



BERKELEY LAB

LAWRENCE BERKELEY NATIONAL LABORATORY



U.S. DEPARTMENT OF
ENERGY

Solar Energy Access and Equity

Research Activity in the Electricity Markets and Policy Department

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Berkeley Lab Community Advisory Group Meeting

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Overview

- Background on the Electricity Markets and Policy Department
- Solar demographics tracking reports
- Online data visualization tool
- Technical assistance to LMI program administrators
- Impact of policy and business models on income equity in rooftop solar adoption
- LMI solar meta-evaluation
- National Community Solar Partnership
- Financial evaluation of LMI lease program in Connecticut
- LMI energy efficiency work
- Future work/LBNL research agenda

Electricity Markets and Policy Department

Mission & Vision

- We inform public and private decision making within the U.S. electricity sector through independent, interdisciplinary analysis of critical electricity policy and market issues. We envision a **clean, efficient, reliable, and affordable** electricity system that meets the United States' diverse and growing energy needs.

Our Approach

- The institutions, policies, and economics that define the current “rules of the road” in electricity markets are as vital to shaping electricity industry outcomes as are the technological advances. ***The EMP Department aims to make an impact through rigorous analysis of the policy, economic, and technical issues that support a successful transition to a clean, efficient, reliable, and affordable electricity sector.***

Interdisciplinary methods and tools

- Economic & statistical data analysis
- Economic & engineering modeling
- Survey and interview-based research

Publically-available work to aid and inform stakeholders, both public and private

- Publications
- Presentations
- Decision support tools
- Direct technical assistance

Electricity Markets and Policy Department

Energy Technologies Area

Energy Analysis & Environmental Impacts Division

Dept Leader
Ryan Wiser

Deputy Dept Leaders
Lisa Schwartz, Peter Larsen

Assistant Dept Leaders
Natalie Mims Frick, Liz Stuart

**Demand Response &
Smart Grid**

**Electric System
Planning**

**Electricity
Reliability &
Resilience**

Energy Efficiency

Renewable Energy

**Utility Regulation &
Business Models**

**Technical Assistance
to States**

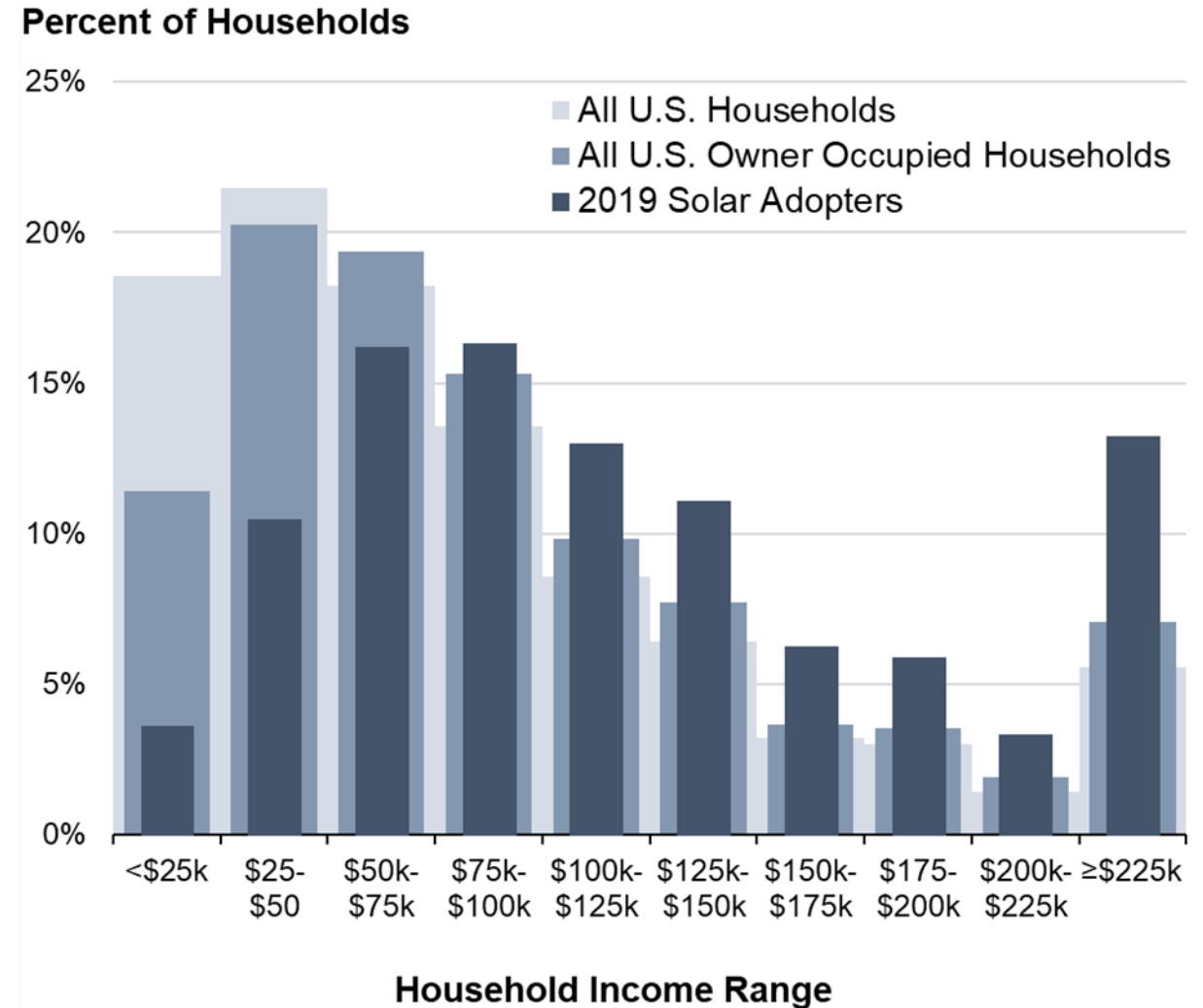
Electricity Markets and Policy Department



