DOI: 10.20357/B74880

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Explaining jurisdictional compliance with California’s top-down streamlined solar permitting law (AB 2188)

Margaret Taylor[1], K. Sydny Fujita[1], Jingjing Zhang[1], Mustapha Harb[1], James Tamerius[2], Michelle Jones[2], and Sarah Price[1]

[1]Building Technology & Urban Systems Division, Lawrence Berkeley National Laboratory, [2] Center for Sustainable Energy

Energy Technologies Area
October 2019

Taylor, M., Fujita, S., Zhang, J., Harb, M., Tamerius, J., Jones, M. and Price, S. (2019). Explaining jurisdictional compliance with California’s top-down streamlined solar permitting law (AB 2188). DOI: 10.20357/B74880

Acknowledgement:

This work was supported by the U.S. Department of Energy Solar Energy Technologies Office under Lawrence Berkeley National Laboratory Contract No. DE-EE0007663.0000.

Executive summary

In the U.S., the process by which residential rooftop solar photovoltaic (PV) system installations are permitted and inspected by an "authority having jurisdiction" (AHJ) varies across AHJs. As the U.S. has roughly 23,000 AHJs with varying degrees of local autonomy, improving the cross-jurisdictional consistency of permitting and inspection is not a straightforward task. One promising approach is a "top-down" streamlined solar permitting (SSP) mandate by U.S. States to their AHJs.

This study set out to understand the factors associated with the likelihood that an AHJ either did or did not comply with California's top-down streamlined solar permitting law, AB2188, and then to consider how these factors might be relevant to the future prospects of top-down SSP outside of California. This report provides background material on AB2188 and tests five hypotheses about the factors that affect the likelihood that an AHJ will comply or not comply with AB2188, as developed from the policy diffusion literature and background knowledge on AB2188 and its implementation.

The five hypotheses tested are: (1) AHJs are more likely to comply with AB2188 if their neighbors comply ("Networks and neighbors"); (2) AHJs are more likely to comply with AB2188 if their population has a majority Democratic Party affiliation ("Political identification"); (3) AHJs are more likely to comply with AB2188 if they have the resources to invest in their administrative systems ("Economics of government infrastructure"); (4) AHJs are more likely to comply with AB2188 if they perceive that compliance will reduce their current or anticipated workload related to the solar permitting process ("Workload management"); and (5) AHJs are more likely to comply with AB2188 if their leading installer has high market share and works in many AHJs, but less likely to comply if their leading installer has high market share and works in only a few AHJs ("Political economy of streamlining"). This fifth hypothesis is a novel contribution of this study, and it recognizes that a firm's knowledge of a unique AHJ permitting and inspection process could be a barrier to entry to other firms interested in working in that AHJ, and could therefore be a source of imperfect competition with potential negative consequences with respect to solar installation cost and quality.

We find support for the Network and neighbors, Economics of government infrastructure, and Workload management hypotheses with respect to AHJ compliance with AB2188. We also find support for the Political economy of streamlining hypothesis as it relates to AHJ non-compliance with AB2188; this finding supports the idea that there is a competitive advantage to some firms in having solar permitting and inspection processes be inconsistent across the country.

We conclude with a discussion of the potential value of projecting the supported hypotheses for AHJ compliance with AB2188. We generate a first-order estimate of the increased installer competition that might occur in AHJs deemed likely to comply with hypothetical top-down SSP mandates in other States. We provide a proof-of-concept of such a projection using data from the U.S. Census Bureau which is associated with the Economics of government infrastructure and Workload management hypotheses, which we felt were the most tractable of the supported hypotheses.

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1 Introduction

In the U.S., the process by which residential rooftop solar photovoltaic (PV) system installations are permitted and inspected by an "authority having jurisdiction" (AHJ) varies across AHJs. In addition, depending on the AHJ, the permitting and inspection process can introduce substantial and/or variable delays in getting a rooftop PV system online; these delays can be costly.

As the U.S. has roughly 23,000 AHJs, according to U.S. Census Building Permit Survey data, and these AHJs have varying degrees of local autonomy (see, e.g. Taylor 2017), improving the cross-jurisdictional consistency of permitting and inspection is not a straightforward task. One approach to permitting and inspection reform that appears to hold promise is a "top-down" approach, through which U.S. States mandate AHJ practices known as "streamlined solar permitting" (SSP). California is a leading example of how this approach could work. In September 2014, the State implemented top-down SSP for its 540 AHJs through a law known as AB2188, which amended the State's Civil Code and Government Code with respect to solar energy. It has also mandated AHJ reforms for other distributed energy resources (DERs) (e.g., AB 1236 (2015) to streamline permitting for electric vehicle charging stations and AB 546 (2017) to streamline permitting for distributed energy storage).

Two years after the AB2188 compliance deadline of September 2015, however, only 386 of California's 540 AHJs had complied with the law (Kaatz and Anders 2016). This 71% compliance rate has potential implications for the likely effectiveness of California's other efforts to reduce the cross-jurisdictional inconsistencies of permitting and inspection for DERs. Beyond California, however, it also has potential implications regarding the likely effectiveness in reducing permitting inconsistencies of establishing similar top-down mandates across all 50 U.S. States. But these outside-California implications rely on the assumption that the factors underlying jurisdictional compliance and non-compliance with AB2188 are not geographically specific to California.

This study set out to understand the factors associated with the likelihood that an AHJ either did or did not comply with AB2188 and then to consider how these factors might be relevant to the future prospects of top-down SSP outside of California. The paper proceeds as follows. In Section Two, we provide background material on AB2188. In Section Three, we detail the hypotheses we generated from the policy diffusion literature and background knowledge on AB2188 and its implementation. In Section Four, we provide information about the data sources we used to construct variables to test our hypotheses. In Section Five we detail our analytical approach, which employed logistic regression modeling. In Section Six we provide the results of our hypotheses testing. And in Section Seven we discuss the results and consider their implications for national diffusion of top-down SSP, as informed by some initial projections.

2 Background on AB2188

California's AB2188 was signed by the Governor on September 21, 2014. It imposed a "state-mandated local program" on every "city, county, and city and county" government, in consultation with "the local fire department or district" and "the utility director," if the local government operated a utility.[1] This local program was defined for "small residential rooftop

[1] In addition to public entities, AB2188 also affected home-owner associations (HOAs, defined in Section 4080 or 6528). It required HOAs to approve or deny solar energy system installation applications in writing within 45 days from the receipt of the application or the application would be "deemed approved," unless the delay was the result of

solar energy systems" that either provided electricity or hot water. The PV systems covered by AB2188: were no larger than 10 kw alternating current nameplate rating; had to conform to "all applicable state fire, structural, electrical, and other building codes"; were installed on a single or duplex family dwelling; and could not exceed the maximum legal building height as defined by the AHJ.[2]

AB2188 imposed four main requirements for local governments with respect to small PV systems. First, it made "void and unenforceable" any provision in a governing document or a covenant, restriction, or deed, contract, security instrument, etc. that effectively prohibited or restricted installation or use.[3] Second, it required that applications for installation or use be processed and approved in the same manner as applications for architectural modification to the property, and that these applications not be "willfully" avoided or delayed. Third, it required the local government to develop and adopt an ordinance that meets four specific criteria, including the creation of an expedited, streamlined permitting process. And fourth, it required that eligible systems only be subject to a single, "consolidated" inspection, done in a "timely manner." This consolidated inspection could be waived in lieu of a separate fire safety inspection if the local government did not have an agreement with a local fire authority "to conduct a fire safety inspection on behalf of the fire authority." In addition, if a PV system failed inspection, a subsequent, non-conformant inspection was authorized.

In determining AHJ compliance with AB2188, most of the focus has been on whether the local government ordinance met the four criteria laid out in the law. The first of these criteria was that the ordinance should create an expedited, streamlined permitting process. This expedited process should both adopt a checklist[4] of all eligibility requirements for PV systems and "substantially conform with the recommendations (including checklists and standard plans) contained in the most current version of the California Solar Permitting Guidebook and adopted by the Governor's Office of Planning and Research." Applications that satisfy the information requirements of the checklist should be deemed "complete" and issued approvals and required permits or authorizations. If the application is deemed incomplete, however, the local government office should issue a written correction notice detailing all application deficiencies and any additional information required for expedited permit eligibility. The second of the four ordinance criteria was that it should make checklists and required permitting documentation available on a publicly accessible website if the local government has such a website. The third

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a "reasonable request for additional information." Willful violations are liable to civil penalties up to $1,000, damages to the applicant or other parties, and attorney's fees.

[2] It must also meet applicable health and safety standards and requirements imposed by state and local permitting authorities, consistent with Section 65850.5 of the Government Code, as well as all applicable safety and performance standards established by the California Electrical Code, the Institute of Electrical and Electronics Engineers, and accredited testing laboratories such as Underwriters Laboratories and, where applicable, rules of the Public Utilities Commission regarding safety and reliability.

[3] The only exception was "reasonable" provisions, defined as those that do not add more than $1,000 in system costs or do not reduce system efficiencies more than 10% over those originally specified and proposed for the system, or provisions that allow for an alternative system of "comparable cost, efficiency, and energy conservation benefits."

[4] According to AB2188, local ordinances can modify the checklists and standards of the guidebook due to "unique climactic, geological, seismological, or topographical conditions."

ordinance criterion was that it allow submission of permit applications and associated documentation through electronic means (i.e., email, the internet, or facsimile). And the fourth ordinance criterion was that it authorize electronic signature on all forms, applications, and other documentation in lieu of an applicant's wet signature, unless the local government states the reasons why it is unable accept electronic signatures.

The consequence to an AHJ of non-compliance is that it may not receive funds from a state-sponsored grant or loan program for solar energy. This is enforced by a requirement to certify compliance with AB2188 when an AHJ applies for funds from a state-sponsored grant or loan program.

3 Hypotheses

In generating testable hypotheses, we built on the policy diffusion literature and our background knowledge of AB2188, focusing on factors both internal to and external to a given AHJ. Possible internal jurisdictional factors identified in the policy diffusion literature include: the jurisdiction's *motivation* for adoption (e.g., salience of the problem the policy addresses, time before the next election, etc.), *obstacles* to adoption (e.g., perceived financial and political costs, low bureaucratic capabilities, etc.), and *resources* available to overcome those obstacles (jurisdiction size and wealth, as well as non-financial resources like connection to policy entrepreneurs and advocacy coalitions). Possible external jurisdictional factors include *inter-jurisdictional learning* (e.g., membership in professional networks, geographic proximity to adopting or rejecting jurisdictions, etc.), which can be helped or hindered by inter-jurisdictional competition and so-called "coercive" forces through which a stronger peer jurisdiction or a jurisdiction at a higher level (e.g., a state to a municipality) exerts pressure to adopt a policy.[5]

We ultimately investigated five hypotheses regarding the factors that might make it likely that a California AHJ would or would not comply with the requirements of AB2188 (respectively, "compliant" and "non-compliant" AHJs). These specific hypotheses – detailed below – were: (1) AHJs are more likely to comply with AB2188 if their neighbors comply ("Networks and neighbors"); (2) AHJs are more likely to comply with AB2188 if their population has a majority Democratic Party affiliation ("Political identification"); (3) AHJs are more likely to comply with AB2188 if they have the resources to invest in their administrative systems ("Economics of government infrastructure"); (4) AHJs are more likely to comply with AB2188 if they perceive that compliance will reduce their current or anticipated workload related to the solar permitting process ("Workload management"); and (5) AHJs are more likely to comply with AB2188 if their leading installer has high market share and works in many AHJs, but less likely to comply if their leading installer has high market share and works in only a few AHJs ("Political economy of streamlining").

These hypotheses cover many of the internal and external factors mentioned above, including inter-jurisdictional learning, motivation, obstacles, resources, and political factors. The fifth hypothesis, however, although related to political factors, is novel to this study. It considers the competitive advantage of firms with respect to whether permitting and inspection is consistent across jurisdictions or not. For some firms, background interviews and some geographic analysis

[5] According to Jordan and Huitema (2014), certain policy attribute combinations correlate with more rapid policy diffusion: (1) policies of high salience and low complexity; (2) policies with broad political appeal and low complexity; (3) policies that are relatively advantageous and easy to follow; and (4) policies that are observable.

suggested to us that there is a competitive advantage associated with having deep knowledge of a local permitting and inspection process that is unique to that AHJ. This local knowledge could be a barrier to entry to other firms that are interested in increasing their geographic scope, with the potential effect of reducing competition and its concomitant price and quality advantages.

One consideration we had in formulating our final hypotheses was whether we could test the hypotheses in a way that could have implications for whether AHJs beyond California might be likely to comply with top-down SSP mandates in the future. We discuss the data we collected to construct variables and test our hypotheses, keeping in mind their national applicability, in Section Four, below.

