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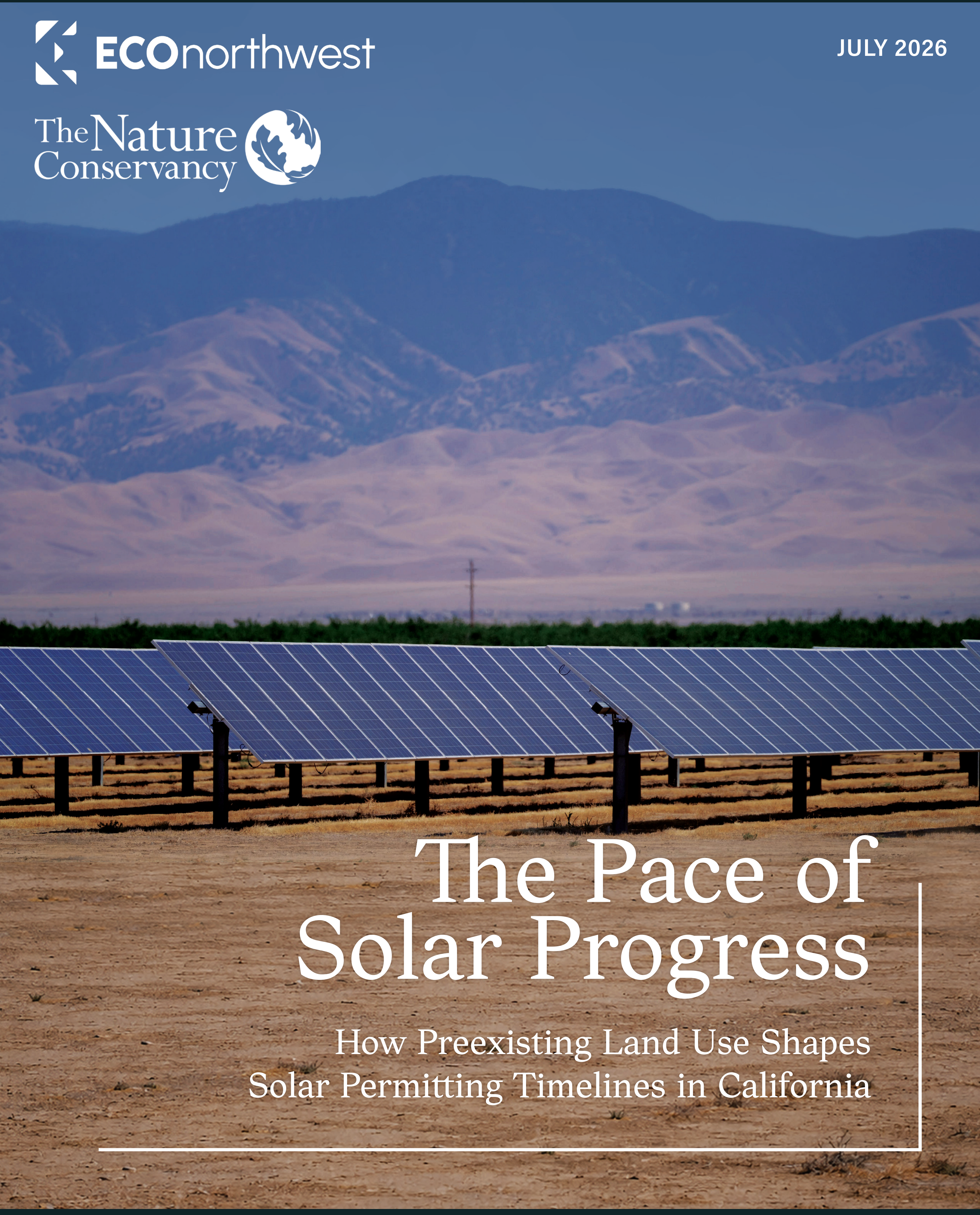
JULY 2026



The Pace of Solar Progress

How Preexisting Land Use Shapes Solar Permitting Timelines in California

Acknowledgments

ECOnorthwest prepared this report with The Nature Conservancy and with the guidance and input of several partners. Other organizations and staff contributed to research that this report relied upon, including The Nature Conservancy and ECOnorthwest's **Green Light Study** (2019).

ECOnorthwest and The Nature Conservancy are responsible for the content of this report based on knowledge of California solar permitting and economics. ECOnorthwest staff contributing to this study included Kelsey Johnson, Terry Wirkkala, Marty Marquis, Sam Schroeder, and Kath Nester. The Nature Conservancy staff contributing to this study included Sarah Skikne, Marybeth Benton, Erica Brand, and Brian Cohen.

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Abstract

California's transition to a clean, reliable, and affordable electricity system requires a rapid expansion of utility-scale solar photovoltaic (PV) development. Environmental review, permitting, and approval processes for utility-scale solar projects are often cited as major sources of uncertainty and delay that can challenge solar deployment and drive increased project costs. Yet few, if any, studies have systematically examined the factors influencing permitting timelines in California.

Through statistical modeling, spatial analysis, and stakeholder interviews, this study examines factors affecting permit durations for utility-scale solar projects in eight California counties, Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare, comprising the San Joaquin Valley and part of the West Mojave. These regions host a substantial share of the state's existing and planned solar capacity. They also face overlapping land-use pressures, including land use change to achieve groundwater sustainability, agriculture, urban growth, housing, habitat conservation, and renewable energy development.

Using a novel dataset of 274 proposed utility-scale solar projects in various stages of the permitting process,[1] initiated between 2009 and 2025, the study evaluates how site conditions, current land use, project characteristics, and temporal factors shape permitting duration. Results indicate that prior land use, specifically the degree of human modification, strongly influences the duration of the county permitting process. Projects located in more heavily modified landscapes tend to move through permitting faster, after controlling for project size. Lands under Williamson Act contracts also experience longer timelines. Factors such as distance to communities, project size, and the year initiated exhibit limited influence on permitting timelines. An analysis of developer site selection shows that developers disproportionately propose projects on more modified lands and avoid open space relative to its regional availability.

Interviews with experts from the solar energy industry, local government, and state agency staff largely reinforce the findings above. Collectively, these findings highlight the central role of land use and site condition in permit review duration. They also underscore the importance of siting strategy and aligning state programs, incentives, and transmission capacity to enable projects on degraded lands.

1 Although the observations in the dataset technically represent permit applications for proposed solar projects, the remainder of this report refers to them as "projects" for readability and consistency with broader solar development terminology.

PHOTO: © Stuart Palley, 2021

Key Terms

AB	Assembly Bill
AB 52	California Assembly Bill 52 (Tribal Consultation under CEQA)
AB 205	Assembly Bill 205 (California Energy Commission Opt-In Permitting Program)
AB 1260	Assembly Bill 1260 (Community Solar and Storage Expansion Proposal)
AB 2316	Assembly Bill 2316 (Community Renewable Energy Program)
AB 327	Assembly Bill 327 (California Renewables Portfolio Standard Program)
BESS	Battery Energy Storage System
BLM	Bureau of Land Management
CAISO	California Independent System Operator
CEC	California Energy Commission
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CUP	Conditional Use Permit
DAC-GT	Disadvantaged Communities Green Tariff
EIR	Environmental Impact Report
ESA	Endangered Species Act
HR	Hazard Ratio
IRP	Integrated Resource Plan
ITP	Incidental Take Permit
LSAA	Lake and Streambed Alteration Agreement
ND	Negative Declaration
MND	Mitigated Negative Declaration
NEPA	National Environmental Policy Act
NLCD	National Land Cover Database
NOE	Notice of Exemption
NOP	Notice of Preparation
NOD	Notice of Determination
PV	Photovoltaic
SB	Senate Bill
SB 100	Senate Bill 100 (100 Percent Clean Energy Act of 2018)
SGMA	Sustainable Groundwater Management Act
TNC	The Nature Conservancy
VIF	Variance Inflation Factor

1

Introduction & Purpose

California has long been a national leader in renewable energy development, driven by ambitious climate and energy goals. Senate Bill 100 established a statewide mandate for 100% clean electricity by 2045 [1]. A large buildout of solar resources is necessary to meet the state's demand for clean energy. Permitting plays a critical role in clean energy development by ensuring projects are reviewed for environmental and community impacts. At the same time, the efficiency and predictability of the permitting process can influence project timelines, cost, and the pace of project deployment.

The Need to Build More Clean Energy Faster

Recent California Public Utilities Commission (CPUC) planning efforts underscore the magnitude and urgency of the solar development challenge. In the Integrated Resource Plan (IRP) proceeding for the 2026-2027 Transmission Planning Process, the CPUC identified that meeting projected load growth and greenhouse gas reduction targets will require an unprecedented expansion of solar and storage capacity statewide [2]. This reflects the increasingly important relationship between modeled resource needs and the permitting, interconnection, and land-use realities that shape large-scale solar deployment. The CPUC's ruling emphasizes that recent build rates, averaging 1–3 GW per year, fall short of the 4–7 GW per year needed to achieve the state's reliability and decarbonization targets [2]. Energy affordability is, at the same time, a large and growing concern, and utility-scale solar is widely recognized as the lowest cost resource today to achieve clean energy at-scale.

> **"A large buildout of solar and storage resources is required to meet growing energy demand in all years. The buildout of solar, in particular, is so large that it calls into question whether it can feasibly be built in the quantities and timing identified in this round of IRP modeling."**
>
> **— September 2025 IRP ruling**

Improving Permitting for Clean Energy

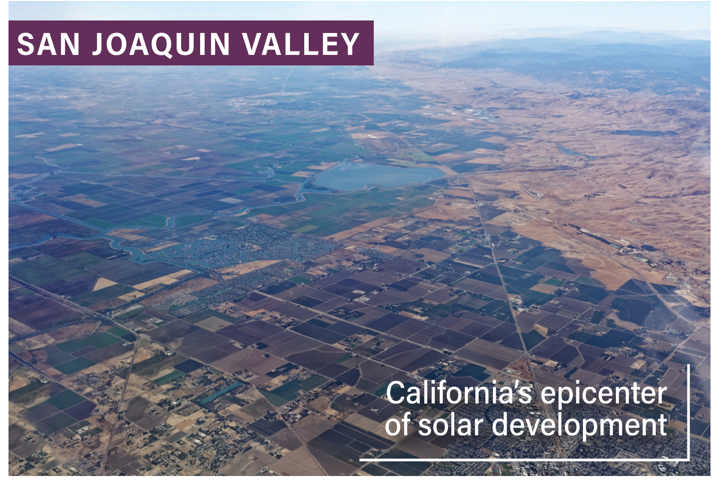
The solar industry and other experts have long observed that variability and delays in permitting processes can extend project timelines and increase costs, which has led to growing policy interest in improving permitting practices. The permitting process for utility-scale solar projects in California is often cited as complex and jurisdictionally fragmented. Local governments typically retain primary authority over land-use approvals through general plans, zoning ordinances, and conditional use permits (CUPs). Simultaneously, state agencies such as the California Department of Fish and Wildlife (CDFW), the State Water Resources Control Board (SWRCB), the CPUC, and the California State Lands Commission may require additional review or approval, particularly when projects affect sensitive environmental resources. When projects intersect federal land or threatened and endangered species, federal agencies such as the Bureau of Land Management (BLM) or U.S. Fish and Wildlife Service (USFWS) are also involved.

Environmental review under the California Environmental Quality Act (CEQA), which operates in parallel to local permitting, is often discussed as a primary driver of permitting delays. In the interest of accelerating solar deployment, policymakers and agencies have launched initiatives and developed tools aimed at increasing predictability and streamlining permitting while preserving environmental safeguards. Examples include the California Energy Commission's (CEC) Assembly Bill (AB) 205 Opt-In process [3], tools to proactively designate solar-compatible areas [4], and the GO-Biz Clean Energy Permitting Playbook and Toolkit [5].

A First of its Kind Effort to Study Permitting in California

Despite this increased policy focus on accelerating renewable energy project development, a review of existing clean energy development literature did not reveal prior studies that evaluate factors that shape permitting duration (see Appendix C). To address this gap and provide policymakers, agencies, and other stakeholders with key findings to inform interventions, we examined the pace and determinants of utility-scale solar permitting in the study area.

We first created a novel data set comprised of over 15 years of utility-scale solar permitting application data in eight California counties representing the epicenter of previous and future solar development: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. The study area (Exhibit 1) is characterized by high concentrations of existing solar capacity (43.5% of California's solar resources [6]), along with planned utility-scale solar projects that are needed to achieve the state's goal of 100% clean electricity. Further, the area possesses high solar resource potential, large expanses of private land, and proximity to major transmission infrastructure. At the same time, the study area is characterized by intensive agricultural production, groundwater stress, and sensitive habitat.