(circa June 2019)

Tracking Solar Demographics

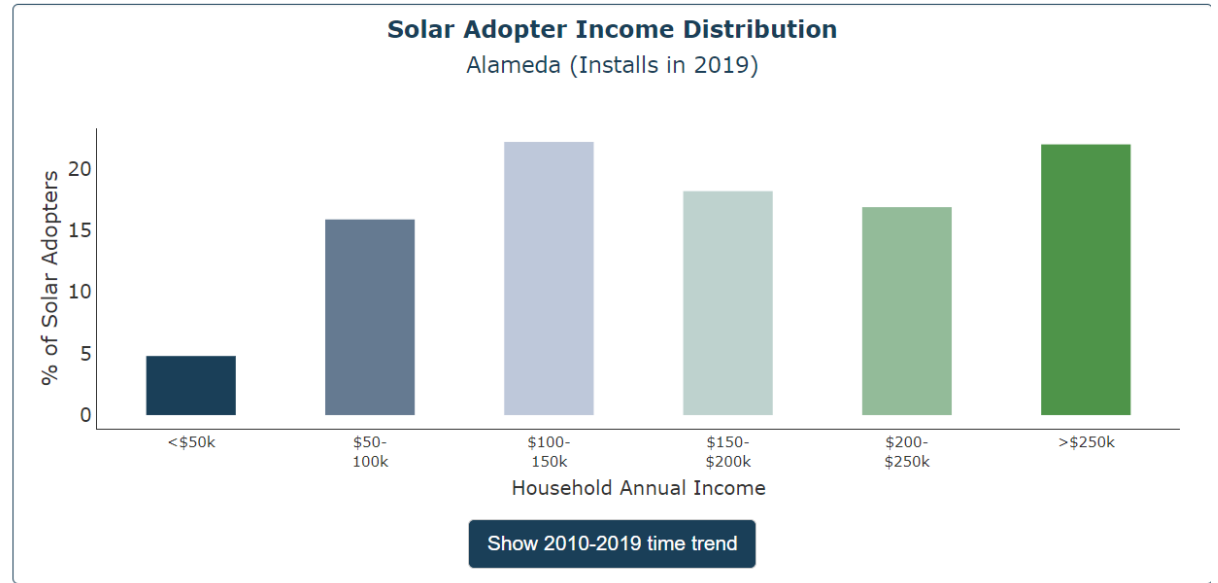
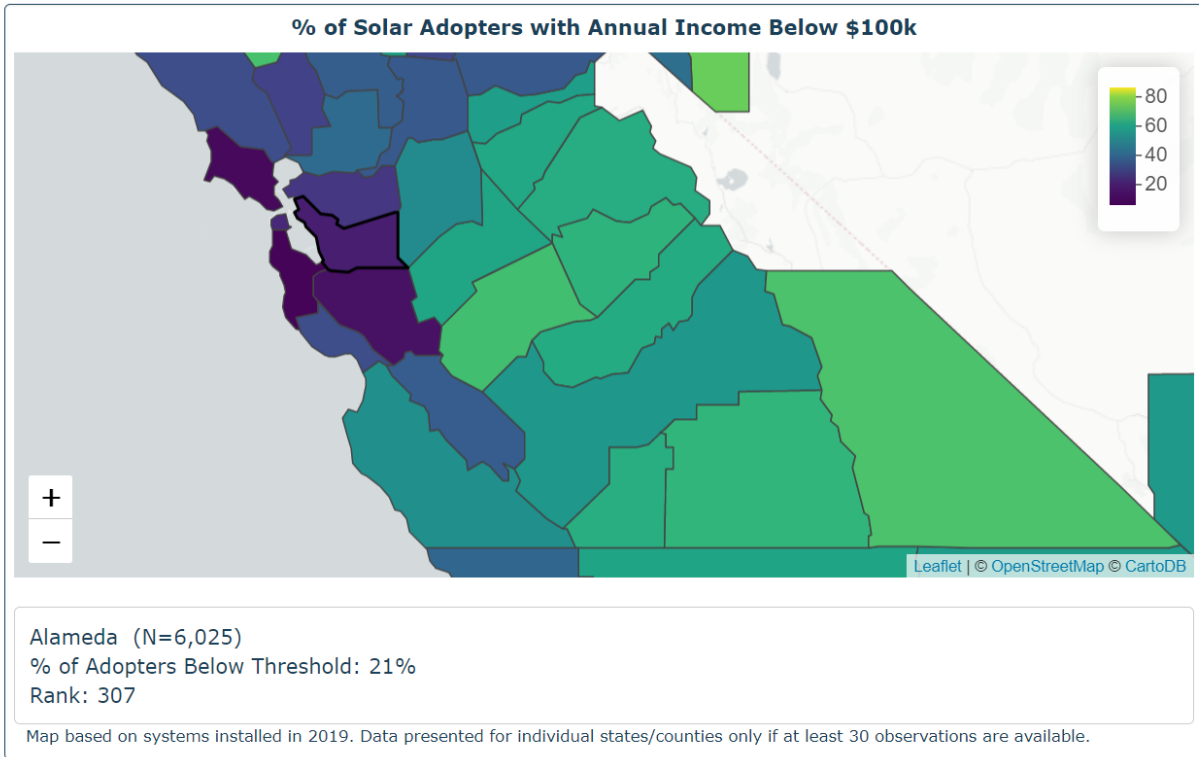
- Unique foundational dataset
- Annual tracking report describes trends in PV adopter incomes and other demographic characteristics (age, education, race/ethnicity)
- Key themes
 - ▣ PV adopters are diverse, spanning all income ranges
 - ▣ They generally skew towards higher incomes
 - ▣ Though that skew has declined over time
 - ▣ With substantial variability across states and localities



Berkeley Lab Solar Demographics Tool

Income Metric: Annual Income
 Map Threshold: 50 \$100k 150 200 250
 Geographic Level: County

