Leveraging Peer Effects: The Effect of Community-based Programs on the Adoption of Solar Panels

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Peer-to-Peer Marketing is an Established Idea

"You need to meet people in the communities where they live, work and play."

- Briane Keane
President of SmartPower

Photos courtesy of Huffington Post, http://dehradunlive.in, and creativesavingsblog.com

This Strategy Works for Energy Too

- Energy demand is sensitive to reported energy use of neighbors (Allcott 2011)

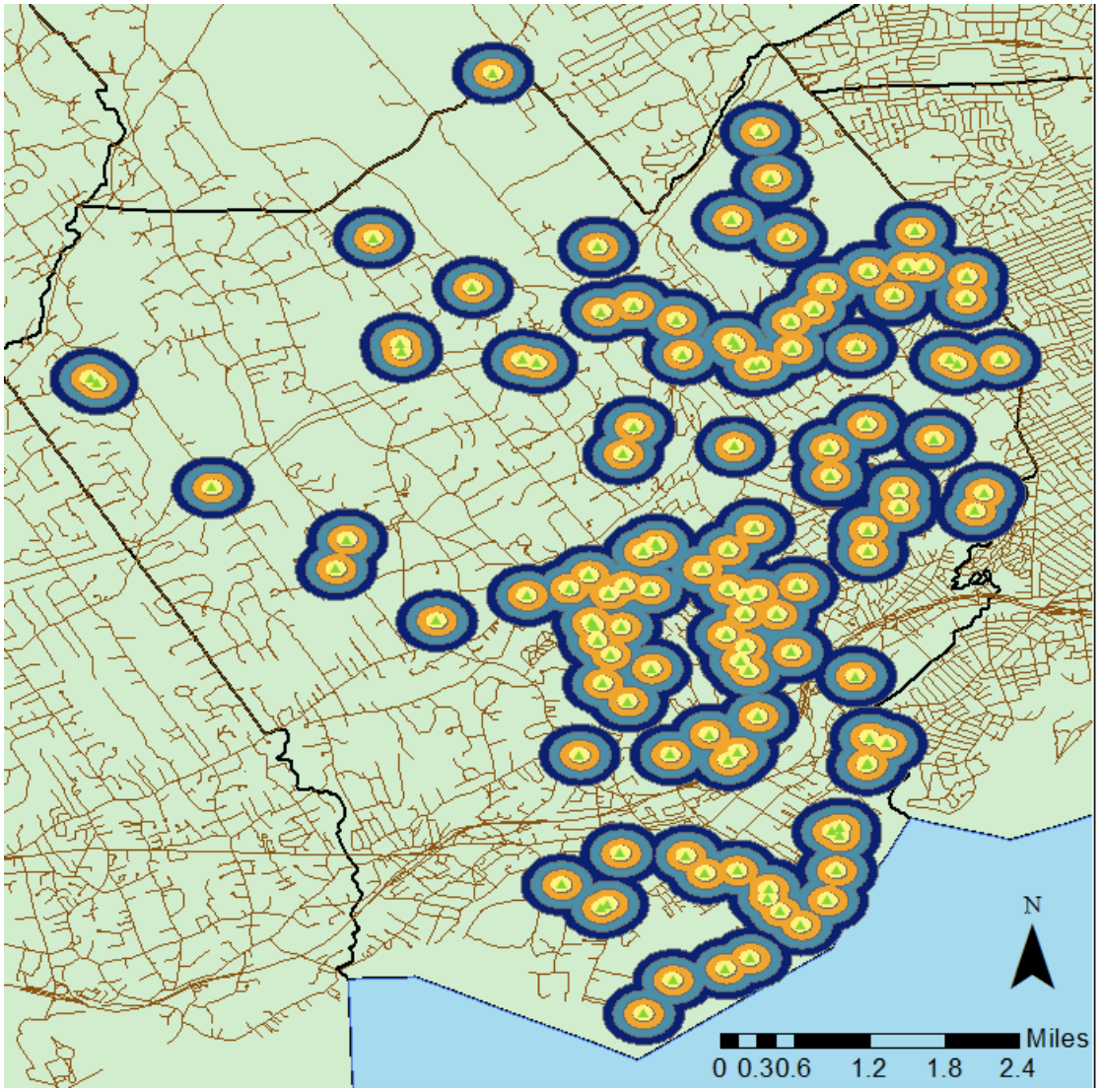
- Peer effects have been shown to have a significant effect on patterns of solar diffusion (Bollinger and Gillingham 2012)