Hypothesis 1: Networks and neighbors

H1. AHJs are more likely to comply with AB2188 if their neighbors comply

This hypothesis – that AHJs are more likely to comply with AB2188 if their neighbors comply – focuses on the external factor of interjurisdictional learning that is discussed in the policy diffusion literature (see, e.g., Zhou et al 2019). The premise of this hypothesis is: (1) California AHJ staff are likely to share tacit knowledge related to AB2188 compliance within their professional networks; and (2) California AHJ staff are likely to have more shared professional networks and closer ties within those networks with AHJ staff from neighboring AHJs.

Hypothesis 2: Political identification

H2. AHJs are more likely to comply with AB2188 if their population has a Democratic Party majority

This hypothesis – that AHJs are more likely to comply with AB2188 if their population has a Democratic party majority – focuses on the internal factors of motivation and/or obstacle that are discussed in the policy diffusion literature. It builds more specifically on the U.S. political context, in which studies like Chernyakhovskiy (2015), Graziano and Gillingham (2015), and Coley and Hess (2012) explicitly consider the relationship between Democratic Party affiliation and PV capacity growth and PV policy support.

Hypothesis 3: Economics of government infrastructure

H3. AHJs are more likely to comply with AB2188 if they have the resources to invest in their administrative systems

This hypothesis – that AHJs are more likely to comply with AB2188 if they have the resources to invest in their administrative systems – focuses on the internal factor of resources that is discussed in the policy diffusion literature. It also builds on AHJ characteristics raised in AB2188 itself, such as concerns about whether an AHJ would even have a publicly accessible website or a capability to accept electronic submissions and signatures.

Hypothesis 4: Workload management

H4. AHJs are more likely to comply with AB2188 if they believe that compliance will reduce their current or anticipated solar permitting and inspection workload.

This hypothesis – that AHJs are more likely to comply with AB2188 if they believe that compliance will reduce their current or anticipated solar permitting and inspection workload – focuses on the internal factor of motivation that is discussed in the policy diffusion literature. Specifically, it builds on the concept of the salience of AB2188 compliance for an AHJ. This salience could either be because the AHJ sees a need to reform its permitting and interconnection process because of a current or anticipated problem or because the AHJ wants to be able to apply for funds from a state-sponsored grant or loan program for solar energy either now or in the near future, something it could not if it cannot certify compliance with AB2188.

Hypothesis 5: Political economy of streamlining

H5. The PV market share and geographic coverage of leading installers within an AHJ will influence AB2188 compliance.

> *H5A. AHJs are* <u>*more*</u> *likely to comply with AB2188 if their leading installer has high market share and works in* <u>*many*</u> *AHJs.*
>
> *H5B. AHJs are* <u>*less*</u> *likely to comply with AB2188 if their leading installer has high market share and works in only a* <u>*few*</u> *AHJs.*

This hypothesis – that AHJs are more likely to comply with AB2188 if their leading installer has high market share and works in many AHJs, but less likely to comply if their leading installer has high market share and works in only a few AHJs – focuses on the internal factors of motivation and/or obstacle that are discussed in the policy diffusion literature. It builds more specifically on the literature on firm lobbying and public policy (see, e.g. Kerr et al. 2014, Lowery 2007).

4 Data sources and variable construction

There are several data sources that could be used to construct variables for use in testing these hypotheses via logistic regression models of AB2188 compliance. We were particularly interested in data and variables that could potentially provide insight into the national applicability of any results we might have with respect to the likelihood that a given AHJ would or would not comply with a form of top-down SSP reform.

Table 4-1 provides information on all of the dependent and explanatory variables we compiled for use in this analysis of AB2188 compliance. We note that exploratory data comparisons and regressions included variables beyond those in this table (e.g., the jurisdiction's unemployment rate, the percentage of single-family housing in the jurisdiction, the education level of residents of the jurisdiction, the average PV system cost, etc.). As detailed below, the Appendix includes statistics on numerous variables that were not included in the final set of models, due to strong correlation to explanatory variables that we have included or insignificance in all preliminary analyses.

Table 4-1*: Variables compiled for use in hypothesis testing*

Dependent Variable	**Notes**
Compliant (binary)	Determined by examining individual AHJ websites and legislative document databases (e.g., municode.com) to verify compliance and determine the effective date of the compliant ordinance. In some cases, we contacted individual jurisdictions by phone or email to clarify data.
Explanatory Variables	
Democratic Party affiliation (%)	Constructed from the 2016 General Election Statement of Vote for Consolidated Precincts, as reported in the California Statewide Database (2019). Calculated by summing the total number of Democratic votes and total votes within each precinct within the AHJ, with overlap divided based on spatial

	proportion of a precinct within an AHJ. ArcGIS shapefiles were used to assign precincts to AHJs and to calculate the degree of overlap.
County AHJ (binary)	AHJs may be cities, towns, or counties. We include an identifier for county-level AHJs as an indicator for unincorporated regions that we expect to have different administrative structures and availability of resources. We assigned city, town, or county status to each AHJ using U.S. Census Bureau Place and County definitions (TIGER/Line 2016).
Median annual household income ($1,000, 2016 inflation-adjusted)	Derived from the U.S. Census Bureau American Community Survey, expressed in terms of thousands of dollars. We used ArcGIS shapefiles to assign Census Block Groups to AHJs. We define the median household income of an unincorporated area as the population-weighted average of median household income across all Block Groups within the unincorporated county area.
Median year of housing construction (year)	Derived from the U.S. Census Bureau American Community Survey, which reports the median year in which housing unit structures were built by Census Block Group (Table B25035). As above, we translate this variable between Census Block Group and AHJ.
Median population density (100 people per square mile)	This variable is the median population density of Census Block Groups within the AHJ. It was calculated from U.S. Census Bureau American Community Survey data on population by Census Block Group, divided by the area of each Block Group, as calculated using ArcGIS shapefiles (TIGER/Line 2016).
Number of residential PV systems (1,000s)	Constructed using data from Lawrence Berkeley National Laboratory's (2017) Tracking the Sun data files. We combined the data files into a single set and filtered it such that PV systems were included only if they were: (a) located in California; (b) residential; and (c) 10kw or less in capacity. A look-up table assigning jurisdictions was created manually using the Permit ID, City, and County fields. Cities were matched with jurisdictions based on name. Cities that did not match identified cities in the jurisdiction list were matched with county names. Records with no county name were manually verified with internet searches to best identify the appropriate jurisdiction. The final lookup table was merged with the filtered Tracking the Sun dataset to append jurisdiction names, then aggregated by the total number of systems for each jurisdiction.
Expenditures per capita ($1,000)	Constructed from the total annual dollar amount of expenditures at the city and county level for 2016, as reported by the California State Controller's Office (2018). We normalized these values by the jurisdiction population, as calculated for median population density described above.
Neighboring AHJ PV systems (per million residents)	Using the number of residential PV systems, described above, we aggregated the total number of systems for all neighboring jurisdictions and divided by the total population for all neighboring jurisdictions, as calculated by aggregating Census population totals for Census Block Groups within each jurisdiction.
Compliance rate in AHJ megaregion (%)	We assign each California AHJ to a "megaregion," as defined by Nelson and Rae (2016). Nelson and Rae (2016) analyze commuter flows to define regions that are significantly interconnected in terms of geography and economic activity. California includes six megaregions: Los Angeles, Bay Area Sacramento, Reno, NorCal, Mid Cal, San Diego. Each jurisdiction was assigned to a megaregion based on spatial intersection, with AHJs outside of the six megaregions assigned to a single "none" category representing the less urbanized areas of California. Using the compliance status of each AHJ in a megaregion (defined above), we calculate the percentage of AHJs in each megaregion that comply with AB 2188.

Annual growth of PV installations (%)	This variable is the annual percentage growth rate of solar PV installations from 2010 to 2015, calculated from the Tracking the Sun data files described above.
HHI of AHJ's PV installers	We calculate the market share for each installer within a jurisdiction by dividing the number of installations for each installer by the total number of installations within the jurisdiction, then multiplying by 100. We next calculate the Herfindahl-Hirshman Index (HHI) for each AHJ by squaring and summing these market share values across all installers in each AHJ.
Geographic scope of AHJ's top PV installer (dummy)	From the Tracking the Sun data files, we calculate the number of jurisdictions that the top installer in each AHJ operated within between 2010 and 2015. We then identify several breaks in the distribution of number of jurisdictions included in top installer's geographic range of business operations and assign variables to AHJs based on the nature of their top solar installer's geographic range: very small (top installer operates in 20 or fewer AHJs), small (top installer operates in fewer than 100 AHJs), large (top installer operates in at least 450 AHJs).
Building Permit Survey respondent (binary)	This variable identifies AHJs that are either included or not included in the U.S. Census Building Permit Survey as of 2018. Absence from this Survey indicates a lack of available resources to respond and/or the existence of local conditions leading to exceptions from response, either of which we view as a proxy for AHJ administrative system resources.

5 Analytical Methods

We performed two types of analysis to inform our variable selection and conduct our hypothesis-testing. We began with an exploratory analysis, including t-tests, chi-square tests, and examination of cross-correlation between potential explanatory variables. We then defined our logistic regression modeling specifications.

5.1 Comparison of means, medians, and variable correlations

We began by comparing the means of the compliant and non-compliant AHJs across the explanatory variables we collected. We performed t-tests to determine for which variables the sample mean of compliant AHJs differs with statistical significance from the sample mean for non-compliant AHJs (see Appendix Table A-2 for results). Note that this simple test can highlight evidence for potential relationships between explanatory variables and compliance, but it does not account for any other factors. For cases in which we have multiple variables that appear to similarly relate to a given hypothesis, the means comparison provides insight into the process of narrowing the number of variables we include in the later logit models.

As the variables we analyze are not necessarily normally distributed, we also performed the Pearson's χ^2 test of independence of distribution, testing against the null hypothesis that for each variable of interest, the median value for AB2188-compliant AHJs is equal to the median value for non-compliant AHJs. See Appendix Table A-3 for results.

In addition to comparing means and medians, we also produced a correlation matrix of all variables of interest (See Appendix Table A-1 Parts 1-4). This matrix allowed us to note instances of high correlation between potential explanatory variables and to select a single representative variable from among a cluster of similar ones in an effort to reduce potential impacts of multicollinearity. As the number of observations in our dataset is limited by the number of AHJs in California, this process allowed us to mindfully avoid over-fitting our regression models.

The list of variables we selected for use in hypothesis testing through this process is presented in Table 5-1. With the exception of one variable (expenditures per capita), each of these variables is readily available at a national level for projections of our results with respect to likely areas for compliance and non-compliance with top-down SSP mandates. It is also likely that even the exceptional variable will be available for many of the 50 States through individual State-level data pulls. Note that we feel that a few of the variables could be improved for a future analysis. First, the megaregion compliance rate variable has limitations with respect to the insight it provides about the networks that matter to top-down SSP compliance, but as we will see, it is a useful variable in understanding AB2188 compliance. Second, the construction of the Democratic Party affiliation variable was based on presidential voting patterns in the 2016 election, and might be informative at a more refined level by looking at party affiliations for down-ticket offices.

Table 5-1: *Variables selected for use in hypothesis testing*

Hypothesis	Variables Selected
H1: Networks and neighbors	Megaregion compliance rate (%)
H2: Political identification	Democratic Party affiliation (%)
H3: Economics of government infrastructure	Survey participant
	Median population density
	Median HH income
	Expenditures per capita
	County AHJ
H4: Workload management	Median year of housing construction
	# of PV systems in AHJ
	Annual growth in PV installations (%)
	# of PV systems in neighbor AHJs
H5: Political economy of streamlining	Small top installer
	Large top installer
	Very small top installer
	Installer HHI
	HHI of small top installer
	HHI of large top installer
	HHI of very small top installer

5.2 Logistic regression analysis

We used logistic regression models to analyze the factors underlying California AHJ compliance with AB2188. The logit model is a standard tool used to model decision behavior. In our case, the "decision-maker" is an AHJ that decides whether or not to comply with AB2188. Logit models are derived from economic random utility models (RUMs), which are based on the assumption that decision-makers attribute a "utility" to each alternative available to them. Utility can be defined as the measure of the level of attractiveness of a certain alternative (McFadden, 2001; Ben-Akiva and Lerman, 1985). In our case, utility is a measure of the benefit an AHJ gains from its choice to comply or not comply with AB2188.

Below we provide a mathematical formulation of the logit model.