Noel V. Baebler/Shutterstock

EXHIBIT 1 Study Area Extent

Source: ECOnorthwest Analysis

This study examines how site conditions (particularly the degree of human modification) as well as project and regulatory characteristics, such as project size and land use designations, influence the duration of utility-scale solar permitting timelines. To address these questions, we integrated publicly available permit application records with spatial data describing land use, environmental conditions, and regulatory context. The dataset includes both completed and ongoing project applications, allowing the analysis to evaluate differences in permitting durations across projects and jurisdictions. The study also analyzes permitting timelines for two permits that CDFW is the lead agency for. A complementary analysis compares the characteristics of proposed solar development sites with the broader regional landscape to identify developer site selection trends. Insights from interviews with developers, consultants, and state and county staff are included to contextualize the empirical findings and identify emerging issues shaping permitting timelines. Together, these approaches provide a comprehensive assessment of the factors associated with solar project siting and permitting in one of California's key energy-producing regions.

2

Background Information

Gaps in Understanding Utility-Scale Solar Permitting

There are few studies that explore timelines for permitting utility-scale renewable energy. To our knowledge, no studies quantify the contribution of individual project, site, or regulatory characteristics to permitting timelines in California or across the U.S. Much of the broader literature instead focuses on household decision-making, incentive structures, and permitting processes for residential and rooftop solar.

Among the studies that address utility-scale renewable energy, existing research provides context for understanding factors that influence the permitting of large-scale solar projects. These include research on public attitudes toward utility-scale renewable energy; analyses of federal, state, and local policy frameworks that govern renewable energy siting and development; and studies of site-specific characteristics such as existing land use and land cover, visual aesthetic considerations, and the presence of culturally and environmentally sensitive resources. These themes are reviewed in depth in Appendix C.

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Recent Policy Efforts Aimed at Accelerating California's Utility-Scale Solar Development

California is reforming its clean energy permitting landscape to accelerate deployment of utility-scale solar and storage while addressing longstanding regulatory, environmental, and land use challenges and constraints. Central to these reforms is the Assembly Bill (AB) 205 Opt-In Certification Program, which enables qualifying developers to bypass local permitting by consolidating CEQA review and approval authority under the CEC.[2]

Opt-In Certification

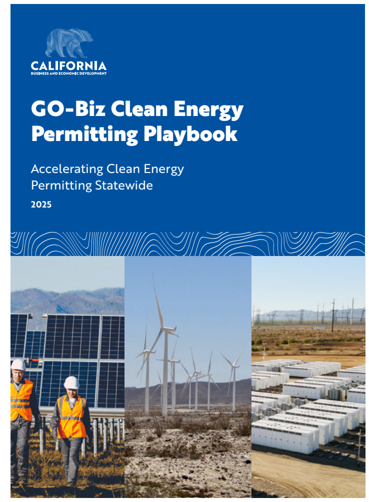
California's AB 205 Opt-In Certification Program provides a centralized permitting process for new generation and storage projects by enabling developers to shift permitting authority from local authority to the CEC [3]. Under this framework, solar projects meeting eligibility criteria can submit a single application to the CEC, which becomes the lead agency under CEQA, consolidating most land-use, environmental review, and local permits [3]. The process is designed for speed and predictability: once a complete application is received, the CEC must deem it complete within 30 days, publish a Draft Environmental Impact Report (EIR), and finalize certification within 270 days (absent significant new issues). Following certification, other participating agencies (e.g., CDFW) are required to issue any secondary permits within 90 days, effectively creating a one-stop shop that bypasses fragmented local processes and judicial reviews [3]. By consolidating the permitting steps and imposing timelines, AB 205 aims to reduce approval times, regulatory uncertainty, and litigation risk, particularly in regions with restrictive local ordinances or limited staff capacity. As of May 2026, only two projects, Intersect Power's Darden Clean Energy Project in Fresno County and Soda Mountain Solar's Soda Mountain Solar Project in San Bernardino County, have been approved through the California Energy Commission's AB 205 process [7, 8, 9].

2 For more information on AB 205, visit the CEC website at https://www.energy.ca.gov/programs-and-topics/topics/power-plants/opt-certification-program or view the full text of the bill at https://legiscan.com/CA/text/AB205/id/2600089.

While the statute mandates certification within 270 days of a complete application, the CEC retains the ability to effectively extend the process by deeming initial applications incomplete and requesting additional information at the end of the 270-day window, according to California's Permit Streamlining Act [10]. The Opt-In process may not be accessible to all developers due to upfront capital requirements to complete technical studies and advance permitting beyond the traditional CEQA stage before entitlement. These requirements present significant barriers for smaller or early-stage firms.

California Governor's Office (GO-Biz) Clean Energy Permitting Initiative

Leadership and staff from the California Governor's Office (GO-Biz) have been working with a wide range of stakeholders to develop a Clean Energy Permitting Playbook and Toolkit [5]. These resources are informed by surveys, interviews, focus groups, and public feedback focused on the challenges of and opportunities for local permitting for utility-scale clean energy projects. They also cover emerging topics such as battery energy storage systems (BESS) permitting and best practices for community engagement. These efforts are part of the Administration's broader strategy to meet California's clean energy, reliability, and climate goals while ensuring that permitting remains transparent, predictable, and community-centered.



3

Permitting Utility-Scale Solar in California

In California, the development of utility-scale solar projects is governed by a combination of local land-use regulations, state-level environmental review requirements, and federal regulations for species and wetlands. Two key components of this process are obtaining county land use permits and compliance with CEQA, which mandates that state and local agencies evaluate and disclose the potential environmental impacts of projects before approval [11].

With few exceptions, utility-scale solar projects require a CUP from a county land-use authority. The CUP constitutes a discretionary action, thereby triggering CEQA review for non-exempt projects. The lead agency (typically, the county) initiates an initial study to assess the potential environmental effects or first determines the type of environmental review needed. CUPs are then approved after the lead agency certifies the CEQA document.

CEQA review is frequently conducted in parallel with other environmental permits and consultations, which may in turn rely on CEQA review, depending on site-specific conditions. These may include an Incidental Take Permit (ITP) or Lake and Streambed Alteration Agreement (LSAA) from CDFW, water quality certifications from the State Water Resources Control Board or applicable Regional Water Quality Control, and consultation with California Native American tribes under AB 52 [12, 13, 14]. These permit processes are included in the mitigation requirements of CEQA, but they typically occur after the county-level permitting is completed. Additionally, necessary permits can include federal permits under the Federal Endangered Species Act (ESA) and for wetlands. All of these permits can affect project timelines and complexity. This multi-agency, multi-permit structure contributes to the variability in permitting durations across jurisdictions and project types.

Process Overview

The local permitting process for utility-scale solar projects in California typically unfolds in three major phases: 1) County CUP application submission and completeness review, 2) CEQA environmental review, including related technical studies, and 3) Post-CEQA permitting. Site studies are conducted sometimes for years in advance of application for a CUP, and the pre-application phase often includes pre-application meetings with the lead permitting agency. Collectively, the CUP, CEQA, and Post-CEQA phases represent a partially overlapping set of processes that shape the pace and predictability of solar project development. Understanding how these phases interact is essential to improving permitting efficiency. These phases and milestones are summarized in Exhibit 2 and Exhibit 3 and described in the following sections.

EXHIBIT 2

General Sequencing of the Permitting and Environmental Review Process

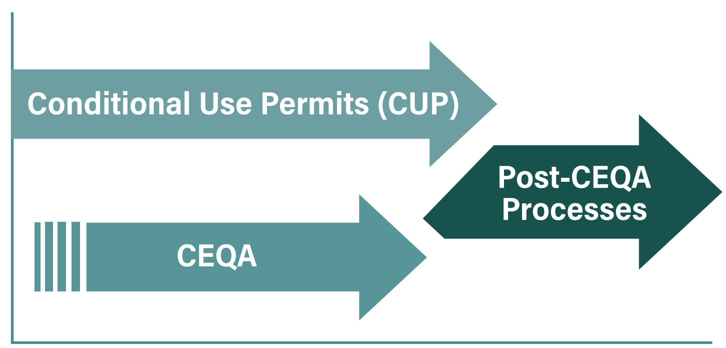


Figure 2 represents the general sequencing of the permitting and environmental review areas we studied for this report.

Source: ECOnorthwest

Conditional Use Permits (CUP)

The local permitting process for utility-scale solar projects officially begins with the CUP phase, where developers submit a CUP application to the relevant land use authority (typically, the county). Prior to formal submittal, projects often undergo site studies and a pre-application stage involving early coordination with county staff. Once submitted, the application is subject to a completeness review, during which counties

EXHIBIT 3 Overview of California's Utility-Scale Solar Permitting Process

Phase	Key Activities & Milestones
CUP	▪ Developer submits CUP application to county (triggers CEQA) ▪ Technical studies: biological, cultural, hydrological, visual ▪ County deems application complete
CEQA Review	▪ Notice of Preparation (NOP) issued (shortly following CUP application submission) ▪ Environmental review: MND, EIR, ND, NOE ▪ Public comment period ▪ County certifies CEQA document, files Notice of Determination (NOD)
Post-CEQA Processes	▪ Permits from CDFW and Water Boards (ex: ITP, LSAA) ▪ May require federal permits ▪ Projects that have additions/changes to plans may require further environmental review ▪ Advanced engineering designs

Source: ECOnorthwest

assess whether required materials have been provided and are adequate to proceed with CEQA review. A key milestone in this phase is when the county deems the application complete; this determination triggers the start of the CEQA process. At this point, the project goes through the CEQA process described below.

CEQA

Once the CUP application is deemed complete, the CEQA process begins which requires the lead agency to evaluate and disclose the environmental impacts of proposed projects. The level of review depends on the anticipated significance of impacts. A lead agency may prepare an Environmental Impact Report (EIR), Mitigated Negative Declaration (MND), or Negative Declaration (ND). If a project qualifies for a categorical exemption, it is not subject to further CEQA review, and the lead agency may file a Notice of Exemption (NOE) [15]. These processes differ in rigor, timeline, and documentation requirements, and the path a project takes is generally determined by the scale, location, and potential environmental effects of the proposed activity.

The CEQA review process typically includes issuance of a Notice of Preparation (NOP) (or a NOE for exempt projects), preparation of environmental documentation, a public review period, and revisions to address comments. The process culminates when the lead agency certifies the CEQA document and makes a decision on the CUP. At that point, the agency files a Notice of Determination (NOD), which both finalizes the CEQA process and triggers the statute of limitations for legal challenges.

Importantly, CEQA review does not occur in isolation. While environmental documents are being prepared, projects are simultaneously reviewed by county departments for compliance with applicable regulations and consistency with local policies. These parallel reviews can lead to project modifications and introduce additional time that is not solely attributable to CEQA requirements.

Post-CEQA

Following CEQA approval and a CUP decision, solar projects move into the Post-CEQA phase, which involves obtaining permits from state resource agencies, particularly the CDFW and regional Water Quality Control Boards, and any federal resource agencies with jurisdiction (for example, over federally-protected habitat or species or federal jurisdictional waters). Although these permits are often incorporated into CEQA mitigation requirements, they may extend beyond the formal CEQA timeline and contribute to overall project duration. In some cases, project modifications or additional environmental review may be required at this stage, further affecting timelines. Developers frequently cite this phase as a significant source of time and cost uncertainty, as mitigation requirements are established later in the process.

4

Empirical Analyses of Permitting Timelines

This section describes the empirical analyses used to evaluate the factors influencing CUP timelines for utility-scale solar projects across the study area. It begins with an overview of the study area and data sources, then presents the results of three analyses: 1) a survival analysis,[3] which examines how site characteristics, regulatory factors, and temporal factors affect the duration of the CUP process; 2) an evaluation of ITP and LSAA timelines; and 3) and an analysis of developer site selection patterns based on the primary CUP dataset. Together, these analyses provide complementary insight into the regulatory and spatial dynamics shaping utility-scale solar development in the region. Although outside the scope of this analysis, a community-scale solar permitting case study is also included in Appendix D for comparison with utility-scale solar project timeline and process.