Annual Income



Downloads

Data: Alameda All Counties

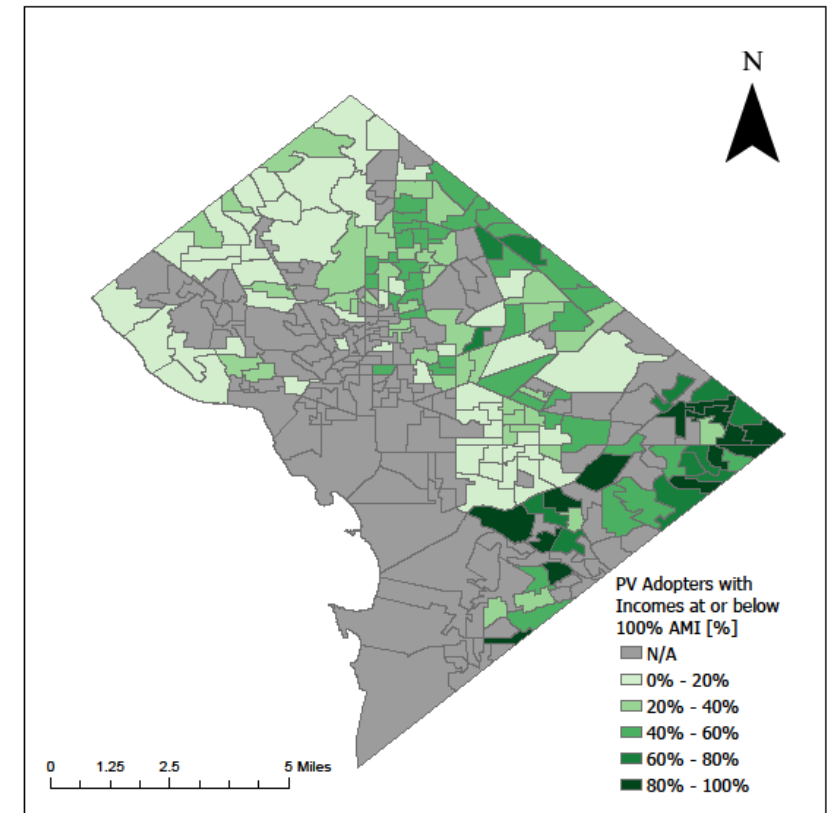
Maps (jpg): Full Map Selection

Plots (jpg): 2019 2010-2019

Technical Assistance to LMI Program Administrators

- Berkeley Lab offers ongoing technical assistance to organizations working on low-to-moderate income (LMI) solar programs and markets
- Over the past year, assistance provided to ~12 entities
- Example: DC Department of Energy & Environment
 - ▣ Customized geographical breakdown by Ward and Single Member District
 - ▣ Custom income metrics: % of AMI, % of DC median income, eligibility level for SolarforAll program

PV Adopters in Washington, D.C.'s Single Member Districts through 2018



Data source: Income Trends among U.S. Residential Rooftop Solar Adopters (Barbose et al., 2020)

LMI Solar Meta-Evaluation:

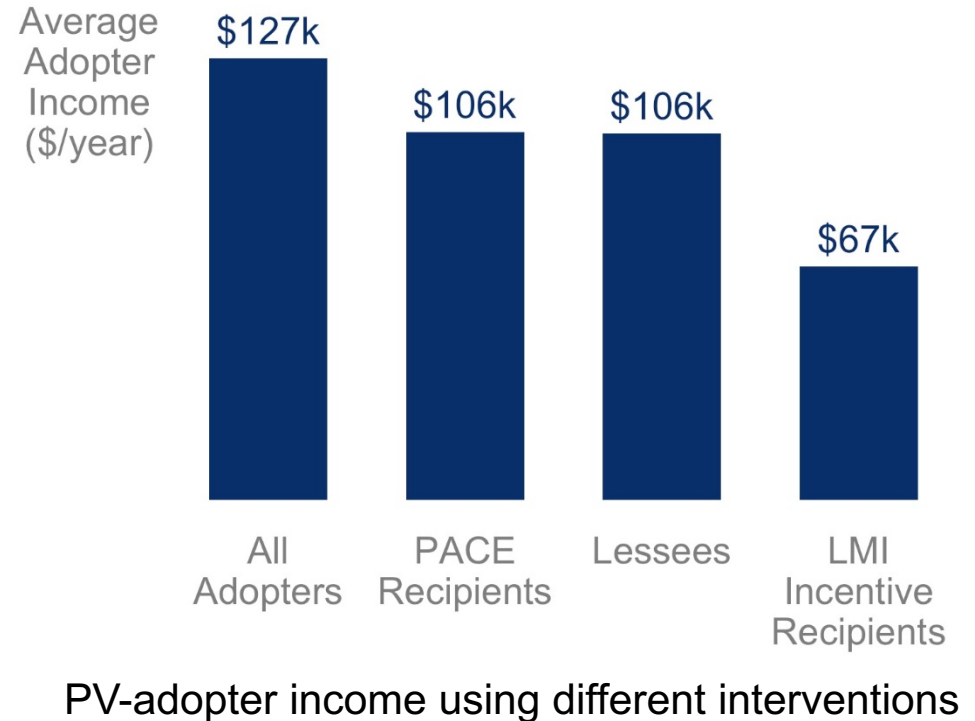
An Evaluation of Program Evaluations

- Reviewed evaluations from 38 state, utility, and local LMI solar programs
 - ▣ Described the range of evaluations applied to LMI solar programs
 - ▣ Compared to standard practices from energy efficiency program evaluation
- Common themes
 - ▣ Common challenge is how to maximize benefits at lowest cost when participants have limited cost-share.
 - ▣ Program goals dictate the evaluations, but not all programs have measurable goals.
 - ▣ Most LMI solar programs are small, so evaluation budgets are small. Administrators have to find creative ways to build rigor into their evaluation process.