The utility of an alternative is represented by:

$$U_{ni} = V_{ni} + \varepsilon_{ni} = \alpha_i + \beta X + \varepsilon_{ni}$$

Where:

U_{ni}: Random utility of alternative i for AHJ *n*
V_{ni}: Systematic utility of alternative i for AHJ *n*
ε_{ni}: Stochastic component of the utility that follows an i.i.d extreme value type I distribution
α_i: Alternative specific constant (ASC) of alternative *i*.
β: The vector of parameter estimates.
X_n: Vector of attributes of alternative i and characteristics of AHJ *n* (e.g. average household income, political ideology, size of AHJ, average cost of solar PV system, etc.)
γ: The parameter estimates for mode attributes and individual characteristics

The probability of selecting an alternative may be expressed as:

$$P(y_{ni} = 1|X) = \frac{e^{V_{n1}}}{\sum_{j=1}^{2} e^{V_{nj}}}$$

Where:
y_{ni}: 1 if AHJ *n* chooses to comply with AB2188, and 0 otherwise

Expanding upon this mathematical formulation in the specific case we are examining, the choice can be represented as:

$$\begin{cases} U_{adopt,n} = V_{adopt,n} + \varepsilon_{adopt,n} = \alpha_{adopt} + \beta X_{n} + \varepsilon_n \\ U_{reject,n} = 0 \end{cases}$$

Where:
U_{adopt}: random utility of compliance for AHJ_n
$V_{adopt,n}$: systematic utility of compliance for AHJ_n
ε_n: stochastic component of the utility that follows an i.i.d extreme value type I distribution
α_{adopt}: constant
β: vector of parameter estimates
X_n: vector of attributes of compliance and characteristics of AHJ *n* (e.g. average household income, political affiliation, population density of AHJ, etc.)

Choice probability:

$$P(y_n = 1|X) = \frac{e^{V_n}}{1 + e^{V_n}} = \frac{1}{1 + e^{-V_{n1}}}$$

Where:
y_{ni}: 1 if AHJ *n* chooses to comply with AB2188 and 0 otherwise.

6 Results

Table 6-1 presents the results of the comparison of means and medians between compliant and non-compliant AHJs for the variables we selected for use in hypothesis testing.

Table 6-1*: Comparison of means and medians for variables selected for hypothesis testing*

Hypothesis	**Variables Selected**	**T-Test Results**	**Pearson's Chi-Square Results**
H1: Networks and neighbors	Megaregion compliance rate (%)	t: 9.35***	$\chi^2(6) = 75.4$***
H2: Political identification	Democratic Party affiliation (%)	t: 3.59***	$\chi^2(363) = 385.5$
H3: Economics of government infrastructure	Survey participant	t: 5.686***	$\chi^2(1) = 30.6$***
	Median population density	t: 5.615***	$\chi^2(535) = 535.6$
	Median HH income	t: 5.735***	$\chi^2(535) = 535.6$
	Expenditures per capita	t: 0.270	$\chi^2(535) = 536.0$
	County AHJ	t: -1.320	$\chi^2(1) = 1.74$
H4: Workload management	Median year of housing construction	t: 0.758	$\chi^2(58) = 58.4$
	# of PV systems in AHJ	t: 2.872***	$\chi^2(513) = 514$
	Annual growth in PV installations (%)	t: -2.344**	$\chi^2(459) = 440.3$
	# of PV systems in neighbor AHJs	t: 5.502***	$\chi^2(411) = 398.4$
H5: Political economy of streamlining	Small top installer	t: -5.688***	$\chi^2(1) = 30.6$***
	Large top installer	t: 3.733***	$\chi^2(1) = 13.6$***
	Very small top installer	t: -5.096***	$\chi^2(1) = 24.9$***
	Installer HHI	t: -4.835***	$\chi^2(496) = 489$
	HHI of small top installer	t: 0.958**	$\chi^2(47) = 120.0$***
	HHI of large top installer	t: 0.991	$\chi^2(377) = 315.8$
	HHI of very small top installer	t: 0.962*	$\chi^2(23) = 74.4$***

We analyzed two logistic regression models, each with three variations in terms of the geographic scope of top PV installers. Model 1 includes AHJ installer HHI and the geographic scope of the AHJ's top installer separately, with versions A, B, and C differing in the particular top installer geographic scope variable included in the version (i.e., small, large, or very small, respectively). Model 2, by contrast, replaces the separate AHJ installer HHI and top installer geographic scope variables with an interaction between the two (e.g., impact of installer HHI if the top installer operates in only a small number of jurisdictions).

The six regression models we employed take the general form:

$$\begin{aligned} y_n = \alpha_{adopt} &+ \beta_{regioncom} RegionCom_n + \beta_{dem} Dem_n + \beta_{survey} Survey_n \\ &+ \beta_{popdens} PopDens_n + \beta_{income} Income_n + \beta_{expend} Expend_n \\ &+ \beta_{county} County_n + \beta_{houseyear} HouseYear_n + \beta_{pvsys} PVsys_n \\ &+ \beta_{pvgrowth} PVgrowth_n + \beta_{neighborPV} NeighborPV_n + \boldsymbol{\beta_{top} X_{top}} + \varepsilon_n \end{aligned}$$

Where:

$RegionCom_n$: Megaregion compliance rate (%);

Dem_n: Democratic Party affiliation (%);

$Survey_n$: participant in the U.S. Census Building Permit Survey;

$PopDens_n$: median population density;

$Income_n$: median household income;

$Expend_n$: per capita expenditures;

$County_n$: county (versus town or city) AHJ;

$HouseYear_n$: median year of housing construction;

$PVsys_n$: # of PV systems in AHJ;

$PVgrowth_n$: annual growth in PV installations over 5 years (%);

$NeighborPV_n$: # of PV systems in neighboring AHJs; and

$\boldsymbol{X_{top}}$ **:** These variables differ across the models. In Model 1, this includes installer HHI separately from an indicator for: A) top installers with small geographic business territories, B) top installers with large geographic business territories, C) top installers with very small geographic business territories. In Model 2, we interact installer HHI with each top installer size indicator, with A, B, and C defined as in Model 1.

Table 6-2 presents the Model 1 results, while

	(A)	(B)	(C)
VARIABLES	Small top installer	Large top installer	Very small top installer
percent_democrat	1.005 (0.0119)	1.003 (0.0118)	1.005 (0.0119)
county_AHJ	0.270** (0.168)	0.270** (0.169)	0.287** (0.179)
medinc_1000	1.007 (0.00513)	1.007 (0.00525)	1.007 (0.00527)
meddens_100	1.021*** (0.00677)	1.021*** (0.00679)	1.022*** (0.00672)
expendpercap_1000	1.359** (0.169)	1.346** (0.164)	1.350** (0.166)
median_year_built	1.059*** (0.0177)	1.058*** (0.0181)	1.063*** (0.0176)
ressys_1000	0.995 (0.00404)	0.995 (0.00416)	0.995 (0.00411)
annual_pct_growth_rate	0.998*** (0.000675)	0.998*** (0.000661)	0.998*** (0.000669)
neighbor_syspermil	1.000 (2.61e-05)	1.000 (2.57e-05)	1.000 (2.57e-05)
pct_adopted_mr	1.024* (0.0129)	1.030** (0.0123)	1.029** (0.0127)
insthhi_100	0.970** (0.0114)	0.969*** (0.0112)	0.970*** (0.0113)
small_installer	0.438* (0.207)		
large_installer		1.432 (0.500)	
verysmall_installer			0.621 (0.394)
Constant	0*** (0)	0*** (0)	0*** (0)
Observations	475	475	475

Notes: Standard error in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6-3 presents the Model 2 results. Note that as these models are logistic regressions the table results report odds ratios. For ease of interpretation, recall that an odds ratio greater than one implies that an increase in the explanatory variable is associated with an increase in the likelihood of an AHJ's compliance with AB 2188.

***Table 6-2**: Logit Regressions (Models 1 A, B, C)*

	(A)	(B)	(C)
VARIABLES	Small top installer	Large top installer	Very small top installer
percent_democrat	1.005 (0.0119)	1.003 (0.0118)	1.005 (0.0119)
county_AHJ	0.270** (0.168)	0.270** (0.169)	0.287** (0.179)
medinc_1000	1.007 (0.00513)	1.007 (0.00525)	1.007 (0.00527)
meddens_100	1.021*** (0.00677)	1.021*** (0.00679)	1.022*** (0.00672)
expendpercap_1000	1.359** (0.169)	1.346** (0.164)	1.350** (0.166)
median_year_built	1.059*** (0.0177)	1.058*** (0.0181)	1.063*** (0.0176)
ressys_1000	0.995 (0.00404)	0.995 (0.00416)	0.995 (0.00411)
annual_pct_growth_rate	0.998*** (0.000675)	0.998*** (0.000661)	0.998*** (0.000669)
neighbor_syspermil	1.000 (2.61e-05)	1.000 (2.57e-05)	1.000 (2.57e-05)
pct_adopted_mr	1.024* (0.0129)	1.030** (0.0123)	1.029** (0.0127)
insthhi_100	0.970** (0.0114)	0.969*** (0.0112)	0.970*** (0.0113)
small_installer	0.438* (0.207)		
large_installer		1.432 (0.500)	
verysmall_installer			0.621 (0.394)
Constant	0*** (0)	0*** (0)	0*** (0)
Observations	475	475	475

Notes: Standard error in parentheses; *** p<0.01, ** p<0.05, * p<0.1

***Table 6-3**: Logit Regressions (Models 2 A, B, C)*

	(A)	(B)	(C)
VARIABLES	Small top installer	Large top installer	Very small top installer
percent_democrat	0.998	0.997	0.999
	(0.0112)	(0.0114)	(0.0112)
county_AHJ	0.279**	0.330*	0.315*
	(0.174)	(0.201)	(0.197)
medinc_1000	1.009*	1.010*	1.009*
	(0.00523)	(0.00533)	(0.00526)
meddens_100	1.023***	1.025***	1.024***
	(0.00676)	(0.00670)	(0.00675)
expendpercap_1000	1.371**	1.306**	1.354**
	(0.175)	(0.152)	(0.172)
median_year_built	1.053***	1.059***	1.056***
	(0.0173)	(0.0183)	(0.0173)
ressys_1000	0.995	0.996	0.996
	(0.00415)	(0.00404)	(0.00414)
annual_pct_growth_rate	0.998***	0.998***	0.998***
	(0.000703)	(0.000695)	(0.000699)
neighbor_syspermil	1.000	1.000	1.000
	(2.60e-05)	(2.54e-05)	(2.58e-05)
pct_adopted_mr	1.027**	1.035***	1.028**
	(0.0126)	(0.0122)	(0.0126)
hhi_smallinst	0.958**		
	(0.0182)		
hhi_largeinst		0.991	
		(0.0128)	
hhi_verysmallinst			0.962*
			(0.0209)
Constant	0***	0***	0***
	(0)	(0)	(0)
Observations	475	475	475

Notes: Standard error in parentheses; *** p<0.01, ** p<0.05, * p<0.1

7 Discussion

In this section, we consider the evidence for each of our hypotheses with respect to AB2188 compliance by California AHJs. We also consider the overall implications of our results, including for likely AHJ compliance with top-down SSP across the country. In support of the national discussion, we provide a proof-of-concept mapping of some of our results to other part of the country. analysis outcome for each hypothesis, in turn, focusing on interpretation of mean and median comparisons and regression results.

7.1 Support for hypotheses

H1: Networks and neighbors

As shown in Table 5-1 above, we proxied the network connections of AHJs using the megaregion compliance rate explanatory variable described in Table 4-1. We found that across all of our tests, the compliance rate of an AHJ's megaregion is a significant predictor of that AHJ's compliance with AB 2188, with higher megaregion compliance rates associated with higher compliance likelihoods for the AHJ.

In summary, we see evidence supporting Hypothesis 1.

***Table 7-1**: H1 Analysis Summary*

Variable	Test	Result
Megaregion compliance rate (%)	T-test χ^2 Logit	t: 9.35*** $\chi^2(6) = 75.4$*** or: 1.024*(1A), 1.035***(2C)

General notes: For explanatory variables present across multiple logistic regression models, we include the range of highest and lowest predicted odds ratios and their significance levels and note the models they come from. For Pearson's Chi-Squared tests, degrees of freedom and included in parentheses. For all statistical tests, significance levels: *** p<0.01, ** p<0.05, * p<0.1.

H2: Political identification

As shown in Table 5-1 above, we proxied the political identification of each AHJ's residents using the Democratic Party affiliation percentage explanatory variable described in Table 4-1. Our t-test revealed a significant difference in the Democratic Party affiliation percentage between compliant and non-compliant AHJs, with higher Democratic Party affiliation associated with higher likelihood of AB2188 compliance by a given AHJ. However, our Pearson's chi-squared test does not find a significant difference in the median values of the compliant and non-compliant distributions, and Democratic Party affiliation is not significant in any of our logit model specifications. A likely explanation for the insignificance within the logit models is that Democratic Party affiliation is correlated with other explanatory variables that are themselves more strongly linked to AB 2188 compliance.

In summary, we find limited support for Hypothesis 2.