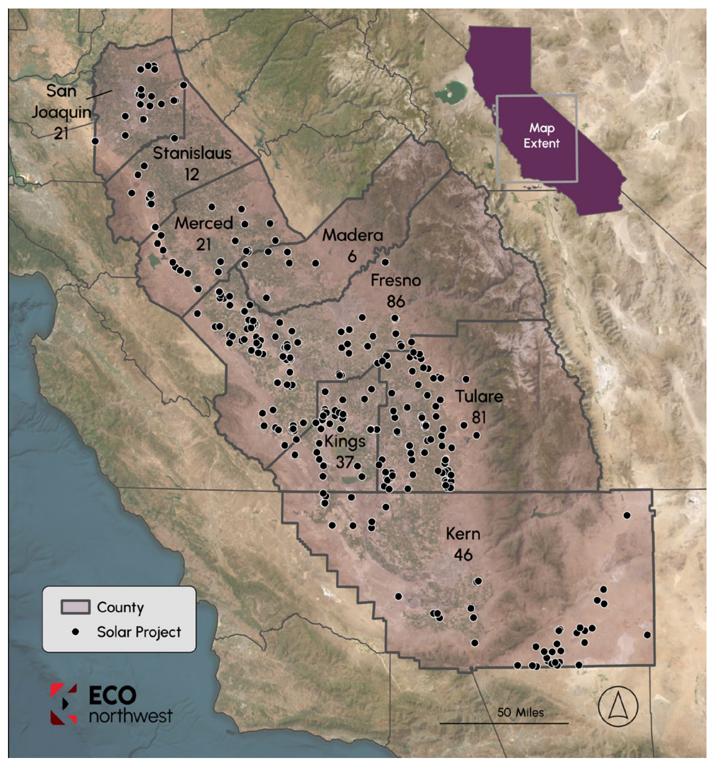
Study Area

The study area includes the eight California counties in the San Joaquin Valley and parts of the West Mojave, including Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare (Exhibit 1). The region faces overlapping land-use pressures: protecting prime farmland, accommodating urban growth, conserving sensitive habitat, and renewable energy development. Competing land uses, particularly from agriculture, have the potential to influence solar project siting, providing a useful context for understanding how permitting and environmental review processes unfold at the epicenter of California solar energy development.

Agricultural land use across the study area is predominantly cropland, with almonds, irrigated row crops, grapes, and citrus representing the primary crop types, with pasture for livestock production particularly prevalent in Kern County. The vast majority of the region's farmland is irrigated, reflecting the region's reliance on managed water resources to sustain high-value crops [16].

Given the prevalence of irrigated crop cultivation in the study area, decreases in water availability, and changes in water policy particularly from the Sustainable Groundwater Management Act (SGMA), significant amounts of land in intensive agricultural production are expected to transition to other uses, which could increase the opportunities for utility-scale solar development on retired agricultural lands [17].

EXHIBIT 4
Utility-Scale Solar Projects in the Study



Source: ECOnorthwest Analysis

NOTE: The solar projects presented here include projects at various stages of the permitting process from proposed to operational. These represent a subset of all solar development within the study area, limited by the availability of geospatial permitting data (see Section 4 Data for more information).

3 Also known as time-to-event, duration, or event-history analysis, survival analysis is a statistical approach used to examine how long it takes for events to occur, making it well-suited for studying solar permitting timelines.

The study area is also a focal point for large-scale solar development due to its abundance of solar-suitable land, marked by large swaths of flat, open land, proximity to electrical transmission, and high solar exposure, creating the opportunity for cost-effective solar development (see Exhibit 4). With potential solar lease payments often exceeding the returns to agricultural uses, agricultural landowners are faced with incentives to convert farmland to solar development [17].

According to data on operational solar power facilities [6], there are 219 operational solar power facilities in the San Joaquin Valley with an Alternating Current (AC) capacity of approximately 7,200 MW.

Data

This analysis incorporates a set of factors identified by industry and agency staff, representing regulatory, geographic, environmental, temporal, community, and project-level characteristics, to evaluate how they influence solar permitting timelines. The core dataset used to estimate CUP timelines for utility-scale solar projects was compiled directly from county planning departments across the study area and includes solar project permits initiated between 2009[4] and July 2025. These data include project-level information such as CUP application submittal dates, decision dates (approval or denial), project size (megawatts), and project location. Because there is no centralized statewide database for CUP applications, assembling this dataset required collecting and harmonizing records from individual counties. Project sites were spatially identified using the geographic information provided by counties and linked to a range of relevant geospatial datasets to capture site and landscape characteristics (described below).

> **"With the potential of solar lease payments to exceed the returns to agricultural uses, landowners are faced with incentives to convert farmland to solar development."**

SNEHIT PHOTO/Shutterstock

4 Available county records only extended back to 2009.

The resulting dataset represents a harmonized set of CUP applications suitable for analyzing permitting timelines across jurisdictions.

Measuring the Permitting Timeline

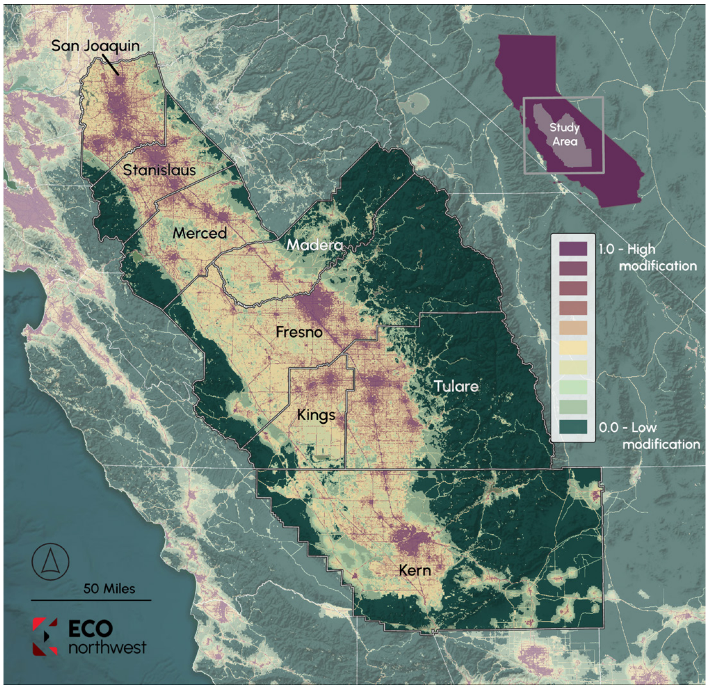
We defined the CUP timeline for each project as the number of days between the date the application was received by the county and the final decision date. This timeline encompasses the first two steps of permitting ("Conditional Use Permits" and "CEQA") outlined in Section 3. For projects that reached a definitive outcome (either approval or denial) the decision date is used as the end date. For some projects, the full permitting timeline was not observed because the project was still in progress when we collected the data or was withdrawn before completing the permitting process. In the survival analysis framework, these projects are "right-censored" observations, meaning that the analysis incorporates the portion of the permitting timeline that was observed, even though the final permitting decision date is unknown. For these projects, the end date is set to July 1, 2025, reflecting the last date of observation. This approach allows all projects to be included in the analysis while appropriately accounting for incomplete permitting outcomes.

Key Variables

SITE AND PROJECT CHARACTERISTICS

Human Modification Index (HMI): The HMI captures the extent to which a project site has been altered by human activity. We included this measure to account for differences in landscape disturbance that may influence permitting timelines, as projects located on more heavily modified land are generally expected to face fewer environmental constraints [18]. The index combines data on different biodiversity threats, such as urban development, agriculture, and energy infrastructure. Each threat is assigned a different level of impact to biodiversity. At each site, these threat values are then combined into a single continuous measure ranging from 0 to 1. Higher values indicate greater levels of modification (see Exhibit 6), which presents some of these values that are most relevant to the study region. Because the human modification index is reported at five-year intervals, each project was assigned the value from the closest prior year to its application submittal date.

EXHIBIT 5
Human Modification Index Across the Study Area



Source: ECOnorthwest and [18]

Land Cover: Similar to the HMI, land cover is used to capture differences in landscape context that may influence permitting outcomes. Using National Land Cover Database (NLCD) data from 2008 and 2016, project sites were classified into three broad categories: developed, agricultural, and open space [19, 20]. See Appendix A for more details on this classification. Projects initiated in or after 2015 were matched with the 2016 NLCD dataset, while projects initiated before 2015 were matched with the 2008 NLCD dataset to align land cover classifications as closely as possible with conditions at the time of project initiation.

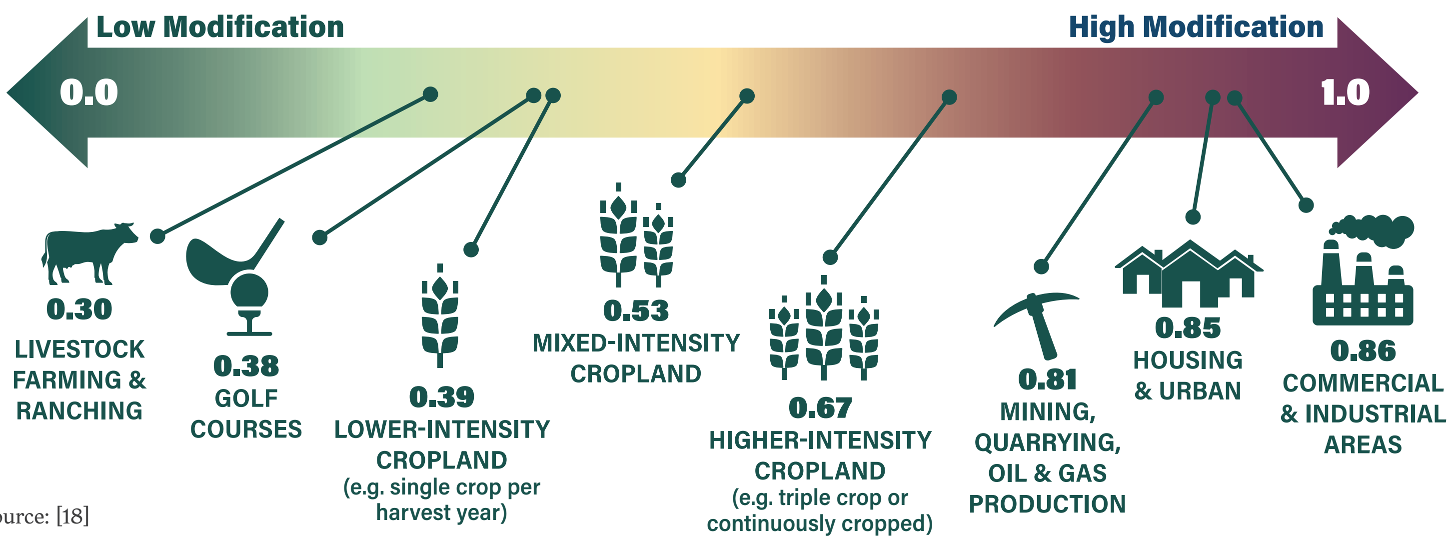
While the human modification index provides a continuous measure of overall disturbance, land cover offers a categorical description of land use. In Appendix A, we therefore specified a different model using land cover instead of HMI to test alternative representations of site characteristics and assess whether permitting timelines respond more to general levels of disturbance or to specific land use types.

Project Size: Project size captures differences in the scale of proposed developments and is measured in megawatts (MW). Larger projects are expected to take longer to permit, since they typically involve greater land disturbance and may trigger more intensive regulatory scrutiny. Information on project size was obtained from project descriptions and supporting documentation within the CUP application materials, as it was not consistently reported in a standardized format across all records. As a result, project size data were not available for all observations; 55 projects in the final CUP dataset were missing this information.

REGULATORY AND JURISDICTIONAL FACTORS

County: The model includes a variable for county to control for county-level characteristics such as administrative capacity, regulatory culture, and levels of community support for renewable energy projects. Controlling for county characteristics allows the model to isolate the influence of unobserved county-specific factors on permitting timelines, ensuring that comparisons across projects were not confounded by broader institutional differences.[5]

EXHIBIT 6 Examples of Land Uses Across the Range of the HMI



Source: [18]

5 To capture differences in ecological conditions and solar development patterns, we initially fit models that separated Kern County into Central Valley and Mojave regions. Because results were substantively similar (not shown) and to avoid overfitting, the reported models use a single Kern County indicator.

Williamson Act Lands: Using 2023 spatial data on Williamson Act designations [21], projects sited on Williamson Act lands were identified to create a categorical variable capturing the regulatory constraint of Williamson Act contracts.

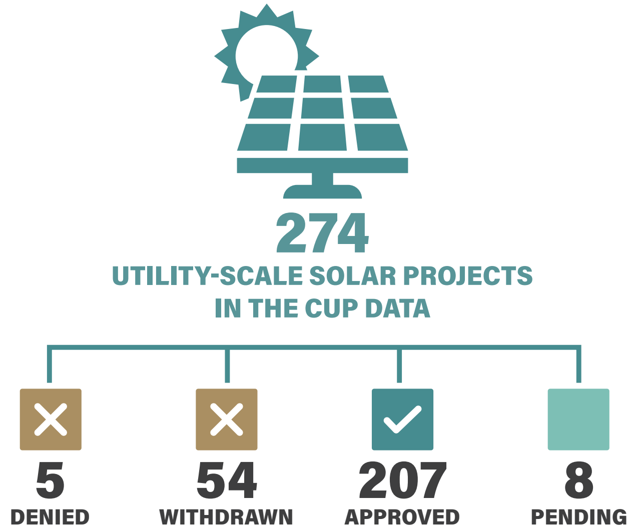
Groundwater Status: Preliminary models explored whether projects located within Critically Overdrafted Basins experienced different permitting timelines, motivated by the possibility that water-stressed agricultural areas may face greater pressure for land-use transition to solar development. However, because very few observations in the dataset were located outside Critically Overdrafted Basins, there was insufficient variation to reliably estimate this relationship. As a result, this variable was not included in the final model specification.