Separately, we demonstrated a low-cost approach to program evaluation, using our data to evaluate LMI incentive programs in CA, CT, and NY. Using a group-time model, we found that programs in those states increased adoption by 1-2 systems per 1000 LMI households.

The Role of Policies and Business Models

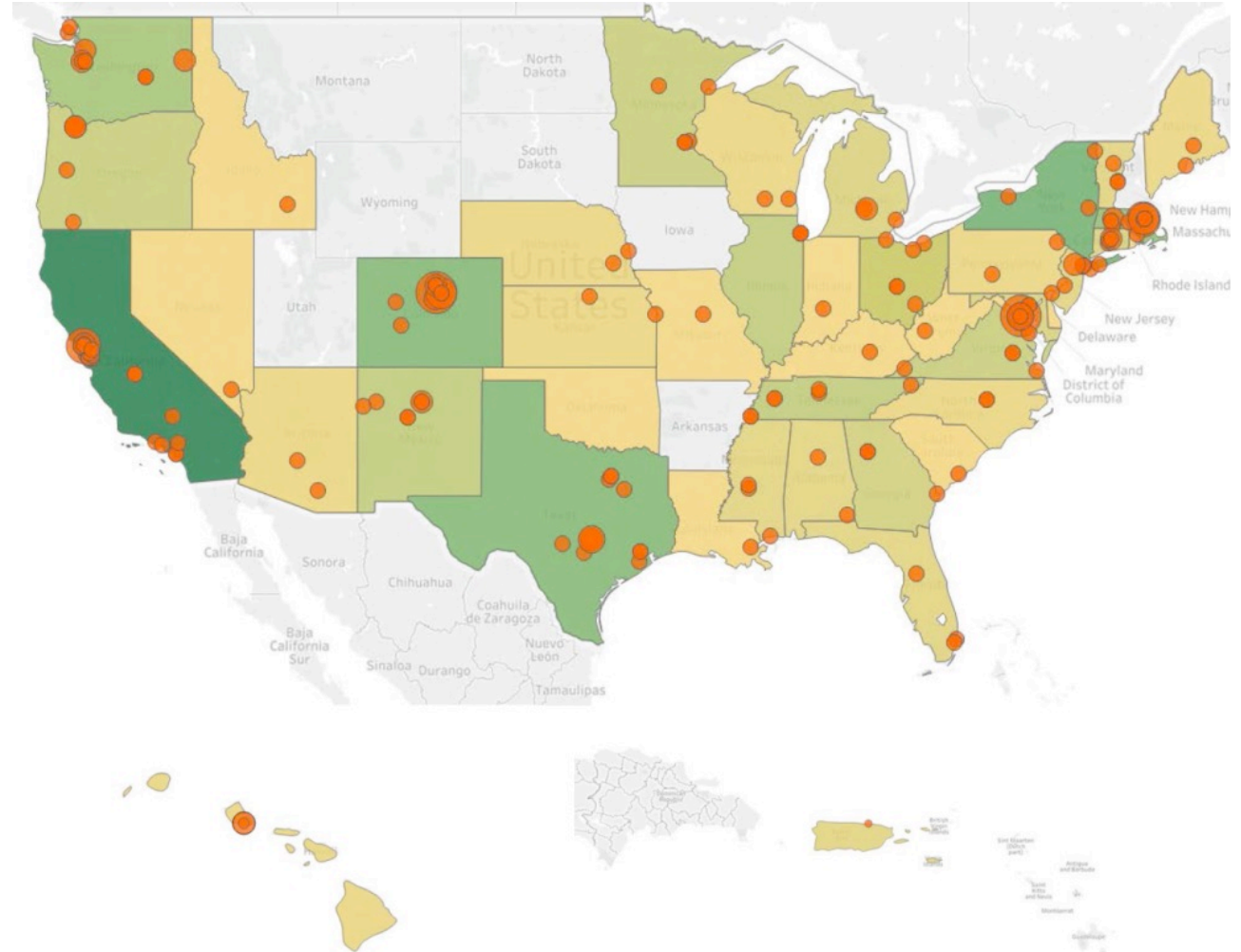
- In a recently-published paper,* we explore the impacts of five policies and business models on PV adoption income equity.
- Three are associated with higher equity: LMI-targeted incentives, leasing, and property-assessed financing (PACE).
- The interventions increase equity in existing markets and push PV into under-served low-income communities.