***Table 7-2**: H2 Analysis Summary*

Variable	Test	Result
Democratic Party affiliation (%)	T-test χ^2 Logit	t: 3.59*** $\chi^2(363) = 385.5$ or: 0.997 (2B), 1.005 (1C)

General notes: For explanatory variables present across multiple logistic regression models, we include the range of highest and lowest predicted odds ratios and their significance levels and note the models they come from. For Pearson's Chi-Squared tests, degrees of freedom and included in parentheses. For all statistical tests, significance levels: *** p<0.01, ** p<0.05, * p<0.1.

H3: Economics of government infrastructure

As shown in Table 5-1 above, we considered five explanatory variables to be relevant to the economics of government infrastructure hypothesis. These five variables – survey participant, median population density, median HH income, expenditures per capita, and county AHJ – are described in Table 4-1 and provide an indicator of an AHJ's administrative complexity and available resources.

Median population density and median household income are significant and positively correlated with AB 2188 compliance in means comparisons and a substantial number of the logit model specifications. Results for expenditures per capita and the county-level AHJ indicator are somewhat less consistent, but we do find expenditures to have a significant positive relationship with compliance in logit regressions, while the county indicator is associated with significantly lower compliance.

Note that our means comparison and Pearson's chi-squared tests demonstrate a very significant positive relationship between an AHJ's compliance with AB2188 and its participation in the U.S. Census Building Permit System survey. Due to a reduction in observations suitable for the logit models (475 out of 539 observations), the status of failing to participate in the Building Permit Survey perfectly predicts failure to comply with AB 2188.

In summary, we find evidence supporting Hypothesis 3.

Table 7-3*: H3 Analysis Summary*

Variable	Test	Result
Survey participant	T-test χ^2 Logit	t: 5.686*** $\chi^2(1) = 30.6$*** --[a]
Median population density	T-test χ^2 Logit	t: 5.615*** $\chi^2(535) = 535.6$ or: 1.021*** (1A), 1.025*** (2B)
Median HH income	T-test χ^2 Logit	t: 5.735*** $\chi^2(535) = 535.6$ or: 1.007 (2AC), 1.010* (2B)
Expenditures per capita	T-test χ^2 Logit	t: 0.270 $\chi^2(535) = 536.0$ or: 1.306** (2B), 1.371** (2A)
County AHJ	T-test χ^2 Logit	t: -1.320 $\chi^2(1) = 1.74$ or: 0.270** (1A), 0.330* (2C)

[a] Due to a reduction in observations suitable for the logit models (475 out of 539 observations), the status of failing to participate in the Building Permit Survey perfectly predicts failure to comply with AB 2188, so it is dropped from the model. This factor is nonetheless a strong predictor of compliance status and suggests that further investigation may be informative.

General notes: For explanatory variables present across multiple logistic regression models, we include the range of highest and lowest predicted odds ratios and their significance levels and note the models they come from. For Pearson's Chi-Squared tests, degrees of freedom and included in parentheses. For all statistical tests, significance levels: *** p<0.01, ** p<0.05, * p<0.1.

H4: Workload management

As shown in Table 5-1 above, we considered four explanatory variables to be relevant to the current and/or anticipated workload management hypothesis. These four variables – median year of housing construction, # of PV systems in AHJ, annual growth in PV installations, and # of PV systems in neighbor AHJs – are described in Table 4-1.

In our logit models, more recent median year of housing construction is significantly correlated with AB2188 compliance. Means comparisons show the number of PV systems installed in an

AHJ and in neighboring AHJs to be significantly positively correlated with compliance, but no significant effect manifests in the logit models.

Counter to our original thinking, we find a significant negative relationship between the annual growth in PV installations in an AHJ and the AHJ's AB2188 compliance. Plausible explanations include: (1) AHJs with recent high growth rates in PV installations are too busy keeping up with applications to comply with AB2188; (2) AHJs with recent high growth rates in PV installations have already found ways to manage their workloads and see no need for AB2188 compliance; or (3) AHJs with recent high growth rates in PV installations perhaps predict a cyclical "cooling period." Further investigation of the rate of growth in PV installations and related variables would be of value to explain this unexpected finding.

In summary, we find evidence supporting Hypothesis 4.

Table 7-4: *H4 Analysis Summary*

Variable	Test	Result
Median year of housing construction	T-test χ^2 Logit	t: 0.758 $\chi^2(58) = 58.4$ or: 1.053*** (2A), 1.063*** (1C)
# of PV systems in AHJ	T-test χ^2 Logit	t: 2.872*** $\chi^2(513) = 514$ or: 0.995 (all models)
Annual growth in PV installations (%)	T-test χ^2 Logit	t: -2.344** $\chi^2(459) = 440.3$ or: 0.998*** (all models)
# of PV systems in neighbor AHJs	T-test χ^2 Logit	t: 5.502*** $\chi^2(411) = 398.4$ or: 1.000 (all models)

General notes: For explanatory variables present across multiple logistic regression models, we include the range of highest and lowest predicted odds ratios and their significance levels and note the models they come from. For Pearson's Chi-Squared tests, degrees of freedom and included in parentheses. For all statistical tests, significance levels: *** p<0.01, ** p<0.05, * p<0.1.

H5: Political economy of streamlining

As shown in Table 5-1 above, we considered seven explanatory variables to be relevant to the two political economy hypotheses of 5A (AHJs are more likely to comply if their leading installer has high market share and works in many AHJs) and 5B (AHJs are less likely to comply if their leading installer has high market share and works in only a few AHJs). These seven variables – small top installer, large top installer, very small top installer, installer HHI, HHI of small top installer, HHI of large top installer, and HHI of very small top installer – are described in Table 4-1.

In support of the broad Hypothesis 5 notion that the market concentration of PV installers has an impact on the policies within an AHJ, we find evidence that installer HHI is negatively associated with AB2188 compliance (i.e., the more powerful the top installer, the less likely an AHJ is to comply).

We also find limited evidence supporting Hypothesis 5A in terms of our PV installer size variables. Our means comparison shows that the indicator for top AHJ PV installers within an AHJ with geographically-widespread interests ("large top installer") is significantly positively correlated with AB2188 compliance. We do not, however, see a significant interaction between this indicator and AHJ installer HHI in our means comparison, nor do we find that the large top installer variables are significant in our logit regressions.

We find stronger evidence supporting Hypothesis 5B, however. We find that the indicator variables for top PV installers with small or very small geographic territories of operation are significantly negatively correlated with AB 2188 compliance through our means testing. This finding also holds for the interaction term combining installer HHI and small or very small top installer indicators in our logit regressions.

In summary, we find evidence supporting Hypothesis 5B and limited evidence supporting Hypothesis 5A.

Table 7-5*: H5A and H5B Analysis Summary*

Variable	Test	Result
Small top installer	T-test χ^2 Logit	t: -5.688*** $\chi^2(1) = 30.6$*** or: 0.438* (1A)
Large top installer	T-test χ^2 Logit	t: 3.733*** $\chi^2(1) = 13.6$*** or: 1.432 (1B)
Very small top installer	T-test χ^2 Logit	t: -5.096*** $\chi^2(1) = 24.9$*** or: 0.621 (1C)
Installer HHI	T-test χ^2 Logit	t: -4.835*** $\chi^2(496) = 489$ or: 0.970*** (1C), 0.969*** (1B)
HHI of small top installer	T-test χ^2 Logit	t: 0.958** $\chi^2(47) = 120.0$*** or: 0.958** (2A)
HHI of large top installer	T-test χ^2 Logit	t: 0.991 $\chi^2(377) = 315.8$ or: 0.991 (2B)
HHI of very small top installer	T-test χ^2 Logit	t: 0.962* $\chi^2(23) = 74.4$*** or: 0.962* (2C)

General notes: For explanatory variables present across multiple logistic regression models, we include the range of highest and lowest predicted odds ratios and their significance levels and note the models they come from. For Pearson's Chi-Squared tests, degrees of freedom and included in parentheses. For all statistical tests, significance levels: *** p<0.01, ** p<0.05, * p<0.1.

7.2 National implications

Before considering the national implications of our analysis, it is useful to take a step back to summarize the support we have for our hypotheses, given our compiled and selected variables. Table 7-6 presents this summary, as well as a list of the relevant variables used to test each hypotheses and whether these variables are readily nationally consistent. As mentioned above, only "Expenditures per capita" is calculated from State-specific data, with the rest of the variables derived from national sources (predominantly from the U.S. Census Bureau data and the Tracking the Sun database).

Table 7-6*: Hypothesis support and consideration of variable consistency nationwide*

Hypothesis	**Hypothesis Support**	**Variables Selected**	**Nationally Consistent Data**
H1: Networks and neighbors	Supported	Megaregion compliance rate (%)	Y
H2: Political identification	Limited support	Democratic Party affiliation (%)	Y
H3: Economics of government infrastructure	Supported	Survey participant	Y
		Median population density	Y
		Median HH income	Y
		Expenditures per capita	N
		County AHJ	Y
H4: Workload management	Supported	Median year of housing construction	Y
		# of PV systems in AHJ	Y
		Annual growth in PV installations (%)	Y
		# of PV systems in neighbor AHJs	Y
H5A: Political economy of streamlining – AHJs with dominant installers with large geographic spread more likely to comply	Limited support	Large top installer	Y
		Installer HHI	Y
		HHI of large top installer	Y
H5B: Political economy of streamlining – AHJs with dominant installers with limited geographic spread less likely to comply	Supported	Small top installer	Y
		Very small top installer	Y
		Installer HHI	Y
		HHI of small top installer	Y
		HHI of very small top installer	Y

Projecting the supported hypotheses for California compliance with AB2188 to a national set of AHJs has the potential to segment non-California AHJs on their likeliness to comply with future top-down SSP efforts, someday. This national compliance-likelihood projection would allow a first-order estimate of the potential for increased competition to occur in compliant AHJs, which would by definition have permitting and inspection practices consistent with other AHJs. Note that the benefits of increased competition are potentially bringing down the costs of solar and/or increasing the quality of solar installations.

Although the analysis described above is outside the scope of the current study, in Figure 7-1 we provide a first-order national projection of some of the variables selected for use in testing Hypotheses H3 and H4 in California, the two tractable and supported hypotheses mentioned above that correlate with an AHJ's likely compliance with top-down SSP (Hypothesis 5B, by contrast, correlates with an AHJ's likely non-compliance with top-down SSP). The variables considered in Figure 7-1 are all derived from U.S. Census Bureau data that are easily obtained at the zip-code level. H3 (Economics of government infrastructure) is represented by the explanatory variables of median population density, median household income, and "major metropolitan area" (which we treat as a converse, of sorts, of "county AHJ"). H4 (Workload management) is represented by the explanatory variable of median year of housing construction, with newer housing more aligned with compliance than older housing.

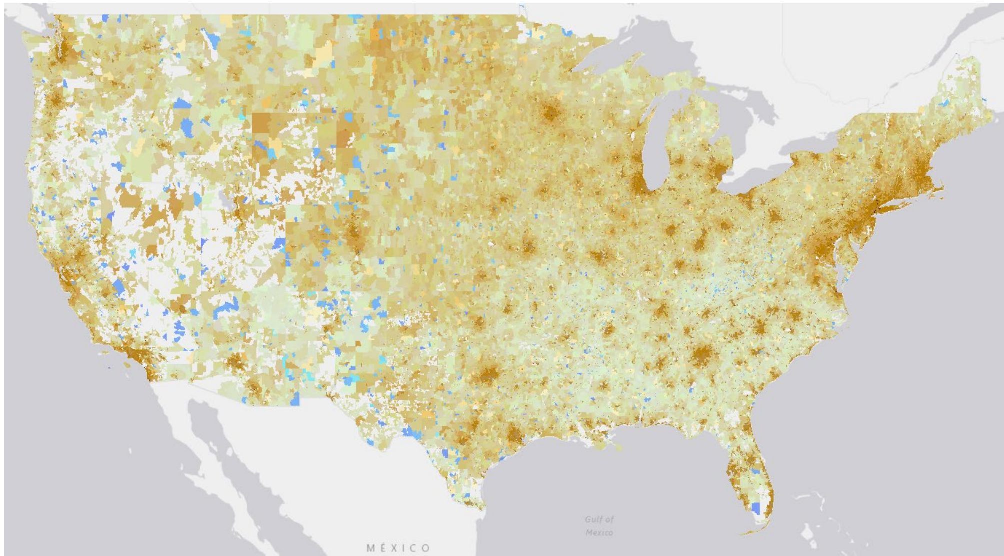

Figure 7-1*: First-order national projection of some variables selected to test H3 and H4 hypotheses that are derived from the U.S. Census Bureau and correlate with AHJ compliance with AB2188. Areas that score highly on all factors appear in darker shades of brown.*

Although Figure 7-1 is not refined with all the variables we might be able to project nationally from our California AB2188 compliance testing results, it is already suggestive of areas of the country in which top-down SSP would appear likely to have high AHJ compliance. In particular, the coastal northeastern States appear to be very likely to have high compliance with a future top-down SSP mandate such as AB2188.