BROADER CONTEXTUAL FACTORS:

Policy and Development Trends: Permitting timelines may also evolve due to shifts in policy and the growing prevalence of renewable energy projects. After testing multiple specifications to capture these temporal dynamics, we created a variable to distinguish projects initiated after 2019, reflecting the substantial policy and market changes affecting solar development that year.

Community Proximity: Finally, the model accounts for the influence of local communities by measuring the distance from each project permit to the nearest Census Designated Place (CDP) [22]. This variable potentially serves as a proxy for opposition to solar development. Projects located farther from communities may face less organized resistance, leading to shorter permitting processes.

EXHIBIT 7 Utility-Scale Solar Project Dataset



Summary Statistics

The dataset has a total of 274 utility-scale solar projects at various stages of the CUP process. Of these, 207 projects have received CUP approval (23 of which did not have a recorded approval date and were removed from the analysis), 5 had been denied, 54 had been withdrawn or otherwise did not complete the process, and 8 were still in process. Across the study area, the median CUP approval duration for approved projects is 591 days (~1.6 years), although timelines vary substantially across projects and counties (Exhibit 8). The median approval duration for projects sited on developed lands was 110 days, while on agricultural lands it was 338 days and in open space was 621 days. Across the eight counties in the study area, Fresno County has the most solar projects in our dataset, with 81 records, followed by Tulare County, while Merced and San Joaquin counties have the fewest records (6 and 11, respectively) (Exhibit 9).

The variables describe a wide range of project characteristics and site conditions (Exhibit 8 and Exhibit 9). Most projects in the sample are sited on agricultural lands (74%), while 21% are sited on open space, and 5% are sited on developed land. Consistent with these land cover patterns, project sites

EXHIBIT 8 Summary Statistics of CUP Timelines and Related Project Characteristics

Variable	Mean	Median	Min.	Max.	Observations
Duration of Approved Projects (Days)	610	420.5	14	3,781	184
Duration of All Projects (Days)	1,300	591	6	5,625	274
Duration of Approved Projects on Agricultural Lands (Days)	593	338	14	3,737	126
Duration of Approved Projects on Developed Lands (Days)	426	110	20	3,781	12
Duration of Approved Projects on Open Space Lands (Days)	706	621	14	2,066	46
Human Modification Index	0.43	0.45	0.05	0.89	274
Project Size (MW)	102	20	0.3	2,800	219
Distance to Communities (km)	4.8	3.6	0	24.7	274

Source: ECOnorthwest Analysis

EXHIBIT 9 Summary Statistics of Categorical Variables

Variable	Value	Count	Percent
Under Williamson Act Contract	Yes	86	31.4%
	No	188	68.6%
Counties	Fresno	81	29.6%
	Kern	46	16.8%
	Kings	36	13.1%
	Madera	6	2.2%
	Merced	21	7.7%
	San Joaquin	11	4.0%
	Stanislaus	10	3.6%
	Tulare	63	23.0%
Land Cover Class	Agriculture	202	73.7%
	Developed	14	5.1%
	Open Space	58	21.2%
Project Initiated in or after 2020	Yes	55	20.1%
	No	219	79.9%

Source: ECOnorthwest Analysis

have an average Human Modification Index (HMI) score of 0.43, indicating that most projects are located on moderately modified landscapes with existing human disturbance, such as low-intensity agricultural areas or recreational lands. Roughly 31% of projects are located on Williamson Act lands, indicating that a substantial share of projects is sited on lands subject to agricultural preservation policies.

Additionally, approximately 20% of projects began the permitting process in or after 2020; the median project size is 20 MW, although several projects exceed 1,000 MW; and, on average, projects are located 5 km from the nearest census-designated place, with distances ranging from 0 to 25 km.

Results

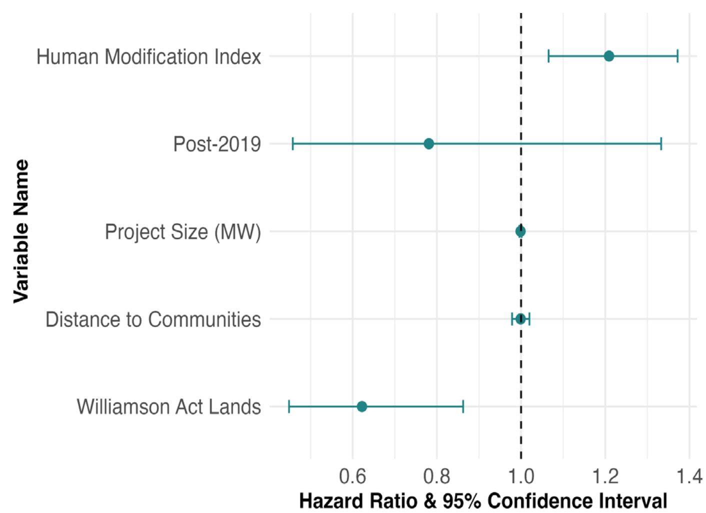
Exhibit 10 presents the estimated hazard ratios and associated confidence intervals for our main model specification, which focused on the subset of projects initiated after 2012 to avoid systematic data incompleteness in earlier records (See Appendix A for further discussion). To verify our findings, we fit multiple models on different subsets of the data and with alternative combinations of variables and find qualitatively similar results. The full set of results is provided in Appendix A.

Key Results

The Human Modification Index (HMI) is a consistent and statistically significant predictor of permitting timelines across model specifications. The >1 hazard ratio (1.21) indicates that projects located in more highly modified landscapes move through the permitting process more quickly. The model estimates that, holding all else equal, a 0.1-point increase in the HMI is associated with a 21% higher chance of approval, or approximately 50 fewer days in permitting.[6] This result suggests that projects sited in areas that have already been altered by human activity (such as high-intensity cropland or previously developed lands) face fewer permitting barriers, which could be due to reduced environmental conflict and fewer requirements for extensive review or mitigation.

Projects located on Williamson Act lands exhibit slower approval, with an estimated hazard ratio of 0.62, indicating that these projects have a 38% lower likelihood of approval, or experience approximately 245 more days in permitting.[6] While the statistical significance of this finding does not hold across all other model specifications (see Appendix A), the general

EXHIBIT 10 Estimated Effect of Key Variables on Permitting Timelines



Source: ECOnorthwest Analysis

NOTE: Hazard ratios greater than one indicate a higher likelihood of approval at any given time (i.e. faster permitting), while those less than one indicates slower permitting. Confidence Intervals that cross one indicate that the estimated effect is not statistically significant. County-level variables were included in the model but are not displayed in this figure; those results can be found in Appendix A. Because variables are measured in different units, the magnitude of the effects should not be directly compared across variables. Instead, results should be interpreted based on direction, statistical significance, and practical implications.

6 These estimates are illustrative back-of-the-envelope approximations intended to aid interpretation of the model results. The model estimates relative permitting speed rather than exact differences in duration. As such, we approximated the estimated differences in days by dividing a reference median permitting duration by the estimated hazard ratio and comparing the result to the reference duration. For categorical variables, the reference duration corresponds to the median timeline of the baseline category. These estimates should not be interpreted as precise predictions of approval time.

trend of slower permitting is consistent, providing evidence that Williamson Act enrollment may impose additional regulatory friction on solar permitting.

Project size does not have a statistically significant effect on permitting timelines (with an estimated hazard ratio close to one). This finding suggests that, within the observed sample, larger projects are not systematically subject to longer permitting timelines, despite the expectation that larger projects may involve greater environmental review complexity. Some project and site characteristics are related in practice. For example, larger projects tend to occur in areas with lower levels of human modification, suggesting that the relationship between project size and permitting timelines may depend in part on project location and landscape context. However, diagnostic tests did not indicate problematic correlation among variables.

Distance to the nearest community does not have statistically significant relationship with permitting timelines, suggesting that proximity to population centers may not meaningfully influence the speed of CUP approval within the study area. Similarly, projects initiated in later years do not exhibit a statistically significant difference in permitting timelines.

Model Validation

To assess the sensitivity of the CUP model results to model specification and sample composition, we estimate a series of alternative models. First, we substitute the Human Modification Index (HMI) with categorical land cover variables (open space, developed land, and agriculture) to evaluate whether the observed effect of landscape disturbance is robust to alternative representations of site conditions. Second, we estimate the model using several alternative samples, which include the full data sample with and without outliers,[7] as well as the full data sample excluding projects with missing approval dates (an alternative approach for handling the uneven distribution of missing approval dates across counties prior to 2013). A table of results including these alternative models is presented in Appendix A.

Across these alternative specifications, the core findings remain consistent. The direction and statistical significance of key variables, including landscape disturbance (HMI) and the Williamson Act lands indicator, are largely unchanged. While coefficient magnitudes vary across specifications, these differences do not materially affect the interpretation of results.

The model specification using land cover classes rather than HMI provides evidence consistent with the HMI-based model, Specifically, projects on developed land are found to move faster than projects on open space, with positive coefficients across all model specifications, though the effect is statistically significant only in the full-sample model. This finding further supports the conclusion that projects sited in more disturbed or developed landscapes tend to experience shorter permitting timelines. By contrast, the model suggests that projects on agricultural lands do not move through permitting significantly faster than projects on open space, suggesting that agricultural lands may experience similarly longer permitting timelines as potentially more environmentally sensitive open space areas. Restricting the sample to more recent projects or excluding extreme outliers does not alter the central findings, suggesting that results are not driven by early-period dynamics or a small number of atypical observations. While descriptive statistics show notable differences in median permitting durations across land cover categories, these differences are not always statistically significant in the survival model after controlling for other jurisdictional, ecological, and temporal factors. This suggests that some of the observed variation in raw medians may reflect correlated site and county characteristics rather than an independent land cover effect.

Consistency Across CEQA Timelines

While the above CUP timeline model encompasses CEQA review, to assess whether these findings extend to just the CEQA portion of the permitting timeline (see Exhibit 2 and 3), an additional set of models were estimated using CEQA review timelines. This supplemental analysis uses a separate database derived from CEQA records. These models exclude projects with incomplete or inconsistent approval records to improve reliability, resulting in a sample size of 147. Results are consistent with the CUP model, with the HMI exhibiting a positive effect of similar magnitude (19% higher likelihood of approval, thus faster permitting) as well as similar directional effects observed across key variables. Full results are provided in Appendix A.

ITP and LSAA Permit Analysis

To better understand permitting timelines associated with state-level environmental approvals, a separate analysis was conducted on permitting timelines for CDFW-issued permits, which include Incidental Take Permits (ITPs) and Lake and Streambed Alteration Agreements (LSAAs). Data on permit application and approval dates for solar projects come from CDFW. These data were filtered to include only solar projects

7 The z-score method (calculated as a project's deviation from the mean duration divided by the standard deviation) was used to identify permitting timeline outliers as those with absolute z-scores greater than 3.

Deron Levy/Shutterstock

that required these permits. For each project, the permitting timeline was calculated as the number of days between the ITP or LSAA application received date and the approval date. All observations in this dataset represent approved permits.

ITP and LSAA permits are generally issued following, or in conjunction with, local land-use approvals such as Conditional Use Permits (CUPs). However, due to the absence of a common project identifier, the CDFW dataset could not be directly linked to the CUP or CEQA datasets used in the primary analysis. As such, the results presented here are descriptive and should be interpreted independently from the main empirical model.

In this project's data set, fewer than 9% of projects obtained ITPs and nearly 19% of projects obtained LSAAs. Summary statistics for ITP and LSAA permitting timelines are presented in Exhibit 11. Across ITPs and LSAAs, the median approval duration is 214 days. When disaggregated by permit type, the median duration is 251 days for ITPs and 214 days for LSAAs. While mean durations are also reported in the table, medians are emphasized here due to the skewed distribution of permitting timelines.

Permitting durations vary widely across observations. The minimum observed duration is 35 days, and the maximum is 1,728 days. Variation is also evident across permit types, with ITPs exhibiting greater variability relative to LSAAs based on differences in standard deviation (respectively 442 vs. 289 days).

