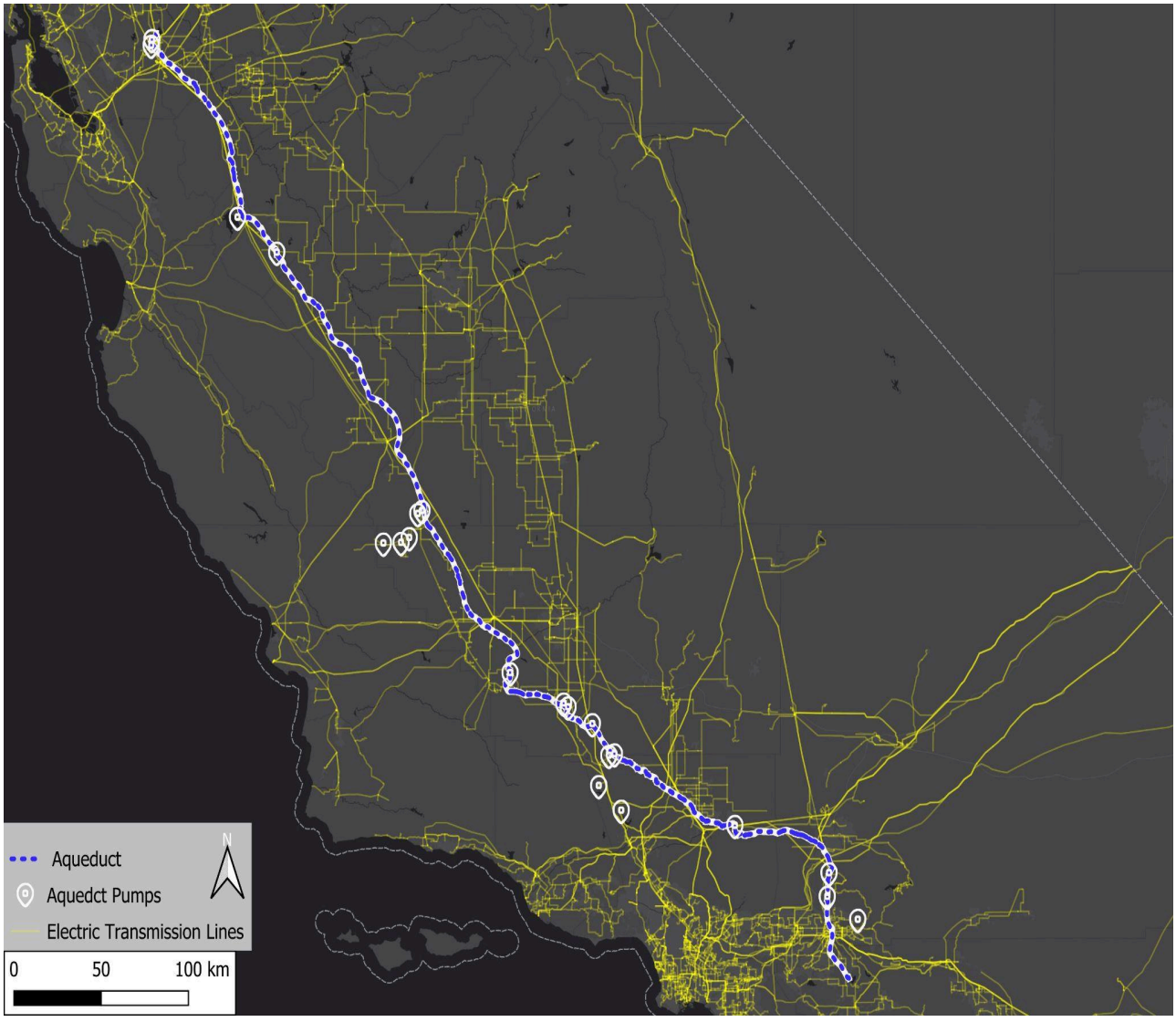

Figure 1. A map showing how electric transmission lines are in close proximity to the CA aqueduct and the location of water pumps.