While California accounts for nearly half of the U.S. total of residential PV (in terms of MW), a number of other states also have a substantial market for residential PV (Table 7-7). Some states, such as New Mexico, are also exploring policies and tools to reduce the administrative and soft cost burdens of PV permitting as residential solar installations become increasingly common over time. Based on the growth of the residential PV industry and the potential value of permit practice streamlining throughout the U.S., we use the findings of our case study of CA AB2188 to project which other areas of the U.S. would likely be receptive to similar SSP policies based on their corresponding demographic characteristics and AHJ-level installer environments (i.e., installer concentration and territory size of top installers). In the appendix, we include figures of individual states from Table 7-7, demonstrating variation in the key variables associated with AB2188 compliance, including installer characteristics by AHJ.

Table 7-7: *Top States in terms of MW of residential PV in 2018*

State	MW in 2018	MW Rank in 2018	Projection included?
CA	54681	1	N/A
AZ	9958	2	Yes
NY	8137	3	Yes*
NJ	7838	4	Yes
MA	6229	5	Yes
MD	5944	6	Partial
HI	4335	7	Partial*
CT	2637	8	Yes
CO	2616	9	No
NV	2328	10	No
TX	2138	11	Yes*
NM	1037	18**	Yes

Source (for MW data): https://www.eia.gov/electricity/data/eia861m/#solarpv

Notes: Hawaii is not included in Tracking the Sun (TtS), but public data were acquired for the county of Honolulu, but we were not able to acquire comparable data for other Hawaiian counties; because Hawaii AHJs are only county-level, we thus cannot analyze the geographic scope of top installer for this case. Nevada is not included in TtS and we were not able to acquire comparable public data. Colorado is included in TtS, but the data do not include city, zip code, or county, so we were not able to match the data to AHJs. Maryland is included in TtS, but locations are defined by county only, so we are only able to consider county-level AHJs. *Denotes the use of a public data set other than TtS. **While not in the top ten states outside CA in terms of MW, we include NM because of recent streamlining efforts (https://reia-nm.org/new-solar-permit-software-to-reduce-costs-and-expand-residential-markets/).

References

Ben-Akiva, M.E. and S.R. Lerman (1985). Discrete Choice Analysis: Theory and Application to Travel Demand, MIT Press, Cambridge, MA.

Cadoret, I. and F. Padovano (2016). "The political drivers of renewable energies policies," *Energy Economics*, 56 (2016) 261-269. https://doi.org/10.1016/j.eneco.2016.03.003

Coley, J. and D. Hess (2012). "Green Energy Laws and Republican Legislators in the United States." *Energy Policy* 48 (1): 576-583.

California Statewide Database (2019). 2016 General Election Statement of Vote for Consolidated Precincts; Retrieved using Statewide Database; <https://statewidedatabase.org/d10/g16.html>; (Accessed March 27, 2019).

California State Controller's Office (2018). County - Expenditures (Finance Application). California State Controller's Office. Retrieved from https://bythenumbers.sco.ca.gov/Finance-Application/County-Expenditures/uctr-c2j8 on (Accessed April 1, 2019).

California State Controller's Office (2018). City Revenues (Finance Application). California State Controller's Office. Retrieved from https://bythenumbers.sco.ca.gov/Finance-Application/City-Revenues/rrtv-rsj9 on (Accessed April 1, 2019).

Chernyakhovskiy, I. (2015) Solar PV Adoption in the United States: An Empirical Investigation of State Policy Effectiveness. Master's Thesis - Department of Resource Economics, University of Massachusetts, Amherst. https://scholarworks.umass.edu/masters_theses_2/141

Graziano, M. and K. Gillingham (2015) "Spatial patterns of solar photovoltaic system adoption: The influence of neighbors and the built environment." *Journal of Economic Geography*, 15(4), July 2015, Pages 815–839, https://doi.org/10.1093/jeg/lbu036

Jordan, A. and Huitema, D. (2014). "Innovations in climate policy: the politics of invention, diffusion, and evaluation." Environmental Politics, 23(5), 2014. pp. 715–734, http://dx.doi.org/10.1080/09644016.2014.923614

Kaatz, J. & S. Anders (2016) AB 2188 Implementation Report: A Review of Ordinances Adopted by Local Jurisdictions in California, Center for Sustainable Energy.

Kerr, W., W. Lincoln, and P. Mishra (2014) "The Dynamics of Firm Lobbying," *American Economic Journal: Economic Policy,* 6 (4), Nov. 2014, pp. 343-379. https://www.jstor.org/stable/43189413

Lawrence Berkeley National Lab (LBNL) (2017) Tracking the Sun Public Data File. Retrieved from https://emp.lbl.gov/tracking-the-sun/search on (Accessed September 14, 2018).

Lowery, D. (2007). "Why Do Organized Interests Lobby? A Multi-Goal, Multi-Context Theory of Lobbying." *Polity*, 39(1), Jan. 2007, pp. 29-54. https://www.jstor.org/stable/4500263

McFadden, D. (2001). "Economic Choices," *American Economic Review*, 91:351-378.

Nelson, G. D. and A. Rae (2016) "An Economic Geography of the United States: From Commutes to Megaregions." *PLOS One*, Nov. 30, 2016. https://doi.org/10.1371/journal.pone.0166083

Shapiro, C. (2010). "The 2010 Horizontal Merger Guidelines: from Hedgehog to Fox in Forty Years." *Antitrust Law Journal*, 77(1), pp. 49-107 <http://www.jstor.org/stable/23075589>

Taylor, M.R. "Understanding Streamlined Solar Permitting Practices: A Primer" Working Paper. https://sites.energycenter.org/solar-permitting November 17, 2017.

U.S. Census Bureau, Geography Division. TIGER/Line 2016: Place (California). Retrieved from https://census.gov/; (Accessed March 28, 2019).

U.S. Census Bureau, Geography Division. TIGER/Line 2016: County. Retrieved from https://census.gov/; (Accessed March 28, 2019).

U.S. Census Bureau; American Community Survey, 2012-2016 American Community Survey 5-Year Estimates, Table B19013: Median Household Income; generated using American FactFinder; accessed 27 March 2019; <http://factfinder.census.gov>

U.S. Census Bureau; American Community Survey, 2012-2016 American Community Survey 5-Year Estimates, Table B25035: Median Year Structure Built; generated using American FactFinder; <http://factfinder.census.gov>; (Accessed March 27, 2019).

U.S. Census Bureau; American Community Survey, 2012-2016 American Community Survey 5-Year Estimates, Table B01003: Total Population; generated using American FactFinder; <http://factfinder.census.gov>; (Accessed March 27, 2019)

U.S. Census Bureau: Residential Construction Branch. Building Permit Survey: Place. U.S Census Bureau. Retrieved from https://www2.census.gov/econ/bps/Place/ (Accessed April 19, 2019)

Zhou, S., D. Matisoff, G.A. Kingsley, M. Brown. (2019) "Understanding renewable energy policy adoption and evolution in Europe: The impact of coercion, normative emulation, competition, and learning." *Energy Research & Social Science* 51, 2019. pp. 1-11.

APPENDIX

We include a matrix of correlation coefficients for all variables available in our data set. High correlation between potential explanatory variables was one factor we considered when formulating our final regression specifications. In the correlation table, strong positive correlations are shaded green, while strong negative correlations are shaded red; darker shading represents a higher absolute value of correlation.

***Table A-1**: Explanatory Variables Correlation Coefficients (part 1)*

	compliant	percent_democrat	percent_republican	county_AHJ	median_hh_income	median_hh_value	density_med
Compliant	1.00	0.12	-0.11	-0.12	0.16	0.18	0.21
percent_democrat	0.12	1.00	-1.00	-0.29	0.16	0.27	0.56
county_AHJ	-0.12	-0.29	0.28	1.00	-0.05	-0.11	-0.32
median_hh_income	0.16	0.16	-0.15	-0.05	1.00	0.89	-0.03
density_med	0.21	0.56	-0.54	-0.32	-0.03	0.07	1.00
ahj_density	0.15	0.54	-0.52	-0.40	-0.07	0.05	0.90
unemployment_rate	-0.13	-0.17	0.17	0.09	-0.56	-0.56	-0.14
percent_one_unit	-0.14	-0.42	0.42	0.38	0.21	-0.01	-0.59
percent_bachelor	0.20	0.24	-0.25	-0.11	0.82	0.85	0.05
percent_graduate	0.18	0.24	-0.25	-0.10	0.83	0.87	0.00
percent_renter	0.00	0.31	-0.33	-0.26	-0.59	-0.35	0.43
permit_system	0.16	-0.02	0.01	0.02	0.00	0.04	0.02
expend_per_capita	0.04	0.04	-0.04	0.51	0.11	0.12	-0.08
revenue_per_capita	0.05	0.05	-0.05	0.50	0.12	0.13	-0.08
median_year_built	0.00	-0.41	0.42	0.12	-0.22	-0.42	-0.42
construction_permit_total	0.10	0.16	-0.15	0.18	0.08	0.10	0.27
permit_per_total_expend	-0.01	-0.21	0.21	-0.14	-0.04	-0.14	-0.14
res_systems	0.11	0.00	0.01	0.01	-0.04	-0.08	0.15
annual_pct_growth_rate	-0.12	0.11	-0.09	-0.16	-0.28	-0.32	0.18
systems_per_capita	0.15	-0.09	0.10	-0.17	0.19	0.17	0.09
Installations	0.09	0.03	-0.02	-0.01	-0.05	-0.09	0.16
installer_hhi	-0.19	0.16	-0.16	0.01	-0.28	-0.29	-0.04
nml_sys_cost	0.02	0.31	-0.33	0.03	0.47	0.54	0.04
lg_inst_share	-0.07	0.14	-0.14	0.01	-0.20	-0.25	0.06
large_installer	0.18	0.12	-0.11	0.00	0.08	0.02	0.24
small_installer	-0.25	-0.08	0.05	0.10	-0.01	0.04	-0.26
verysmall_installer	-0.19	-0.05	0.03	0.15	-0.14	-0.10	-0.18

__Table A-1__: Explanatory Variables Correlation Coefficients (part 2)

	ahj_density	unemployment_rate	percent_one_unit	percent_bachelor	percent_graduate	percent_renter	permit_system
Compliant	0.15	-0.13	-0.14	0.20	0.18	0.00	0.16
percent_democrat	0.54	-0.17	-0.42	0.24	0.24	0.31	-0.02
percent_republican	-0.52	0.17	0.42	-0.25	-0.25	-0.33	0.01
county_AHJ	-0.40	0.09	0.38	-0.11	-0.10	-0.26	0.02
median_hh_income	-0.07	-0.56	0.21	0.82	0.83	-0.59	0.00
median_hh_value	0.05	-0.56	-0.01	0.85	0.87	-0.35	0.04
density_med	0.90	-0.14	-0.59	0.05	0.00	0.43	0.02
ahj_density	1.00	-0.13	-0.57	0.02	-0.02	0.46	0.01
unemployment_rate	-0.13	1.00	0.11	-0.65	-0.57	0.25	-0.01
percent_one_unit	-0.57	0.11	1.00	-0.12	-0.08	-0.77	-0.03
percent_bachelor	0.02	-0.65	-0.12	1.00	0.96	-0.34	0.01
percent_graduate	-0.02	-0.57	-0.08	0.96	1.00	-0.34	0.03
percent_renter	0.46	0.25	-0.77	-0.34	-0.34	1.00	0.03
permit_system	0.01	-0.01	-0.03	0.01	0.03	0.03	1.00
expend_per_capita	-0.20	-0.07	0.07	0.11	0.10	-0.07	0.02
revenue_per_capita	-0.20	-0.08	0.06	0.11	0.10	-0.06	0.02
median_year_built	-0.43	0.28	0.33	-0.33	-0.35	-0.19	-0.01
construction_permit_total	0.11	-0.06	-0.18	0.13	0.10	0.07	0.03
permit_per_total_expend	-0.13	0.10	0.23	-0.15	-0.14	-0.17	0.02
res_systems	0.01	0.02	-0.11	-0.01	-0.03	0.06	0.03
annual_pct_growth_rate	0.18	0.37	0.04	-0.43	-0.41	0.14	-0.07
systems_per_capita	0.02	-0.20	-0.08	0.22	0.17	-0.11	0.02
Installations	0.03	0.04	-0.11	-0.04	-0.06	0.08	0.02
installer_hhi	-0.01	0.26	0.02	-0.37	-0.33	0.19	-0.01
nml_sys_cost	0.04	-0.41	-0.14	0.55	0.54	-0.09	0.06
lg_inst_share	0.04	0.13	-0.02	-0.27	-0.26	0.16	-0.03
large_installer	0.19	-0.04	-0.09	0.01	-0.03	0.05	0.04
small_installer	-0.19	-0.03	0.08	0.05	0.06	-0.07	0.02
verysmall_installer	-0.15	0.04	0.02	-0.02	-0.02	0.00	0.01