* O'Shaughnessy et al. 2020. "The impacts of policies and business models on income equity in rooftop solar adoption." *Nature Energy*.

National Community Solar Partnership

- A coalition of community solar stakeholders working to expand **access** to **affordable** community solar
- Also seeks to enable communities to realize supplementary benefits and other value streams (resiliency, workforce development)
- Currently 260 partner organizations
- Approach
 - ▣ Network infrastructure
 - ▣ Collaboration
 - ▣ Technical Assistance

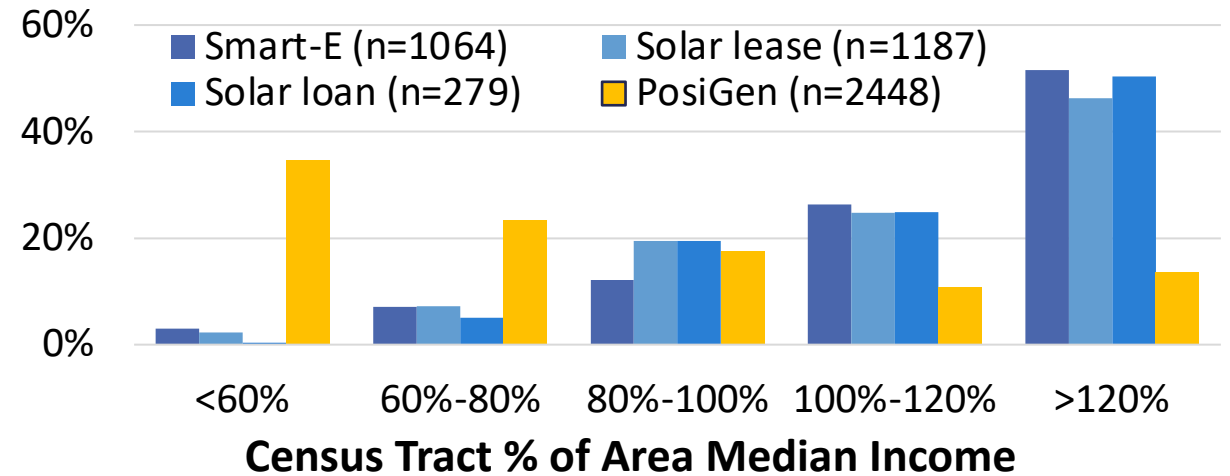


Source: NREL

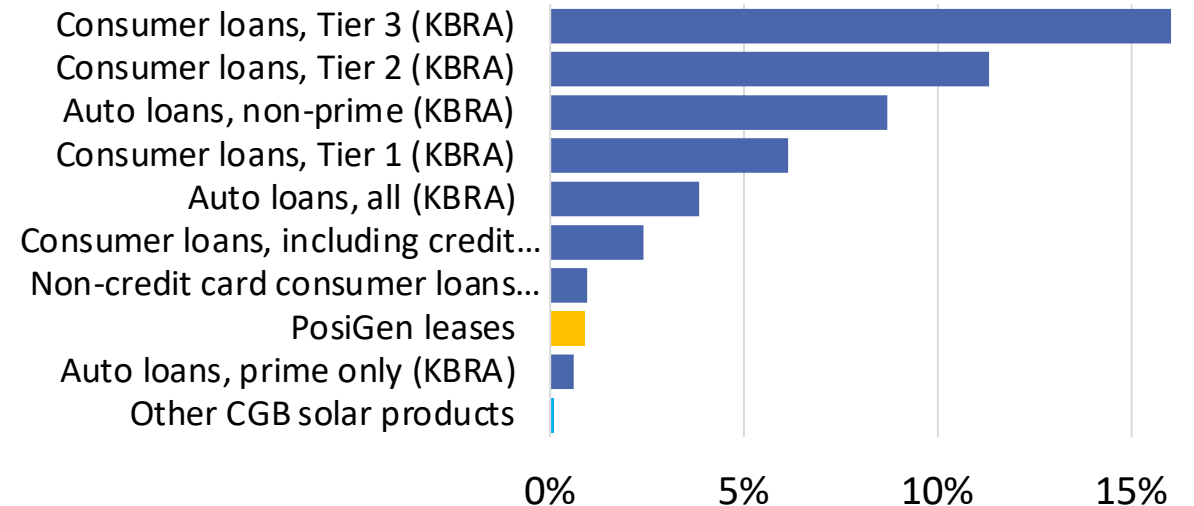
Financial Evaluation of LMI Lease Program in Connecticut