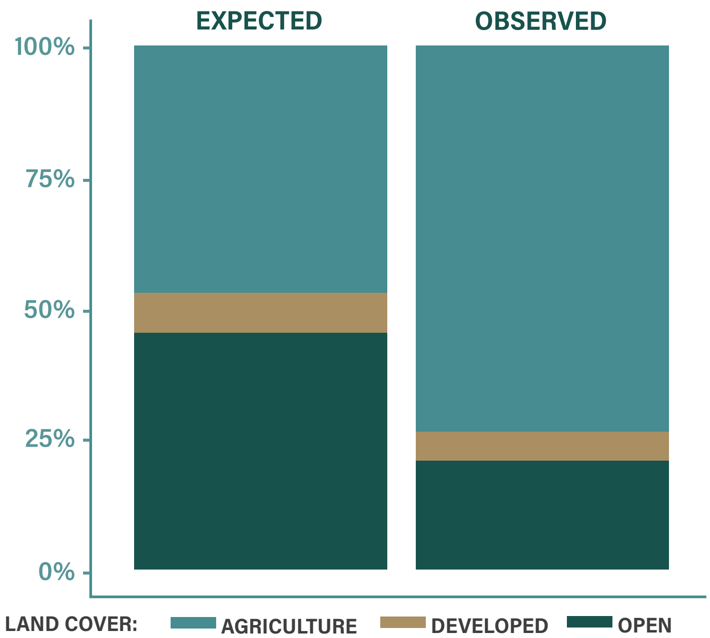
These results highlight the range and variability of state-level permitting timelines, though the limited sample size and lack of linkage to project-level data constrain further interpretation.

Analysis of Developer Site Selection

To explore which sites developers select for potential projects, we compared the site characteristics of the 274 projects in the CUP database to the region as a whole. We characterized the region as a whole by extracting data on random points from the study region and then removing protected areas and locations with land cover that is incompatible with solar (e.g. forests, wetlands), resulting in a final set of 329 random points.

We found fewer solar projects than expected by chance in open space: 21% of projects are in open space, but open space makes up 45% of the study region. In contrast, 74% of projects are on agricultural sites while the geography is only 47% agricultural land cover (Exhibit 12).

EXHIBIT 12 Observed Versus Expected Percent of Projects Across Land Cover Types



Source: TNC analysis

NOTE: "Expected" is what we would expect if projects were sited randomly across the region, whereas "observed" is the actual distribution of utility-scale solar projects in the region.

EXHIBIT 11 Summary Statistics for ITP and LSAA Permitting

Permit Type	Mean	Median	Min.	Max.	Observations
Incidental Take Permit (Days)	421.4	251	60	1,728	18
Lake and Streambed Alteration Agreement (Days)	296.8	214	35	1,697	39

Source: CA Department of Fish and Wildlife and ECOnorthwest analysis

Relatedly, we found that solar developers select sites with high HMI (modification) compared to the region as a whole (mean 0.43 versus 0.33, respectively). This difference is most apparent for projects in open space (mean 0.23 versus 0.14 in random sites). In other words, when project proponents do choose open space, they choose relatively disturbed sites within that broader category.

Finally, we found that solar developers avoid Williamson Act lands and disproportionately submit permits in Critically Overdrafted Basins. While 83% of agricultural lands are designated as Williamson Act lands, only 38% of projects on agricultural land had Williamson Act designation. While the preference for Critically Overdrafted Basins can be partly explained by the level of Critically Overdrafted Basins on agricultural lands generally, there is still a higher preference for them, indicated by the fact that 94% of permits on agricultural land are in these areas compared to 85% of all agricultural lands in the region.[8] The differences we found between solar permit sites and the region as a whole broadly align with our findings in our timeline models and may reflect solar developers' understanding of factors affecting permitting timelines — for example, that projects on modified lands are more likely to have faster permitting timelines. In addition, some lands are unavailable or impractical for solar (e.g. complex topography or dense urban areas) but were not accounted for in our analysis.

8 To learn more about Critically Overdrafted Basins, visit: https://water.ca.gov/programs/groundwater-management/bulletin-118/critically-overdrafted-basins.

5

Interviews

To complement the quantitative analyses, the project team conducted interviews with a state agency, local governments, and the solar industry to contextualize findings and identify new and emerging issues that are starting to shape permitting timelines. Together, the quantitative analyses and the expert interviews provide a structured assessment of the factors associated with solar project site selection and permitting timelines in a key energy producing region of California. Key findings from interviews are discussed below.

Counties

Interviews with permitting directors and staff at six of the eight counties informed conclusions drawn from the quantitative analysis.[9] Interviews were anonymous to allow permitting directors and staff to speak freely. Conclusions and recommendations represented in this report are not endorsed by the participating counties and are those of the study authors alone.

In several cases, these interviews identified newly emerging factors that are beginning to shape solar permitting timelines in California. The recent nature of some of these factors may explain why they were not picked up by our statistical analysis covering the last 15 years of solar permitting.

While there are several common factors shaping land use, the economy, and energy development in the study region, counties in the study area experience notably unique factors that can shape each county's permitting timeline. These include the year in which solar development increased in the county, the level of solar interest and development over time, the level of other development types seeking permitting approvals, and variability in existing land uses, including relative amount of Williamson Act lands and protected environmental areas. Some counties report social opposition to projects waning following initial concerns earlier on in the study timeline, while some counties are just now starting to experience growing concern about the rate and location of clean energy, especially in the case of BESS, which were not part of the analysis for this report.

A common theme across all counties is adaptation to respond to the needs of the moment. When asked about current and future resourcing, counties spoke to partnerships and processes that they have put in place to process higher volumes of projects. All permitting departments expressed commitment to responsiveness and effective, transparent permitting for developers and their community members, sometimes highlighting the challenges of balancing commercial interest with community concerns that might emerge about the proliferation of solar in the community on certain lands and related community benefits.

Counties with pre-application processes consistently report smoother, faster reviews. Most counties now have these types of offerings in place, which were implemented as they received higher levels of applications. Developers are also becoming more sophisticated in their preparations for applications. When serving as the lead agency for solar projects, counties can face criticism or legal action if they are perceived as "cutting corners," which can present a tension between moving quickly and communities and environmental groups that want to feel processes are thorough. At least two counties mentioned CEQA as a helpful organizing process to ensure community members feel like they have had their say. CEQA plays a dual role—it is both a set of environmental reviews and the primary mechanism for community engagement; some counties describe it as lengthy but indispensable for surfacing local concerns.

In terms of other advancements in recent years, where experienced, well-resourced developers lead projects, which counties report is now most developers of utility-scale solar projects, applications arrive more complete and move through review with fewer delays, controlling for sensitive landscapes. In several places, longstanding permitting experience and a history of reviewing solar projects has produced practical local criteria and agreements with county review boards that steer projects away from the most sensitive lands, reducing surprises during public review.

Interviews also revealed that siting tends to be the single biggest driver of extended timelines: prime irrigated farmland,

9 Two of the study counties could not be reached for interview.

Williamson Act contracts, Delta and watershed constraints, and the presence of protected species routinely trigger additional studies and reviews, which aligns with our study's findings. While our analysis demonstrates developers generally seek to avoid these types of lands, it is plausible that pursuing projects in these areas is not always avoidable, especially given the prevalence of Williamson Act lands throughout the region, as well as and transmission constraints that can limit where developers can propose projects.

Other factors that we did not capture in our models or that are not part of the permitting process were also deemed important. For example, interconnection and transmission availability act as the market's magnet: developers follow substations and queue positions, concentrating interest in certain places and creating sometimes sudden surges in county processes. New technical elements—most notably the rapid addition of battery energy storage systems—add complexity to environmental review and community conversations.

Several recurring but locally distinct dynamics emerged from interviews. Many counties trace their solar experience back to early waves of entitlement activity and subsequent resale to specialized developers; where that history exists, permitting workflows are more mature. SGMA and fallowing are reshaping the land-use picture: retired or fallowed acreage is increasingly considered for solar, and counties are exploring dual-use concepts such as raised panels over recharge areas or panels along canals to combine generation with water management benefits. Some counties, noting they are without municipal utilities, raise equity concerns: In their view, large grid-export projects can generate limited direct benefit for local ratepayers, prompting interest in community benefits agreements, local tariffs, or other mechanisms to ensure local economic returns. Finally, some counties prefer to set standards rather than prescriptive siting maps, while others apply stricter avoidance rules for permanent crops—differences that materially affect how quickly projects clear review.

California Department of Fish and Wildlife

As CDFW is the lead agency for ITPs and LSAAs and collaborates on CEQA, all of which we studied for our analysis, we also interviewed CDFW staff who oversee related processes and teams. Interviews were conducted anonymously and do not represent the opinion of CDFW.

Interviewees emphasized that early consultation and, in the case of ITPs, mitigation availability, are the strongest determinants of permitting timelines. While agency experience with solar permitting has grown, challenges persist: available funding as the scope and scale of work grows, limited mitigation land, new species listings, and complex title issues can strain reviews. Recent improvements, including a checklist co-developed with the solar industry, dedicated solar staff, and programmatic tools, have helped, but structural constraints remain. Overall, these sentiments are supported by our models, which showed longer permitting timelines for projects on lands of higher conservation value.

Mitigation emerged as one the most significant bottlenecks in the overall project timeline. While mitigation bank credits are the fastest option, they are often unavailable or nonexistent for certain species, especially newly petitioned or candidate species. When credits are not available, developers must secure conservation lands or easements in perpetuity, a process that can take six months to a year due to title complications, land scarcity, and the need for habitat connectivity. Staff noted that conservation land is becoming increasingly difficult to find, and some project sites selected by developers would be more appropriate as mitigation lands. Newer tools such as landscape-scale conservation planning and mitigation conservation agreements have helped, and there is growing interest from developers in onsite mitigation for species like burrowing owl, although the science is still developing.

CDFW's approach to solar permitting has evolved over the past two decades. CDFW now has far more experience with solar projects and a deeper understanding of how they affect sensitive species. At the same time, the permitting landscape has become more complex due to a steady increase in species petitions, including species whose habitats overlap heavily with solar development areas. Once a species becomes a candidate, it has the same protections as species listed as threatened or endangered under CESA, which can reshape permit conditions mid-process and significantly alter staffing needs within the department. Staff also highlighted the role of the Fish and Game Commission, which accepts petitions based on completeness, meaning candidate listings can occur even when scientific information is still emerging.

The interviews also provided insight into the implementation of the AB 205 process. Although the legislation was intended to accelerate permitting, staff reported that the process required more time and resources than traditional CESA reviews and did not collect the same fees as standard ITPs. Despite these challenges, CDFW met statutory timelines. Staff emphasized that without the additional funding that supported these positions, meeting timelines would have been far more difficult.

Energy Industry

Interviews undertaken with solar project developers and environmental permitting experts highlight a complex set of challenges that collectively contribute to extended permitting timelines for utility-scale solar projects in California. While CEQA remains a central component of the process, interviewees consistently emphasized that the most significant sources of delay and uncertainty occur at the interface between CEQA, local permitting, and state environmental approvals.

A central theme of these interviews is limited permitting predictability, especially related to compensatory mitigation. Interviewees perceive mitigation requirements as not proportionate to expected environmental impacts, for example, relying on acreage-based metrics. Interviewees stated that unpredictable and inconsistent expectations made it difficult for developers to estimate costs or design viable project timelines. Interviewees reported that after completing CEQA and local land use review, it can take 6 to 12 months or more to obtain permits for endangered species, water impacts, and cultural resources.

Interviewees indicated significant jurisdictional variability when seeking CUPs. Administrative hurdles were identified throughout the permitting process but were particularly pronounced during the CUP review timeline, especially as it relates to limited administrative capacity and inconsistencies across counties. Interviewees emphasized that permitting complexity is not evenly distributed across jurisdictions; some counties are recognized for being efficient and well-staffed, while others have imposed zoning restrictions or larger decommissioning requirements. However, even in counties that are considered "solar friendly," jurisdictional specific changes in the permitting process can increase project timelines and costs. For example, one county introduced cumulative impact fees as part of mitigation requirements, and projects already in the permitting process were required to comply. As previously noted, some interviewees reported an interest in using the CEC's Opt-In process as a workaround to local permitting challenges.

A key issue identified in interviews is the mismatch in sequencing between the permitting process and solar project development and financing. Financing for utility-scale solar projects generally follow a multi-stage structure tied to development milestones. Early-stage project activities including site control and permitting are typically funded by early investors or developer equity for larger solar development firms. Once permits are obtained and other requirements are met, developers can secure construction loans to fund procurement and construction. Often these loans have timeline conditions. Finally, once a project is operational, long-term project financing is secured which repays construction loans and leads the project to be cash-flow positive when revenue can be generated through energy sales. CDFW permits require advanced engineering documentation, which developers typically defer until after financing is secured. Interviewees noted that this disconnect can create a bottleneck late in the project lifecycle and undermine project timelines and costs.

While developers often seek out low-conflict land, such as fallowed agricultural fields, which aligns to our study's statistical findings, they noted that environmental mitigation requirements remain high even on degraded sites. For example, the Western Burrowing Owl has recently been designated as a Candidate for the California Endangered Species Act. As a candidate for listing, the species is temporarily afforded the same protections as a state-listed endangered or threatened species. When the listing status of a species changes during project development or permitting, interviewees noted it can introduce new risk, uncertainty, and potential to extend the project timeline.