***Table A-1**: Explanatory Variables Correlation Coefficients (part 3)*

	expend_per_capita	revenue_per_capita	median_year_built	construction_permit_total	permit_per_total_expend	res_systems	annual_pct_growth_rate	systems_per_capita
Compliant	0.04	0.05	0.00	0.10	-0.01	0.11	-0.12	0.15
percent_democrat	0.04	0.05	-0.41	0.16	-0.21	0.00	0.11	-0.09
percent_republican	-0.04	-0.05	0.42	-0.15	0.21	0.01	-0.09	0.10
county_AHJ	0.51	0.50	0.12	0.18	-0.14	0.01	-0.16	-0.17
median_hh_income	0.11	0.12	-0.22	0.08	-0.04	-0.04	-0.28	0.19
median_hh_value	0.12	0.13	-0.42	0.10	-0.14	-0.08	-0.32	0.17
density_med	-0.08	-0.08	-0.42	0.27	-0.14	0.15	0.18	0.09
ahj_density	-0.20	-0.20	-0.43	0.11	-0.13	0.01	0.18	0.02
unemployment_rate	-0.07	-0.08	0.28	-0.06	0.10	0.02	0.37	-0.20
percent_one_unit	0.07	0.06	0.33	-0.18	0.23	-0.11	0.04	-0.08
percent_bachelor	0.11	0.11	-0.33	0.13	-0.15	-0.01	-0.43	0.22
percent_graduate	0.10	0.10	-0.35	0.10	-0.14	-0.03	-0.41	0.17
percent_renter	-0.07	-0.06	-0.19	0.07	-0.17	0.06	0.14	-0.11
permit_system	0.02	0.02	-0.01	0.03	0.02	0.03	-0.07	0.02
expend_per_capita	1.00	1.00	-0.07	0.31	-0.18	0.04	-0.18	-0.11
revenue_per_capita	1.00	1.00	-0.07	0.30	-0.18	0.03	-0.18	-0.11
median_year_built	-0.07	-0.07	1.00	-0.09	0.44	0.12	0.20	0.11
construction_permit_total	0.31	0.30	-0.09	1.00	-0.06	0.51	-0.08	0.04
permit_per_total_expend	-0.18	-0.18	0.44	-0.06	1.00	0.06	0.18	0.08
res_systems	0.04	0.03	0.12	0.51	0.06	1.00	0.03	0.22
annual_pct_growth_rate	-0.18	-0.18	0.20	-0.08	0.18	0.03	1.00	0.04
systems_per_capita	-0.11	-0.11	0.11	0.04	0.08	0.22	0.04	1.00
Installations	0.02	0.02	0.12	0.61	0.08	0.91	0.05	0.12
installer_hhi	0.01	0.02	0.18	-0.08	0.10	-0.13	0.20	-0.28
nml_sys_cost	0.18	0.18	-0.38	0.17	-0.20	-0.08	-0.40	-0.12
lg_inst_share	0.02	0.03	0.20	0.02	0.08	-0.05	0.20	-0.23
large_installer	0.00	0.00	0.09	0.14	0.05	0.13	0.10	0.16
small_installer	0.03	0.03	-0.08	-0.10	-0.05	-0.10	-0.18	-0.13
verysmall_installer	0.05	0.05	-0.02	-0.07	-0.04	-0.07	-0.13	-0.12

Table A-1: *Explanatory Variables Correlation Coefficients (part 4)*

	installations	installer_hhi	nml_sys_cost	lg_inst_share	large_installer	small_installer	verysmall_installer
compliant	0.09	-0.19	0.02	-0.07	0.18	-0.25	-0.19
percent_democrat	0.03	0.16	0.31	0.14	0.12	-0.08	-0.05
percent_republican	-0.02	-0.16	-0.33	-0.14	-0.11	0.05	0.03
county_AHJ	-0.01	0.01	0.03	0.01	0.00	0.10	0.15
median_hh_income	-0.05	-0.28	0.47	-0.20	0.08	-0.01	-0.14
median_hh_value	-0.09	-0.29	0.54	-0.25	0.02	0.04	-0.10
density_med	0.16	-0.04	0.04	0.06	0.24	-0.26	-0.18
ahj_density	0.03	-0.01	0.04	0.04	0.19	-0.19	-0.15
unemployment_rate	0.04	0.26	-0.41	0.13	-0.04	-0.03	0.04
percent_one_unit	-0.11	0.02	-0.14	-0.02	-0.09	0.08	0.02
percent_bachelor	-0.04	-0.37	0.55	-0.27	0.01	0.05	-0.02
percent_graduate	-0.06	-0.33	0.54	-0.26	-0.03	0.06	-0.02
percent_renter	0.08	0.19	-0.09	0.16	0.05	-0.07	0.00
permit_system	0.02	-0.01	0.06	-0.03	0.04	0.02	0.01
expend_per_capita	0.02	0.01	0.18	0.02	0.00	0.03	0.05
revenue_per_capita	0.02	0.02	0.18	0.03	0.00	0.03	0.05
median_year_built	0.12	0.18	-0.38	0.20	0.09	-0.08	-0.02
construction_permit_total	0.61	-0.08	0.17	0.02	0.14	-0.10	-0.07
permit_per_total_expend	0.08	0.10	-0.20	0.08	0.05	-0.05	-0.04
res_systems	0.91	-0.13	-0.08	-0.05	0.13	-0.10	-0.07
annual_pct_growth_rate	0.05	0.20	-0.40	0.20	0.10	-0.18	-0.13
systems_per_capita	0.12	-0.28	-0.12	-0.23	0.16	-0.13	-0.12
installations	1.00	0.00	-0.03	0.12	0.14	-0.10	-0.07
installer_hhi	0.00	1.00	0.06	0.81	-0.01	0.08	0.14

nml_sys_cost	-0.03	0.06	1.00	0.06	-0.09	0.20	0.16
lg_inst_share	0.12	0.81	0.06	1.00	0.14	-0.10	-0.03
large_installer	0.14	-0.01	-0.09	0.14	1.00	-0.54	-0.36
small_installer	-0.10	0.08	0.20	-0.10	-0.54	1.00	0.66
verysmall_installer	-0.07	0.14	0.16	-0.03	-0.36	0.66	1.00

***Table A-2**: Means comparison (T statistics and P values)*

	Mean: Compliant (N=441)	Mean: Non-Compliant (N=98)	Mean difference	T stat	P value
Normalized system cost	4898.02	4776.88	121.14	1.518	0.130
Largest installer's share of total systems	0.15	0.20	-0.04	-3.530	0.000
Large installer	0.79	0.61	0.18	3.733	0.000
Small installer	0.07	0.26	-0.19	-5.688	0.000
Very small installer	0.03	0.15	-0.12	-5.096	0.000
Percent Democrat	59.20	52.62	6.59	3.592	0.000
Percent Republican	34.80	40.90	-6.10	-3.370	0.001
County-level AHJ	0.10	0.14	-0.05	-1.320	0.187
Median HH income	74291.90	52294.81	21997.09	5.735	0.000
Median HH value	525733	280081	245651	5.767	0.000
Median population density	5277.53	2719.82	2557.70	5.615	0.000
AHJ minimum population density	4078.37	2832.25	1246.12	3.231	0.001
Unemployment rate	8.44	10.96	-2.52	-5.918	0.000
Single family housing (%)	74.53	80.25	-5.72	-3.508	0.000
Percent bachelor's degree	33.33	19.46	13.86	6.474	0.000
Percent graduate degree	13.09	6.60	6.49	5.748	0.000
Percent renters	41.36	43.28	-1.92	-1.195	0.233
Survey participant	0.98	0.87	0.12	5.686	0.000
Expenditures per capita	10614.33	6050.26	4564.06	0.270	0.787
Revenue per capita	11113.84	22141.52	-11027.68	-0.555	0.579
Median year of construction	1975.04	1974.04	1.00	0.758	0.449
Number of residential PV systems in AHJ	1425.40	527.52	897.88	2.872	0.004
Total construction permits	1905389	576634	1328754	3.185	0.002
Number of permits normalized by expenditures	0.00	0.00	0.00	-0.433	0.665
Annual growth in PV installations (%)	181.08	246.69	-65.61	-2.344	0.020
PV systems per capita in neighbor AHJs	0.01	0.01	0.00	5.502	0.000
Number of installations by largest installer in AHJ	204.17	81.71	122.47	2.523	0.012
HHI of installers in AHJ	1485.46	2376.24	-890.77	-4.835	0.000
Number of AHJs in which largest installer is active	419.29	314.65	104.64	6.057	0.000
Number of AHJs in which largest installer is the largest	297.61	211.73	85.88	4.519	0.000
Majority of neighboring AHJs comply	0.95	0.92	0.04	1.464	0.1437

Note: Positive value of mean difference and t-statistic mean that AHJs that comply with AB2188 have a higher mean of the relevant variable than AHJs that do not comply with AB2188; for negative values of mean difference and t-statistic, compliant AHJs have a lower mean of the relevant variable than non-compliant AHJs.

__Table A-3__: Pearson's Chi-Squared Test Results

Explanatory variable	**Result**	**P value**
Percent democrat	$\chi^2(363) = 385.5$	0.200
County AHJ	$\chi^2(1) = 1.744$	0.202
Median HH income	$\chi^2(535) = 535.6$	0.484
Median population density	$\chi^2(535) = 535.6$	0.496
Expenditures per capita	$\chi^2(535) = 536.0$	0.480
Median year of construction	$\chi^2(58) = 58.442$	0.459
Number of residential PV systems in AHJ	$\chi^2(513) = 514.0$	0.479
Annual growth in PV installations (%)	$\chi^2(459) = 440.329$	0.727
Number of residential PV systems in neighboring AHJs	$\chi^2(411) = 398.4$	0.664
Megaregion compliance rate (%)	$\chi^2(6) = 75.4$***	0.000
Building Permit Survey participant	$\chi^2(1) = 30.6$***	0.000
HHI of top installer (small geographic coverage)	$\chi^2(47) = 120.0$***	0.000
HHI of top installer (large geographic coverage)	$\chi^2(377) = 315.8$	0.990
HHI of top installer (very small geographic coverage)	$\chi^2(23) = 74.4$***	0.000

Note: degrees of freedom in parentheses

While California accounts for nearly half of the U.S. total of residential PV (in terms of MW), a number of other states also have a substantial market for residential PV. Some states, such as New Mexico, are also exploring policies and tools to reduce the administrative and soft cost burdens of PV permitting as residential solar installations become increasingly common over time. Based on the growth of the residential PV industry and the potential value of permit practice streamlining throughout the U.S., we use the findings of our case study of CA AB2188 to project which other areas of the U.S. would likely be receptive to similar SSP policies based on their corresponding demographic characteristics and AHJ-level installer environments (i.e., installer concentration and territory size of top installers).

Because an in-depth, sophisticated projection of our CA findings to the rest of the U.S. is outside the scope of our project, we instead focused on the top residential solar states other than CA. We used ArcMap to overlay the key variables we identified for CA such that darkly shaded regions represent a confluence of characteristics associated with acceptance of streamlined solar permitting policy. The projection process included the following steps: 1) we reviewed the Tracking the Sun (TtS) database for each of the states of interest and cleaned the data as needed (e.g., standardizing city name spellings, assigning cities or zip codes to counties, standardizing PV installer name spellings, etc.), 2) we assigned each record of TtS to an AHJ (city/town or county) depending on if the city appears in our list of known AHJs and defaulting to the county if not, 3) we computed installer HHI for each AHJ, 4) we identified the top installer in each AHJ, 6) we computed the number of AHJs in which each installer was active, 7) we defined a cut-off number of active AHJs for “small” installers, such that the cut-off of each state was proportional to that of CA, 7) we imported our installer calculations to ArcMap and joined it to an AHJ shapefile that already had key demographics associated with it, and finally we adjust symbology to show overlap of key variables, such that a dark brown region of the map represents an area we project to be likely accepting of streamline solar permitting policies. We use the following variables for our projection maps: population density, household income, year of construction, city-level AHJ identifier, identifier of small geographic range of top installer, installer HHI.

Including California and the eight of the next top ten states in terms of residential PV, we cover approximately 80% of U.S. residential PV, including 66% of total residential PV outside of CA (see Table 7-7 in the main paper). We note that, given enough time, this projection exercise could be carried out for the entirety of the U.S.

Below we present our streamlined solar permitting projection maps for the following states: Arizona, New York, New Jersey, Massachusetts, Maryland, Hawaii, Connecticut, Texas, and New Mexico. Note that darker shades equate to higher values of key variables, i.e., we would expect darker shaded areas to be more likely to adopt and comply with SSP policies like CA AB2188. For each state, we include two maps; the first includes all key variables, while the second focuses only on installer HHI and the geographic range of top installers. To avoid creating a false impression of confidence in specific values of key attributes, we do not include legends coding values to color scales.