- Connecticut Green Bank extends leases to LMI households in partnership with a private leasing company (PosiGen) using alternative underwriting
- The program is very successful at reaching LMI households
- Lease repayment rates are well within the range of other consumer financing products, and better than other LMI-focused consumer products

% of Loans and Leases by Program

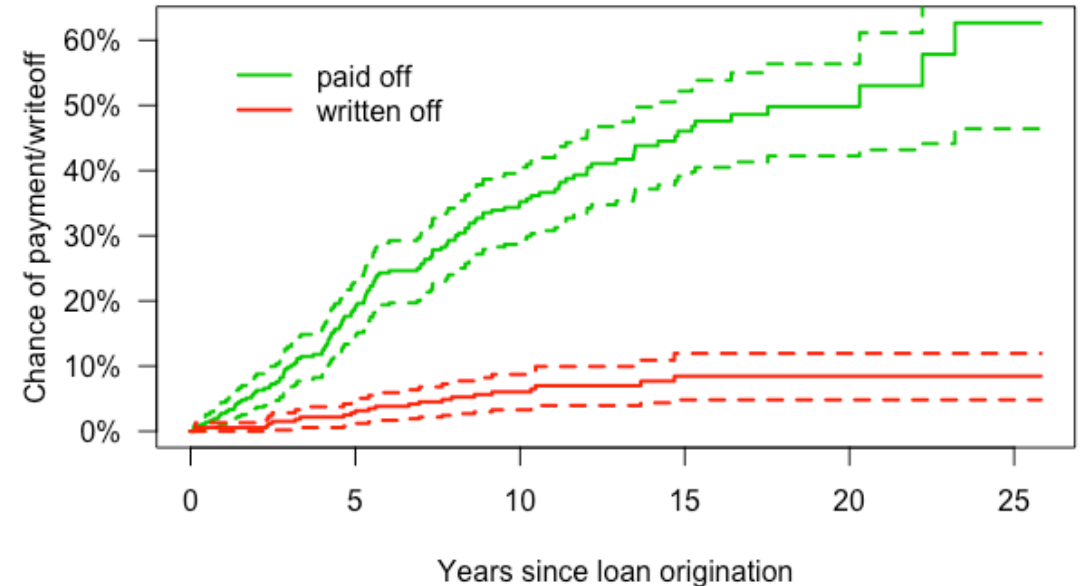


Annualized Gross Loss Rate



LMI Energy Efficiency Work

- **Energy Efficiency Financing for Low- and Moderate-Income Households**
 - ▣ Surveys efficiency financing products and assesses benefits/drawbacks for LMI households
- **Deferred Payment Loans for Energy Efficiency**
 - ▣ Repayment only required upon home sale
 - ▣ Most loans do return over time
- **EE Financing Program Performance**
 - ▣ *Credit* far more correlated with loan performance than *income*
- **Utility EE Program Tracking**
 - ▣ Low-income programs account for a modest share of overall savings (2%) and spending (9%)



Future Research: Planned and Potential

- **Tracking income/demographic characteristics of solar adopters**
 - ▣ Potentially expanding to include energy efficiency program participants and communities surrounding large-scale solar installations
- **Causes of (and solutions to) solar adoption inequity**
 - ▣ Peer effects and impacts of income segregation
 - ▣ Installer behavior and other supply-side dynamics
- **Distributional impacts of renewable energy deployment**
 - ▣ Including air quality, public health, and local economic (employment, tax) benefits
 - ▣ Potentially in conjunction with multi-sectoral electrification
 - ▣ Could also examine communities with fossil generation retirements
- **Policy analysis**
 - ▣ Explore a broader range of interventions, including community solar
 - ▣ Comparative evaluations of strategies for reducing household energy burden

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For more information

Download publications from the Electricity Markets & Policy Department: <https://emp.lbl.gov/publications>

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