In parallel, the rise of local opposition and litigation from both well-funded hyper-local opposition groups and social advocacy groups impacts timelines [9]. Interviewees noted that early community engagement and transparent project information sharing from a trusted source (such as a local champion or respected third-party specialists) are now essential components of project development strategy.

Interviewees overwhelmingly reported that Williamson Act was a major barrier that has historically influenced site selection. Interviewees reported avoiding development on Williamson Act lands due to significant costs associated with canceling contracts, but that they now feel it is becoming harder to avoid these lands as fewer new sites remain.

Finally, interviewees noted that interconnection delays have become the biggest driver of total project timelines. Recent interconnection reforms by the California Independent Systems Operator (CAISO) aim to address this by prioritizing high-readiness projects through a scoring and validation process [23]. While the results of this restructuring remain to be seen, currently, full buildout timelines remain as long as 7 to 9 years from queue entry to operation, significantly longer than even the longest permitting timelines. This reinforces the need for integrated policy reforms that align permitting, interconnection, and development to accelerate deployment in support of Senate Bill (SB) 100 goals.

6

Discussion

Our analysis points to a clear takeaway for policymakers: where a project is sited matters far more than most project-level characteristics. Only a small set of factors consistently influence how long utility-scale solar projects spend in permitting, and they relate to landscape conditions and designations.

Projects located in more developed areas move through permitting noticeably faster. Higher Human Modification Index (HMI) scores and siting on developed land are both associated with shorter review times, suggesting that projects in landscapes with fewer ecological sensitivities face fewer procedural hurdles. This aligns with what we see in project location selection: developers overwhelmingly choose previously modified sites and, even within open space, gravitate toward areas with higher levels of human disturbance than the regional average. State-level permit data reinforce the importance of site conditions. Approvals for ITPs and LSAAs vary widely, with median timelines of roughly 210–250 days, underscoring how additional, site-specific regulatory requirements can introduce uncertainty and extend overall timelines.

> **"What often gets lost is that costs associated with solar permitting delays increase project costs which are ultimately passed onto the ratepayer, threatening the affordability of electricity for Californians."**
>
> **— Solar Industry Expert**

Certain regulatory factors also matter. The presence of Williamson Act designation is associated with a 38% lower likelihood of permit approval, or approximately 245 more days in permitting. This is consistent with the Act's role in preserving agricultural land and limiting conversion to non-agricultural uses, which may require additional review, compatibility determinations, contract cancellation, or mitigation depending on county implementation.

While it was hypothesized that recent projects would move through permitting faster, the analysis finds that projects initiated after 2019 do not have a statistically significant difference in permitting duration than earlier projects. Further, we did not observe an increase in permitting speed across any period within the study period. This pattern may reflect competing dynamics in solar development. While increased agency familiarity with solar permitting, developer experience, and procedural streamlining may be expected to accelerate permitting for more recent projects, the declining availability of low-conflict lands may offset these gains, as remaining suitable sites may face greater environmental or regulatory constraints that previously made them less desirable for development.

Notably, several factors often assumed to slow down permitting, such as project size and distance to communities, do not show meaningful effects in this dataset. This may indicate these are newly emerging challenges or that these variables may not independently drive permitting timelines.

Cost Implications of Solar Permitting Delays

Solar developers report that the cost implications of permitting delays for utility-scale solar projects in California can threaten project viability. A key financial constraint is that projects cannot reach financial close until all permits are secured and any litigation is resolved, potentially requiring developers to settle at great cost to avoid timeline delays. Missing critical windows, such as the interconnection "blackout period," can delay energization by six months or more, while missing biological survey window requirements (e.g., for wildlife clearance) may result in even longer delays. Industry interviews suggest that these delays erode project economics and can lead to the loss of tax credits or increased interest rates, both of which materially impact the project's bottom line. As a result, interview participants noted, even small permitting setbacks may have financial ripple effects, many of which ultimately flow through to ratepayers in the form of higher electricity prices.

Limitations and Future Work

Several data and scope limitations constrain how broadly our results can be interpreted. Several potentially important project characteristics could not be observed. For example, developer knowledge and expertise may influence both site selection and permitting outcomes but is not captured in the available data.

Similarly, changes in project ownership or design during the permitting process are not consistently documented. Although earlier models considered groundwater basin status as a predictor of permitting timelines, too few projects were located outside Critically Overdrafted Basins to reliably estimate its effect. Further investigation of this relationship would require additional observations from less water-stressed sites.

Additionally, the relatively small sample size limits statistical power and the ability to include more explanatory variables in the model and obtain reliable estimates. While the dataset includes 274 projects, missing data reduces the estimation sample to 219 observations, with 173 completed events. This constrains model complexity and may limit the ability to detect smaller effects.

Future work could expand the analysis in several ways. Further exploration of the relationships between key variables (such as the relationship between HMI and project size or distance to communities) and how that influences permitting timelines would be fruitful. As more projects move through the permitting pipeline and additional data become available, re-estimating the model would allow for a more complete assessment of permitting timelines. Expanding the geographic scope beyond the study area would also help evaluate whether the relationships observed in this study hold across other regions of California with different land-use patterns and development pressures. Extending the analysis to multiple states, but with an explicit focus on identifying causal relationships, would further improve understanding of how permitting timelines interact with state and federal policies. Incorporating additional stages of the permitting and development process (e.g. interconnection, construction) would provide a more comprehensive view of project timelines and bottlenecks, though assembling consistent data across jurisdictions remains a challenge. Further refinement of site characteristics, and more detailed policy variables, could improve measurement of landscape and regulatory conditions. Additional contextual factors, such as drought conditions or economic cycles, may also help explain variation in permitting timelines. Together, these extensions would improve understanding of how permitting dynamics evolve over time and across jurisdictions.

A

Technical Appendix

This appendix presents additional model specifications and supporting analyses referenced in the main report. The primary model discussed in the report focuses on Conditional Use Permit (CUP) timelines using the Human Modification Index (HMI) as the primary measure of landscape conditions. The analyses presented here explore alternative specifications, including the use of land cover classifications, models estimated on different data subsets, and models estimated using CEQA permitting data.

Model Details

Survival analysis is well suited for studying the drivers of solar permitting durations because the outcome of interest is not simply whether a project receives approval, but how long it takes for projects to move through the permitting process. In addition, the dataset includes both projects that have completed permitting as well as projects that are still in progress or did not successfully complete the process. For projects that have not reached completion, observed durations are right-censored, meaning the permitting outcome was not observed. Survival analysis explicitly accounts for this censoring, allowing incomplete observations to be retained in the analysis rather than excluded.

To estimate the factors influencing the duration of the CUP process, we employ a Cox proportional hazards model, which is a semi-parametric survival framework that estimates how the variables of interest influence the hazard ratio (the probability that a project reaches completion at a given point in time, conditional on not yet being completed), and thus, variation in permitting timelines. The dependent variable is the number of days from permit filing to permit approval (or censoring date), and covariates capture site and project characteristics and regulatory conditions. The model is specified as follows:

$$h_{ic}(t|X_{ic}) = h_0(t)\, exp\left(\sum_{i=1}^{P} \alpha_c x_c + \beta_i x_i + \varepsilon_{ic}\right)$$

Where $h_{ic}(t/X_{ic})$ is the hazard rate for project i in county c at time t given the vector of covariates X_{ic}, $h_0(t)$ is the baseline hazard rate at time t, which represents the hazard for a project i if all covariates are zero. $\alpha_c x_c$ represents the vector of county dummy variables and associated coefficients, which function as county-level fixed effects to control for time-invariant county characteristics that may influence permitting timelines. $X_{ic} = (X_{ic1}, X_{ic2}, \ldots, X_{icn})$ is the vector of n predictor variables for individual project i in county c. Finally, ε_{ic} represents the unobserved factors influencing timelines. All models are estimated using robust standard errors clustered by county to account for within-county correlation in project timelines.

Construction of a solar photovoltaic farm in California

CUP Dataset Construction Details

Note: Projects were screened to ensure that the dataset captures utility-scale solar development. This process involved reviewing project names, descriptions, and associated documentation to remove non-utility-scale projects (e.g., small-scale installations or non-energy developments).

Details on land cover classifications: The National Land Cover Database (NLCD) provides detailed land cover classifications for each project site. For the purposes of the analysis, these original classifications were aggregated into three broader land cover categories: developed (including high-, medium-, and low-intensity development), agricultural (cultivated crops and pasture/hay), and open space (including grasslands, shrub/scrubland, and developed open space). Exhibit 13 presents these categorizations.

EXHIBIT 13 Land Cover Classifications Used in Analysis

Aggregated Category	Original NLCD Category
Developed Land	Low-Intensity Development; Medium Intensity Development; High Intensity Development
Agricultural Land	Cultivated Crops, Pasture/Hay
Open Space	Grassland/Herbaceous; Shrub/Scrub; Developed Open Space

Source: ECOnorthwest

Alternative Model Specifications and Results

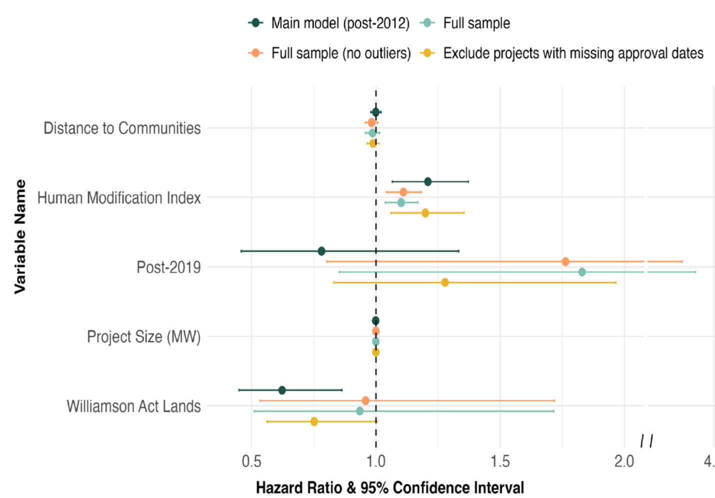
This section presents alternative model specifications used to evaluate the robustness of the main results. These specifications vary key modeling choices, including the representation of site conditions and the underlying dataset used for estimation.

CUP Model

The full set of alternative specifications presented are as follows. Alternative specifications were used to assess the sensitivity of results to different measures of landscape conditions and sample restrictions. Exhibit 14 provides a visual summary of the model results, allowing for comparison across key variables and model specifications. Exhibit 15 presents the full table of results.

- **The primary model** (Exhibit 15, Column 1): This is the model presented in the main text, and is estimated with the subset of projects initiated after 2012. Tulare County disproportionately lacked records of approval dates prior to 2012, so to avoid any sample selection bias that could occur due to this systematic lack of data, we truncate our sample of projects to those initiated after 2012.
- **Full sample of projects** (Exhibit 15, Column 2): projects with missing approval dates are treated as "right-censored" rather than approved in the model. The timeline for these projects ends on the last day of observation (July 1, 2025). While this treatment of approved projects with incomplete timeline data is not preferred, the results are consistent with the findings of the main model.
- **Full sample of projects with outliers removed** (Exhibit 15, Column 3): We use the z-score method[10] to identify and remove permitting duration outliers. This eliminates three observations that had approval timelines above 2,600 days. No outliers were identified using this method on the sample of post-2012 projects used in the primary model.
- **Full sample of projects excluding those with missing approval dates** (Exhibit 15, Column 4): As an alternative approach to dealing with systematic missing approval dates for projects initiated prior to 2013, we estimate a model on the sample of projects excluding those missing approval dates. Since these projects disproportionately occur in Tulare County, their exclusion could introduce geographic sample-selection bias and this method is not preferred to the primary model. However, the results provide additional evidence that the main findings are consistent across sample definitions and are not meaningfully influenced by approval data missingness. As an additional robustness check, we also estimate the model without Tulare County observations (results not presented).
- **Models using land cover classification rather than HMI** (Exhibit 15, Columns 5-7): In this specification, the HMI was replaced with categorical land cover variables to evaluate whether similar relationships emerge using a more discrete

EXHIBIT 14 Main and Alternative CUP Model Results



Source: ECOnorthwest Analysis

NOTE: County-level hazard ratios are not shown for clarity, as they are included as control variables in the model.