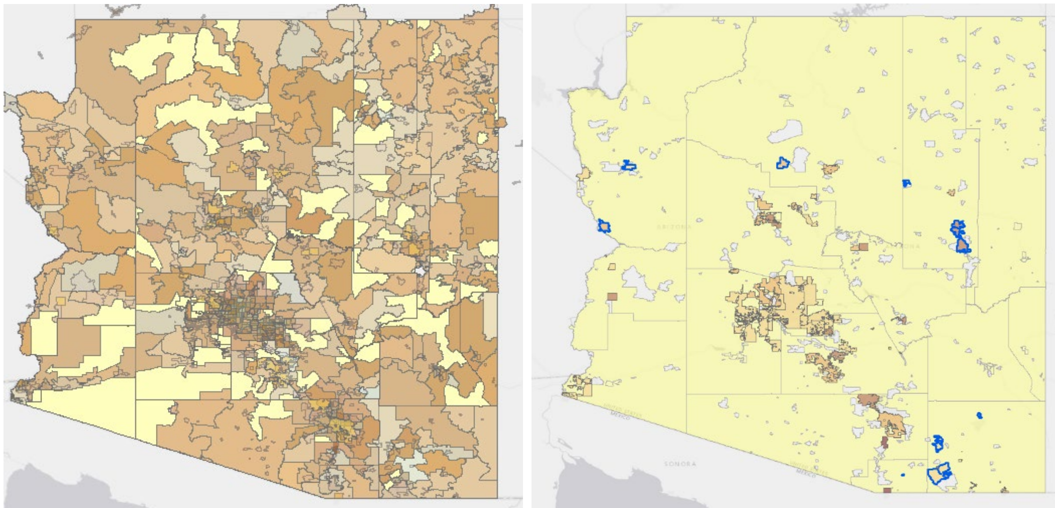

Figure A1. Arizona – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the left panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The right panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades, while a bold blue outline denotes AHJs with top installers with small geographic ranges (for AZ, we define this as 15 or fewer AHJs).

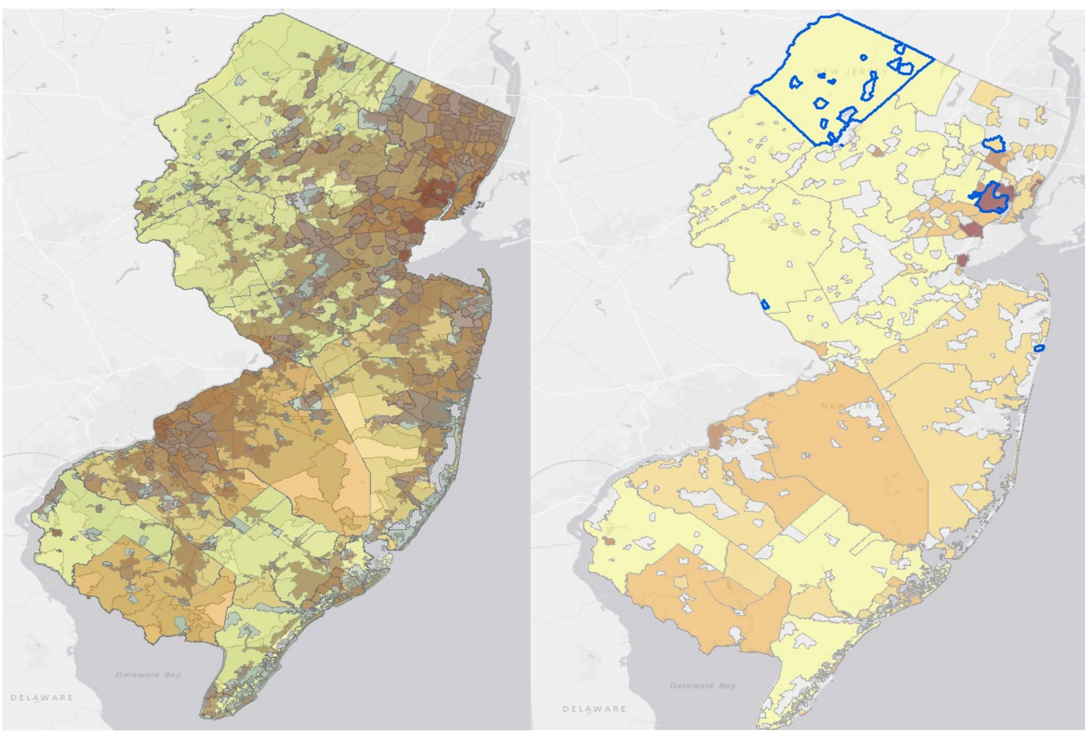

Figure A2. New Jersey – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the left panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The right panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades, while a bold blue outline denotes AHJs with top installers with small geographic ranges (for NJ, we define this as 15 or fewer AHJs).

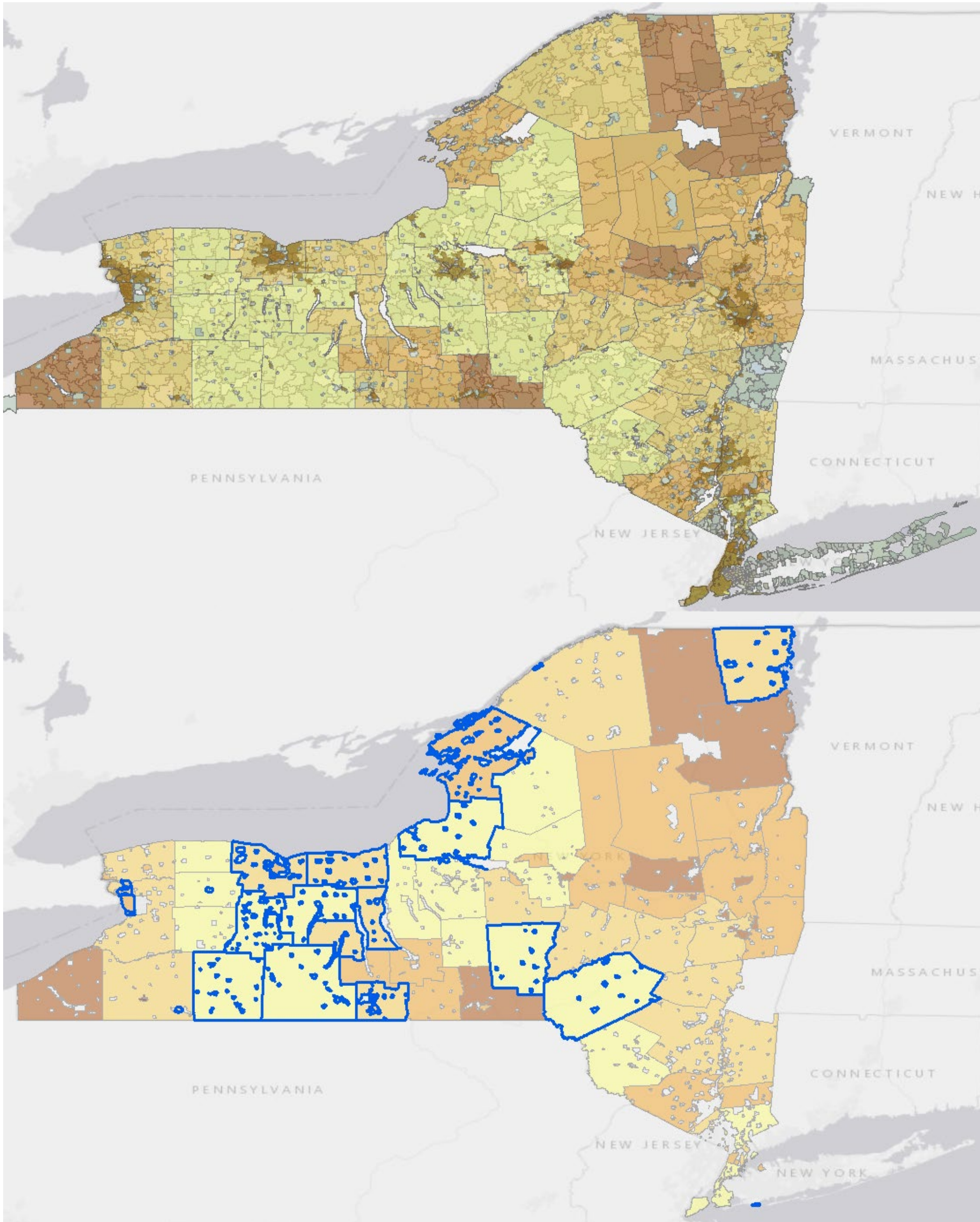

Figure 3. New York – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the top panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The bottom panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades, while a bold blue outline denotes AHJs with top installers with small geographic ranges (for NY, we define this as 22 or fewer AHJs).

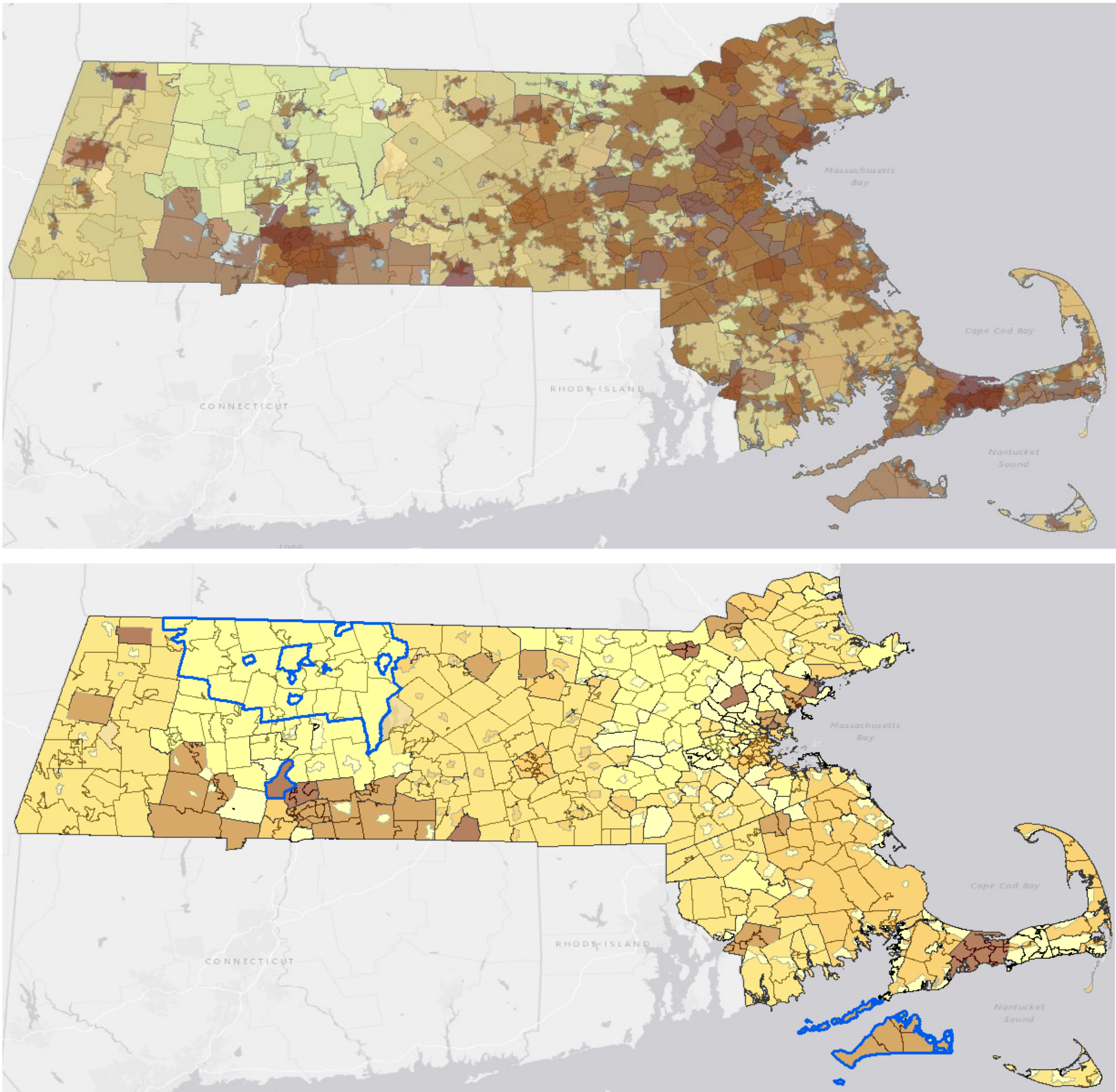

Figure A4. Massachusetts – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the top panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The bottom panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades, while a bold blue outline denotes AHJs with top installers with small geographic ranges (for MA, we define this as 12 or fewer AHJs).