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Background

As climate change makes rainfall more unpredictable and the impact of new groundwater recharge policies remains subpar, concerns over the sustainability of CA's water management have continued to grow. One idea to both generate more clean electricity and save valuable water is to deploy solar panels above CA's 715-kilometer (km) aqueduct, which is one of the world's largest. Moreover, CA has an ambitious goal to reach 90% clean energy production by 2035, and 100% by 2045, as outlined in 2018 by Senate Bill 100. As of 2021, CA has 59% of its electricity production coming from renewable and zero-carbon resources. However, in the face of surging energy demand driven primarily by the demand for more data centers to power artificial intelligence, as well as a new federal administration hostile to clean energy projects, achieving a 90% clean energy goal in the next nine years will require using every resource to its fullest potential and enabling swift implementation of promising ideas.

Issue Analysis

CA plans on utility-scale solar making up the majority of its clean energy resources by 2045. To achieve this, the state is working to vastly increase the amount of solar panels on the grid, but getting large-scale solar projects built is often very difficult. A common roadblock is finding an optimal site to deploy them, as many communities and towns follow a "not in my backyard" mindset and exploit the CEQA process to delay or cancel projects. Nevertheless, new research suggests a promising path forward that utilizes CA's 6,350 km canal network. To have the largest impact with the least amount of resources, construction should specifically focus first on the continuous 715km of state-owned aqueduct infrastructure, which has fewer barriers to implementation than more disjointed federal or locally owned canal systems.

As figure one highlights, CA's aqueduct system is very close to existing electric infrastructure. In other words, connecting new solar projects built over the aqueduct to the grid will not require significant investment in new transmission infrastructure. Furthermore, because pumping water over CA's mountainous terrain takes an enormous amount of energy, another potential way to reduce infrastructure costs is to initially prioritize solar deployment over parts of the aqueduct that are closest to the cluster of water pumps with the highest energy demand. Constructing solar panels on these sections of the aqueduct would enable energy production to be closer to energy demand, thus reducing strain on the grid, as well as the need to build more transmission lines.

Choosing to build solar panels above the state's aqueduct would be a very efficient process because there are no buildings or objects obstructing the sun, and the existing physical foundation already exists. Research estimates that over-canal solar has the substantial benefit of having a 20-50% higher return on investment than conventional overground solar. Research also suggests that putting solar panels near the

water improves their operating efficiency and allows them to generate more electricity than solar panels placed in hotter areas. Building solar panels above CA's vast canal network also has the large co-benefit of reducing freshwater loss to evaporation, as they would provide shade to the water moving below them. "Over-canal solar could reduce *annual* evaporation by an average of 39 ± 12 thousand m^3 per km of canal". To put this into perspective, 715 (km of aqueduct) x 39,000 (m^3 of water) =27,885,000 m^3 of *yearly* water savings just from covering the CA aqueduct—which is roughly 2.5% of the amount of water the state spends growing food and fiber in a normal year.

Policy & Implementation Recommendations

There is no question that CA will build more solar, but what still needs to be decided is where the best place to do so is. Thus, to maximize the benefits of future solar projects, state agencies such as the CA Energy Commission (CEC) and the California Department of Water Resources (CDWR) should work together to enact the following policies.

1. **Make construction of solar panels over canals the easiest way to create new solar projects.**

   This can be done by providing a CEQA exemption for solar built on top of canals, and/or providing a subsidy to developers who prioritize building solar over the CA aqueduct. Pilot projects have already proved to be very promising and dovetail the interests of the CEC and DWR. (See figure 2)

2. **Optimize solar deployment after every project.**

   After six months, a representative from CEC and the CDWR should speak to whoever is operating the solar project and record what is going well, and what can be improved in future solar projects. Due to the homogeneous nature of CA's aqueduct, every subsequent solar project should be able to build on the success and shortcomings of the previous project.

3. **Conduct further research to maximize solar deployment benefits.**

   More research is required to find out if evaporation benefits over the CA aqueduct are homogeneous, if electricity generation is homogeneous, if other CA canal networks are strong candidates for solar deployment, and whether the transmission infrastructure costs savings of placing solar near water pumps are greater than just putting the electricity directly onto the grid.

Figure 2: A picture of a solar installation above a canal in CA with a reporter for perspective.

Source: (University of California 2025)

Further Reading

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Authorship

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