10 The z-score is calculated as a project's deviation from the mean divided by the standard deviation. Observations with an absolute z-score greater than 3 are considered outliers.

representation of landscape conditions. Project sites are classified into three land cover categories: developed land, agricultural land, and open space. The model estimates the relative permitting speed of projects across these categories, using open space as the reference group. The following three models are estimated using land cover classification:

a. Post-2012 sample (Exhibit 15, Column 5)
b. Full sample (Exhibit 15, Column 6)
c. Full sample with outliers removed (Exhibit 15, Column 7)

Overall, we find that the effect of HMI is consistent across models, though the magnitude of the effect varies depending on the sample used. The magnitude of its effect varies slightly, with various versions estimating that a 0.1-point increase in the HMI leads to a 10% to 20% increase in the likelihood of approval. Finally, multicollinearity among variables was evaluated using variance inflation factors (VIF), with all values below two, indicating no evidence of problematic collinearity

LANDCOVER SPECIFICATION

Results with landcover provide some evidence provides some evidence that projects located on developed land may be associated with faster permitting timelines relative to those on open space (Hazard Ratio ranges from 1.74 to 2.53). However, only the model estimated on the full sample shows a statistically significant effect (Hazard Ratio = 1.78). Specifically, this model

EXHIBIT 15 CUP Model Table of Results

Dependent Variable: Duration (days)	(1) Primary Model (post-2012)	(2) Full Sample	(3) Full Sample (no outliers[1])	(4) Exclude Projects with Missing Approval Dates	(5) Primary Model: Land Cover	(6) Full Sample: Land Cover	(7) Full Sample: Land Cover (no outliers)
County: Kern	0.297*	0.418***	0.361***	0.602***	0.165	0.281**	0.165
County: Kings	-0.274*	0.077	-0.003	0.016	-0.055	0.156	-0.04
County: Madera	1.618***	1.667***	1.616***	1.927***	1.678***	1.689***	1.587***
County: Merced	-0.522***	-0.736***	-0.780***	-0.793***	-0.621***	-0.761***	-0.860***
County: San Joaquin	0.151	0.279	0.191	0.366	0.381	0.261	-0.044
County: Stanislaus	-1.211***	-0.272*	-0.317**	0.017	-1.298***	-0.462**	-0.612***
County: Tulare	1.931***	-0.339***	-0.397***	1.547***	2.069***	-0.284***	-0.374***
HMI[1]	0.190***	0.097***	0.105***	0.181***	-	-	-
Land Cover: Agriculture	-	-	-	-	0.348	0.007	0.001
Land Cover: Developed	-	-	-	-	0.556	0.574**	0.927
Post-2019 projects	-0.247	0.604	0.567	0.245	-0.226	0.654	0.545
Project Size (MW)	-0.001	-0.0005	-0.001	-0.0005	-0.001	-0.001	-0.001
Distance to Communities (km)	-0.001	-0.014	-0.018	-0.012	-0.014	-0.016	-0.023*
Williamson Act Lands	-0.475***	-0.067	-0.043	-0.286*	-0.562***	-0.101	-0.063
Observations	136	219	216	204	136	219	209
Events	117	173	170	173	117	173	173
R^2	0.417	0.154	0.155	0.292	0.401	0.153	0.162
Wald Test (df = 12)	22,848.130***	64,600.640***	60,915.390***	9,211.230***	59,291.460***	3,188.990***	1,883.940*** (df = 13)
LR Test (df = 12)	73.461***	36.657***	36.380***	70.498***	69.662***	36.336***	36.861*** (df = 13)
Score Test (df = 12)	96.226***	48.820***	47.903***	93.570***	91.833***	49.737***	50.667*** (df = 13)

Note:*p<0.1**p< 0.05***p<0.01

Source: ECOnorthwest Analysis

NOTES: 1. This table presents estimated coefficients. To calculate the Hazard Ratio, take the exponent of the estimated coefficient. 2. The HMI variable is scaled by a factor of 1/10 so that coefficient estimates reflect the effect of a 0.1-point change in the index.

estimates that projects sited on developed lands have about a 78% higher likelihood of approval relative to projects sited in open spaces, which translates to approximately 281 fewer days in permitting.[11]

These results suggest that while land cover provides an intuitive and interpretable measure of site conditions, it may not capture the impact of landscape disturbance as consistently as the continuous HMI measure used in the main specification. Overall, the alternative land cover specification yields results that are directionally consistent with the main model but less stable across samples, perhaps due to the relatively small number of projects on developed land (14). This provides some support for the use of the Human Modification Index as a more comprehensive measure of site conditions' impact on permitting.

CEQA Model

To complement the CUP analysis, additional models were estimated using CEQA permitting data to examine the duration of environmental review processes. These models use the same survival analysis framework described in the main text. While CEQA records offer insight into environmental review processes, the primary analysis in this report relies on CUP timelines, which provide more accurate and consistently recorded permitting durations, more complete project-level information (including project size), and clearer identification of approval outcomes. For this reason, CEQA models are presented as a supplemental rather than primary analysis.

DATA SOURCES AND SAMPLE CONSTRUCTION

The CEQA dataset was constructed from the CEQA online database (CEQAnet), which compiles environmental review documents submitted to the State Clearinghouse (SCH). Not all environmental documents are submitted to the State Clearinghouse, so this is not a comprehensive database of all environmental documents, but it is the most comprehensive source for this information. Each project was assigned a unique SCH number that links all associated filings, allowing projects to be tracked through the permitting process. CEQAnet provides detailed information on document type, filing dates, project descriptions, and location information. These fields were used to identify projects, construct permitting timelines, and link projects to spatial datasets.

The dataset includes projects with initial CEQA filings between January 1, 2002 (the year the state enacted Senate Bill 1078, establishing its first renewable energy standards) and December 1, 2024. To identify utility-scale solar projects, we applied a multi-step filtering process across project type, title, and description fields using keywords such as "solar," "photovoltaic," and "PV." Records associated with non-utility applications (e.g., schools, parking structures, on-site generation) were excluded. The resulting sample was manually reviewed to confirm inclusion of utility-scale solar development.

CONSTRUCTION OF CEQA TIMELINES

The primary variable of interest is the duration of the CEQA environmental review process. Timelines are constructed at the project level using CEQAnet filing histories. For each project, we identify:

1. the earliest CEQA document, representing the start of environmental review (typically a Notice of Preparation or Mitigated Negative Declaration), and
2. the completion point, defined as either:
    a. the earliest Notice of Determination (NOD), or
    b. the most recent filing when no NOD is recorded.

Permitting duration is calculated as the number of days between these two points.

Project status is determined based on the most recent filing. Projects with a final document classified as a NOD or Notice of Exemption (NOE) are treated as having completed the CEQA process. Projects without a completion document are treated as right-censored in the survival analysis.

A subset of projects entering the Mitigated Negative Declaration (MND) and the NEG pathways lack subsequent filings, making completion status ambiguous. Because treating these cases as either completed or ongoing would introduce bias, projects with MND or NEG as the only recorded document and no clear completion indicator are excluded from the primary analysis.

SUMMARY STATISTICS

The final CEQA dataset includes a total of 147 utility-scale solar projects across the study area with complete data records. Of those, 113 have completed the CEQA review process. The median duration of CEQA review among completed projects is approximately 174 days. Summary statistics for the continuous covariates are presented in Exhibit 16, and categorical variables are summarized in Exhibit 17. The project sample reflects a range of siting conditions and regulatory contexts.

11 These estimates are illustrative back-of-the-envelope approximations intended to aid interpretation of the model results. Because the model estimates relative permitting speed rather than exact differences in duration, the estimated differences in days were approximated by dividing the median observed permitting duration (641 days for approved projects on open-space lands (the baseline landcover type)) by the estimated hazard ratio and comparing the result to the median duration. These estimates should not be interpreted as precise predictions of approval time.

Most projects (62%) are located on agricultural land, with smaller shares on open space (35%) and developed land (3%). Approximately one-third of projects began the permitting process after 2019, and over 20% of projects were subject to Williamson Act contracts.

EXHIBIT 16 Summary Statistics of Continuous Covariates

Variable	Mean	Median	Min.	Max.	Observations
Duration of Approved Projects (Days)	441.7	174	33	5,329	113
Duration of All Projects (Days)	1,276.4	355	19	5,594	147
Human Modification Index	0.4	0	0	1	147
Project Size (MW)	143.2	40	0	1,500	147
Distance to Communities (km)	4.7	3	0	22	147

Source: ECOnorthwest Analysis

EXHIBIT 17 Summary Statistics of Categorical Covariates

Variable	Value	Count	Percent
Counties	Fresno	18	12.2%
	Kern	59	39.9%
	Kings	28	18.9%
	Madera	3	2.0%
	Merced	13	8.8%
	San Joaquin	6	4.1%
	Stanislaus	5	3.4%
	Tulare	15	10.1%
Approved	Yes	113	76.4%
	No	34	23.0%
Land Cover Class	Agriculture	91	61.5%
	Developed	4	2.7%
	Open Space	52	35.1%
Under Williamson Act Contract	Yes	35	23.6%
	No	112	75.7%
Project Initiated in or after 2020	Yes	42	28.4%
	No	105	70.9%

Source: ECOnorthwest Analysis

CEQA MODEL RESULTS

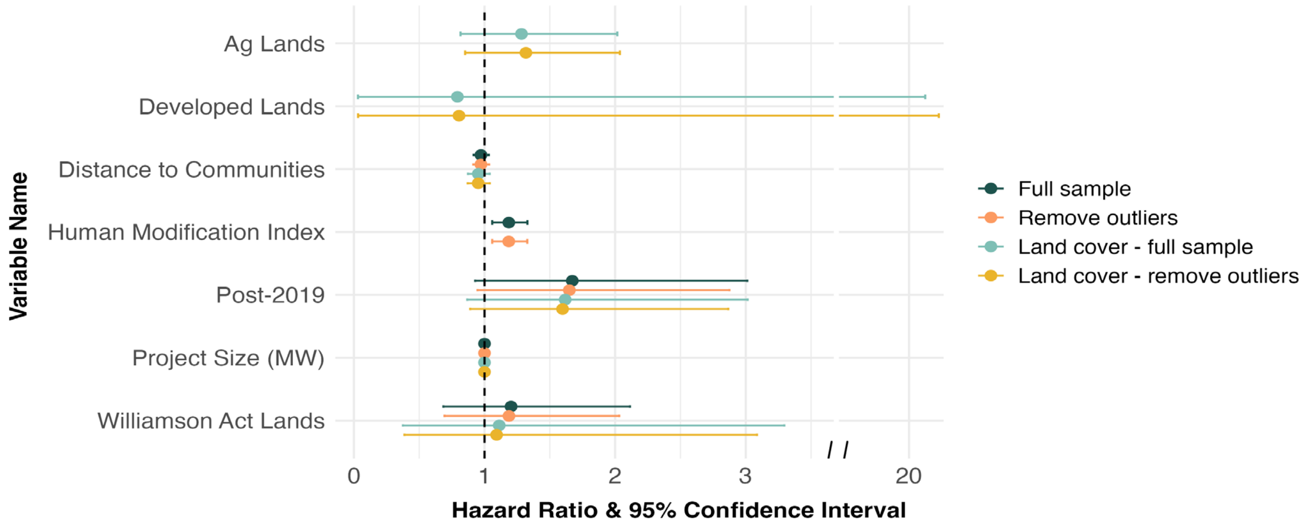
The results from the CEQA model (Exhibit 18) are presented as hazard ratios (HRs), where values greater than one indicate a higher likelihood of project completion at any given time and values less than one indicated longer timelines. All specifications include county fixed effects and standard errors clustered at the county level. A full table of model results is presented in Exhibit 19.

Consistent with the CUP model results, the CEQA model data finds a consistently positive and significant effect of HMI. Both models (full sample and outliers removed) estimate that an additional 0.1-point increase in a site's HMI is associated with a 19% higher likelihood of environmental review completion (HR = 1.19) (Exhibit 19, Columns 1 and 2).

When using land cover instead of HMI (Exhibit 19, Columns 3 and 4), the estimated effect for projects located on developed lands is highly imprecise, with a wide confidence interval spanning from zero to 20. This indicates substantial uncertainty in the estimate, likely reflecting the small number of projects in this category (4). As a result, the model does not provide reliable evidence on the direction or magnitude of the relationship between developed land siting and permitting timelines in this specification.

Finally, the other covariates (post-2019, project size, distance to communities, and Williamson Act lands) are not found to have significant effects on CEQA timelines.

EXHIBIT 18 CEQA Model - Hazard Ratios with 95% Confidence Intervals



Source: ECOnorthwest Analysis

NOTE: County-level hazard ratios are not shown for clarity, as they are included as control variables in the model.