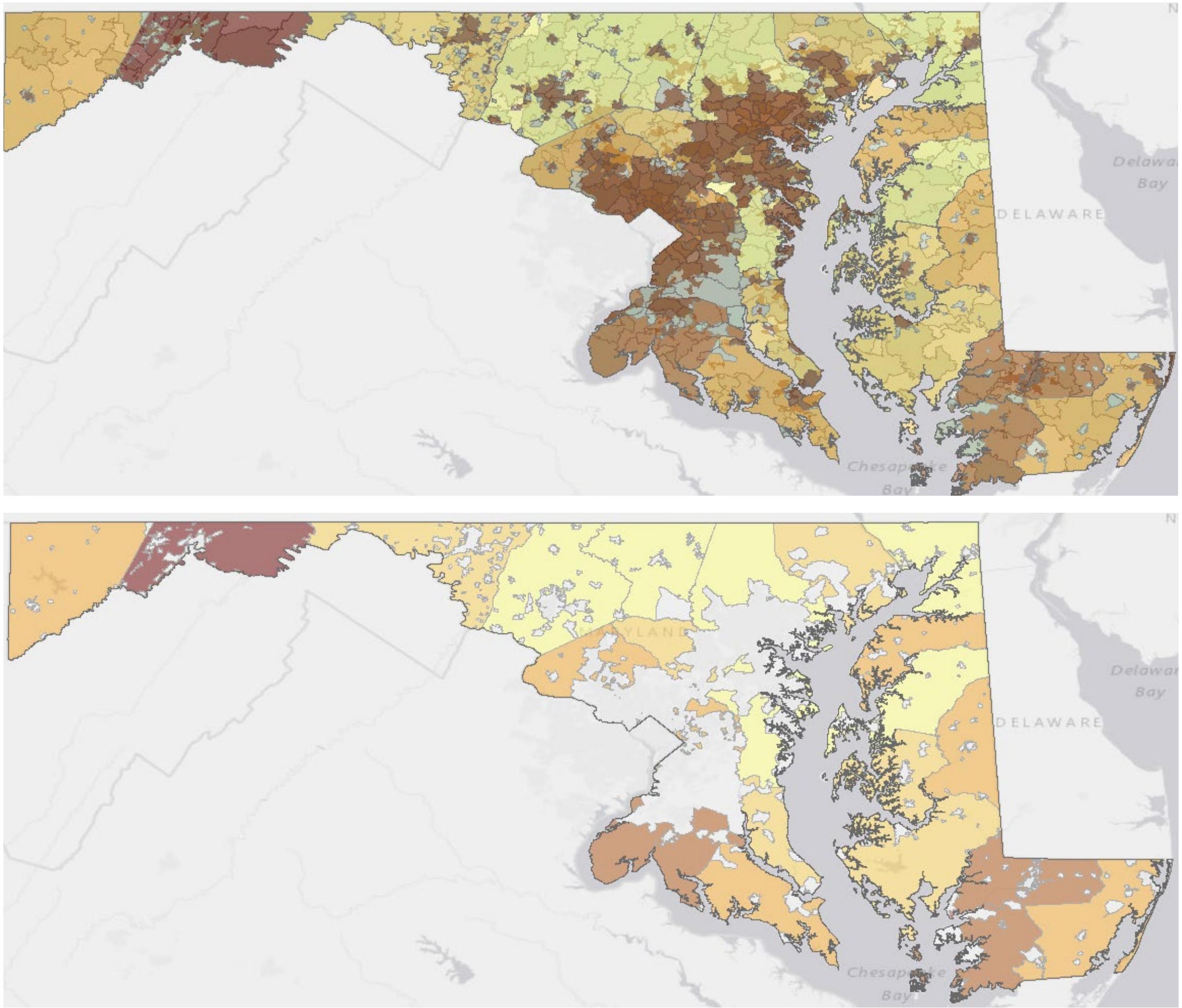

Figure A5. Maryland – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the top panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The bottom panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades; as we only have data for county-level AHJs for MD, we do not attempt to identify “small” top installers in this case.

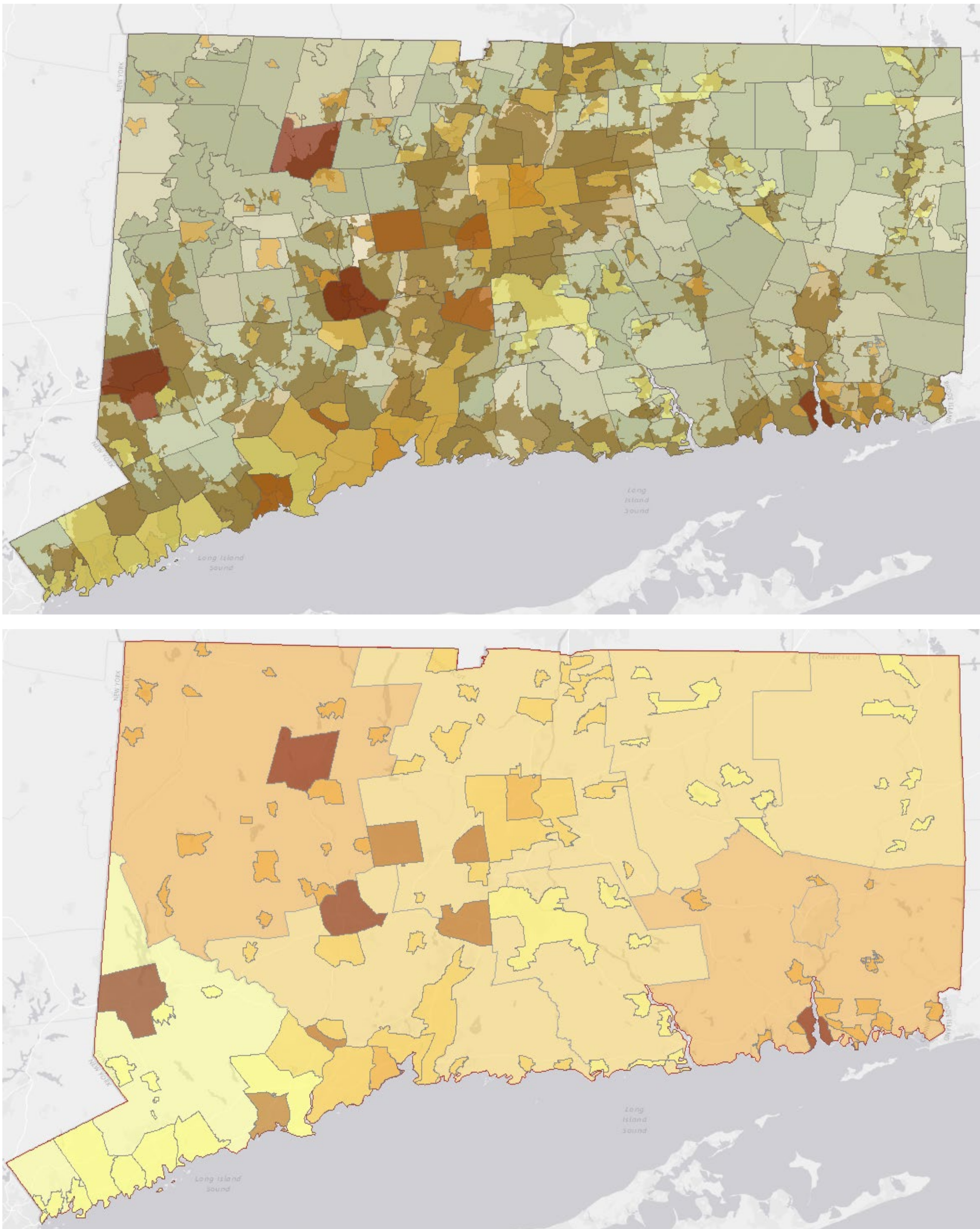

Figure A6. Connecticut – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the top panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The bottom panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades; note that none of the CT AHJs have a “small” top installer.

Figure A7. Hawaii – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the left panel, each of the key variables listed above contributes to the overall darkness of the shading of each. The right panel focuses on the installer characteristics of each AHJ; for the one county we can examine, Honolulu, installer HHI is low (compare to, e.g., HHI variation in MD); as we only have data for county-level AHJs for HI, we do not attempt to identify "small" top installers in this case.

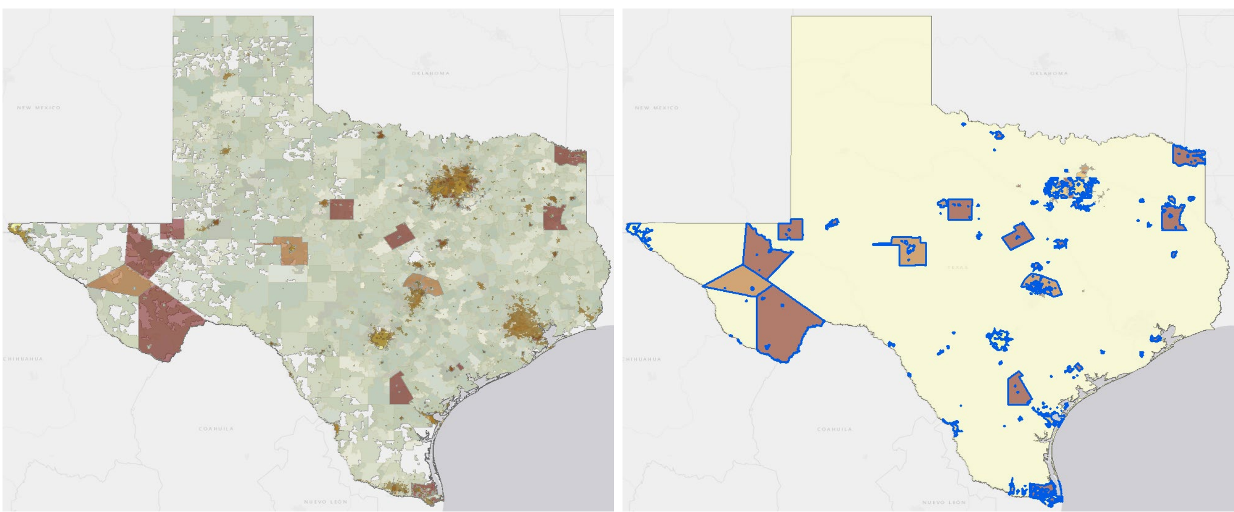

Figure A8. Texas – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the left panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The right panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades, while a bold blue outline denotes AHJs with top installers with small geographic ranges (for TX, we define this as 22 or fewer AHJs).

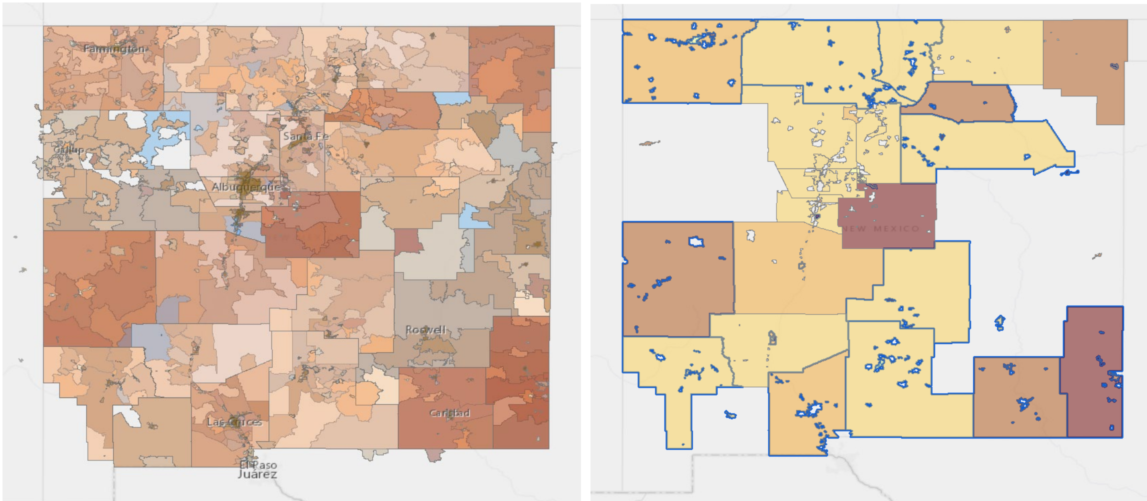

Figure A9. New Mexico – Areas of Likely SSP Acceptance and/or Compliance

Notes: In the left panel, each of the key variables listed above contributes to the overall darkness of the shading of each AHJ. The right panel focuses on the installer characteristics of each AHJ; higher installer HHI is represented with darker shades, while a bold blue outline denotes AHJs with top installers with small geographic ranges (for NM, we define this as 16 or fewer AHJs). Areas with missing data remain gray.