EXHIBIT 19 CEQA Model — Table of Results

Dependent Variable: Duration (days)	(1) Full Sample	(2) Remove Outliers	(3) Land Cover - Full Sample	(4) Land Cover - Outliers Removed
County: Kern	-0.356***	-0.339***	-0.530***	-0.497***
County: Kings	1.137***	1.139***	1.166***	1.174***
County: Madera	1.274***	1.277***	1.166***	1.448***
County: Merced	0.086	0.088	0.053	-0.047
County: San Joaquin	-0.362	-0.354	-0.303	-0.284
County: Stanislaus	0.485*	0.469*	0.447	0.445
County: Tulare	0.461***	0.484**	0.661*	0.681
HMI[1]	0.171***	0.170***	-	-
Land Cover: Agriculture	-	-	0.249	0.275
Land Cover: Developed	-	-	-0.233	-0.217
Post-2019 projects	0.514*	0.501*	0.481	0.468
Project Size (MW)	-0.00004	-0.0001	-0.0002	-0.0003
Distance to Communities (km)	-0.027	-0.028	-0.048	-0.049
Williamson Act Lands	0.185	0.171	0.107	0.089
Observations	147	144	147	144
Events	113	110	113	110
R^2	0.37	0.364	0.343	0.338
Wald Test	4,346.580*** (df = 12)	3,726.490*** (df = 12)	1,480.370*** (df = 13)	1,339.680*** (df = 13)
LR Test	67.922*** (df = 12)	65.242*** (df = 12)	61.842*** (df = 13)	59.459*** (df = 13)
Score Test	82.128*** (df = 12)	78.258*** (df = 12)	74.912*** (df = 13)	71.369*** (df = 13)

Note:*p<0.1**p< 0.05***p<0.01

Source: ECOnorthwest Analysis

NOTES: 1. This table presents estimated coefficients. To calculate the Hazard Ratio, take the exponent of the estimated coefficient. 2. The HMI variable is scaled by a factor of 1/10 so that coefficient estimates reflect the effect of a 0.1-point change in the index.

B

Interview Question Format

Interviews undertaken with developers, industry experts, environmental permitting experts, local government, and a state agency highlight a complex set of challenges and factors that collectively contribute to permitting timelines for utility-scale solar projects in California [24].

ECOnorthwest and TNC conducted interviews with industry and government experts focused on permitting solar energy development projects in California. Interviews were conducted remotely via Zoom using a standard questionnaire across stakeholder groups.

- Please tell me about your position, department, and organization.
- Please tell me about your experience permitting solar/BESS projects.
- In your experience with permitting utility-scale solar projects in California, what are the major permitting related issues that lead to time delays?
- Have you found that land use, habitat/conservation value, presence of sensitive species, county, etc. leads to different permitting outcomes?
- Have you encountered any other factors during project permitting that have increased timelines?
- How do permitting timelines translate to project costs? (some participants)
- Do you have experience permitting community scale solar projects? And if so, how does the permitting timeline issues related to utility-scale projects extend to community scale projects? (some participants)
- Is there anything else you think we should know relevant to understanding permitting timeline issues for utility-scale solar project in California?

C

Background Research

Among the studies that address utility-scale renewable energy, several thematic areas provide context for understanding factors that may influence the permitting of large-scale solar projects in California. These include research on public attitudes toward utility-scale renewable energy; analyses of federal, state, and local policy frameworks that govern renewable energy siting and development; investigations of renewable project timelines; and studies of site-specific characteristics such as existing land use and land cover, visual and aesthetic considerations, and the presence of culturally and environmentally sensitive resources. These themes are reviewed in depth in the following sections.

Public Attitudes

A significant portion of the literature examines factors shaping public attitudes toward proposed solar and wind facilities on utility-scale renewable energy development These studies help identify variables that may capture the effect of public attitudes on permitting timelines. Local opposition to utility-scale solar is driven in large part by the public's perception of these projects' impact on their communities [24, 25, 26]. Lack of community support for solar projects has been found to both increase the costs of solar development and delay project timelines [26].

Communities are more likely to support solar projects if there is an expectation of economic benefits, such as job creation [24, 25]. Furthermore, public trust regarding the developer, as well as perceptions of regulatory fairness, also influence support, with higher trust and belief that the regulatory system is fair leading to higher community support [25, 27]. Community support for these projects declines amid concerns about negative impacts on property values, landscape aesthetics, and the environment [25, 26, 28, 29, 30]. The literature also emphasizes that community engagement is a key step in addressing community opposition to solar projects, as inadequately acknowledging and responding to community concerns results in project delays and cancellations [31]. While community engagement may lead to the need for design changes and extended initial timelines, effective engagement—including use of local firms—often reduces overall project delays by minimizing opposition [25, 27, 31].

Project Site Characteristics

A previous TNC California and ECOnorthwest study found that the location of proposed solar projects plays a significant role in permitting and development timelines [32]. In a study of Rhode Island residents, the largest factor determining approval for a proposed development site is the current land use; the public prefers solar developments to be placed on brownfield and commercial lands and would be willing to pay to avoid solar development of forest and ag lands [33]. Environmental and cultural resource concerns can also lead to significant resistance and delays to renewable energy projects, including litigation related to the protection of plant and animal species [34].

Site characteristics such as land cover and land use are also closely tied to local, state, and federal regulations. Some local governments across the US have adopted ordinances prohibiting solar energy projects on farmland, including direct restrictions on the placement of solar projects on agricultural land [29, 35]. Other site characteristics that are tied to regulatory factors include land cover, presence of plant and animal species, and other cultural and tribal resources including the National Environmental Protection Act (NEPA). NEPA requires lengthy environmental reviews, which have been found to delay project timelines on average by 2.5 years and by up to 5 years [36].

The potential environmental impacts of a project are inherently tied to a project's site characteristics, and determine the type of environmental review requirements, which can affect county permitting timelines since CUP approval depends on CEQA review. Depending on the location of a project, additional permits may be required. In California, examples include ITPs when a project is expected to negatively impact endangered species habitat, and LSAAs, when a project is expected to impact waterways. A study of 53 utility-scale solar projects across the U.S. found that there were significant delays and obstacles associated with securing permits for such projects [31, 37].

Regulatory Environment

Literature that reviews utility-scale renewable energy legislative policies highlights the influence of the complex interactions between federal, state, and local policies on project timelines. State and local ordinances, particularly restrictive zoning and siting policies, contribute to delays and limit land availability for renewable energy projects [26, 38]. Many studies cite these regulations as a significant factor that constrains where solar projects may be sited, posing both procedural delays and substantive barriers to project feasibility [29, 26, 38, 39].

The fragmented nature of local governance, with multiple jurisdictions and agencies, creates notable administrative and regulatory challenges, exacerbating delays in solar project approval and implementation [31, 28, 29]. Conflict amongst different levels of government can occur between local and state governments, regional and local governments, or federal and state agencies, all of which can cause a lack of clarity for developers and ultimately longer project timelines [31, 28, 40, 29]. The impact of federal policy on renewable energy project timelines can be substantial and has historically been an issue for projects located on federal land, wind projects subject to Federal Aviation Administration height reviews, or when projects disturb habitats of listed species under the Endangered Species Act [28]. Starting in 2025, several changes in federal regulations regarding renewable energy have been initiated and may have an impact on all renewable energy projects in the future.

Administrative capacity within local governments can also be a factor contributing to delays in solar project permitting. The efficiency of local permitting processes significantly influences project timelines. Cities adopting streamlined local solar permitting processes see an increase in both the size and number of residential solar installations [41]. Furthermore, a study of 53 utility-scale solar projects across the US suggests that existing regulatory systems in place in the US may be ill-equipped to handle the increasing volume of utility-scale renewable energy projects in development [31].

Interconnection Timelines

Interconnection is the process by which solar and other electricity generation projects connect to the transmission system to deliver power to end users. While connection to the power grid occurs after the permitting phase of a solar project's development, the interconnection process is a frequently cited factor causing significant delays in the timeline from renewable energy project initiation to generation. Interconnection delays are often linked to the queue of applications and infrastructure upgrades required before a new facility can be interconnected. Active interconnection requests exceed existing available grid capacity, and the median wait time for utility-scale projects to connect to the grid is approximately five years across all ISOs/RTOs in the United States [42]. These delays contribute to higher development costs for utility-scale solar projects [42]. Interconnection delays are such a significant obstacle to solar deployment that approximately 80% of grid interconnection requests ultimately withdraw from the queues, often due to the need for large transmission upgrades [42].

D

Community Solar Case Study

Background

Community solar projects are small-scale (often defined as 5MW or less) solar projects where electricity or financial benefits are shared among multiple customers (e.g. individuals, businesses, or other groups) often in places where participants can't have rooftop solar such as in rental communities [43, 44].

California has had long-standing challenges in making community solar programs functional at scale. Several CPUC and legislative efforts have tried to improve rules, program designs, and incentives, but many proposals have not passed or been viewed as insufficient. In 2002, AB 2316 established community solar program in California to benefit underserved communities, where at least 50% of capacity serves low-income customers, while mandating prevailing wages for construction [45].

AB 327 aimed to increase adoption of renewable generation in disadvantaged communities and led to the development of California's Disadvantage Communities Green Tariff (DAC-GT). The program enables residential customers in disadvantaged communities within California's three large investor-owned utilities (IOU) service territories and ten community choice aggregators to benefit from utility-scale clean energy and receive a 20% discount on their electricity bill [46].

In the 2025-2026 legislative session, the proposed AB 1260 is designed to strengthen and expand CA's existing community solar and storage program established under AB 2316, by ensuring fair compensation and a viable path for widespread adoption [47]. Another effort with broad support by solar companies, consumer advocates, homebuilder industry groups, and Environmental Justice groups referred to as 'Net Value Building Tariff', which would enable the building of up to 8 GW of community-solar and battery projects in the coming decades, was passed on by the CPUC in 2024. Instead, the CPUC ordered the state's major utilities to restructure existing distributed solar programs, which are broadly seen as ineffective at leading to the development of community solar [48, 49, 50].

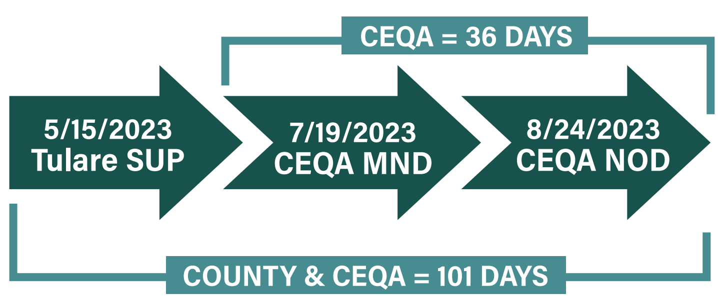
Community Solar Permitting Process

Community solar projects typically require the same permits as larger utility-scale solar projects, though often at a reduced scale or scope. Key permitting steps include (1) local process, often a county CUP, (2) state environmental review through the CEQA process, and (3) additional state and local permits including CDFW LSAA/ITP permits, interconnection review, building permits, and potentially local permits as required for fire, traffic, etc. as needed. The costs for this lengthy and involved permitting process, when tied to a small community scale project, can be a significant battier to adoption.

Case Study: Visalia Project

Dimension Energy has developed three pilot community scale solar projects: Visalia, Corcoran, and Lemoore, generating over a combined 12 MW to serve over 3,700 low-income households under California's Disadvantaged Communities Green Tariff (DAC-GT) Program [51]. The Visalia Project is situated on roughly 20 acres of agricultural land in Tulare County [52]. The Project's CEQA process went through the MND pathway, requiring just 36 days between filing of the MND and the NOD (see Exhibit 20). CDFW ITP and LSAA permits were not required for this project. In total, permitting was 101 days for the Project when

EXHIBIT 20 Dimension Energy Visalia Community Solar Project Permitting Timeline



Source: [52], [54]

considering the timeline for the County's special use permit and CEQA process. The Project was recently constructed, generating roughly 4 MW to server over 1,170 households [53].

The permitting timeline for the Visalia community solar project was significantly shorter than the average duration for both utility-scale and other MND-pathway solar projects examined in this study. The project advanced from MND filing to Notice of Determination in just 36 days and completed its overall permitting process, including the County's special use permit, in 101 days. By comparison, other solar projects in the dataset that followed the MND pathway required an average of 238 days, making the Visalia project's CEQA timeline nearly 85% faster than the typical case.

Several factors may have contributed to this expedited review. The project was located in a Critically Overdrafted Basin, which aligns with findings from the utility-scale model suggesting shorter permitting timelines in areas undergoing land-use transition driven by water scarcity. In addition, the site had no documented rare species, and did not require ITP or LSAA permits, eliminating potential sources of permitting delay. Although the project was sited on Williamson Act agricultural land, Tulare County deemed the project to be a compatible use under its local rules, avoiding further regulatory complications related to farmland protection. Additionally, the project's alignment with state policy goals, specifically its service to low-income households under the DAC-GT program, may have encouraged more streamlined agency coordination and review.

Taken together, these conditions (low biological conflict, water-stressed agricultural land, and clear local land-use compatibility) likely facilitated a faster and less complex CEQA process. This case highlights how site selection, land-use context, and regulatory clarity at the local level can work in combination to reduce permitting timelines, even for projects subject to CEQA. It also reinforces the broader study finding that spatial and environmental factors, alongside institutional familiarity, are key determinants of permitting efficiency in California.

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