OPOWER

Photo courtesy of opower.com

Clustering of Installations

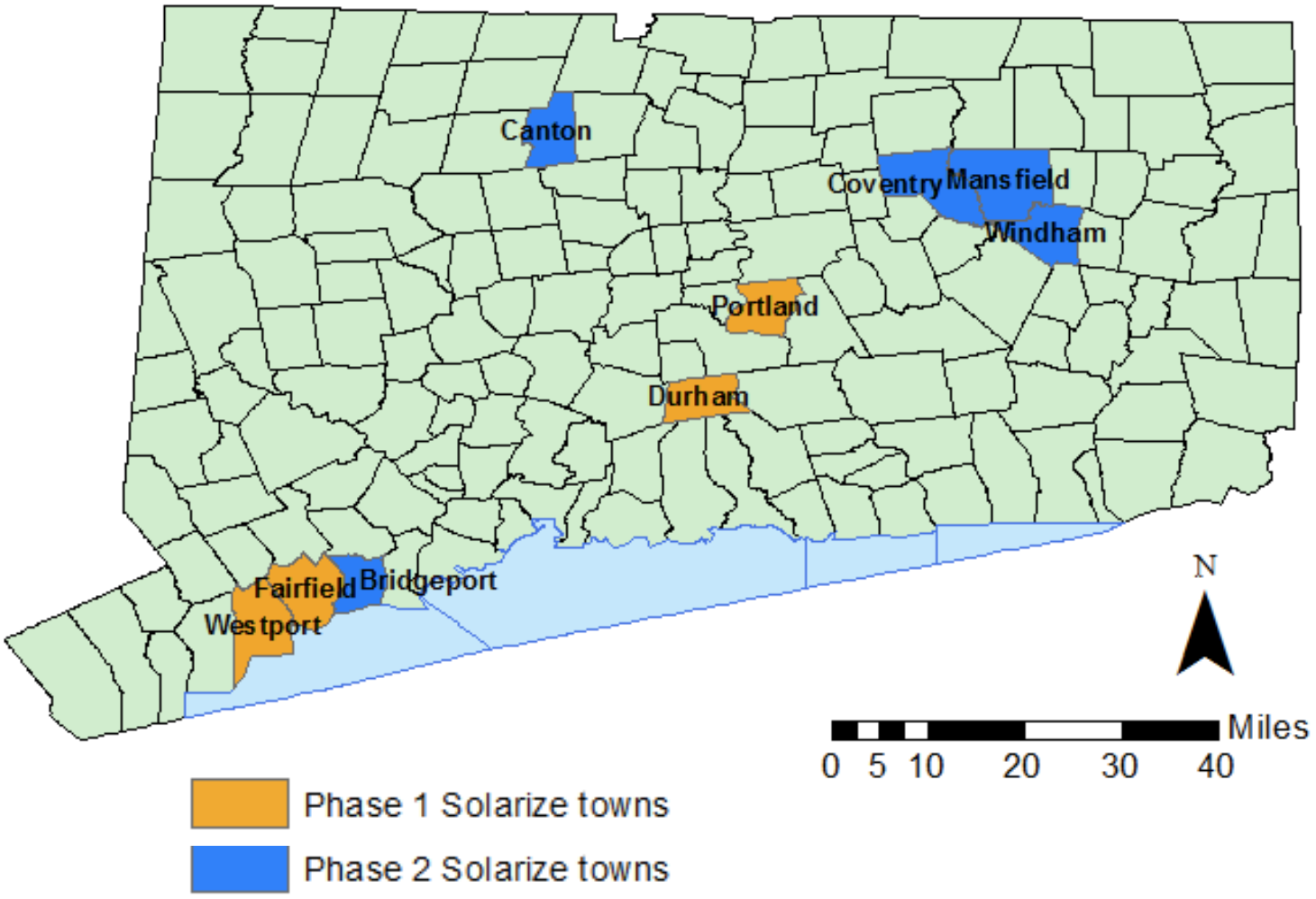
Most solar installations fall within 200 meters of each other.
(Fairfield, CT)



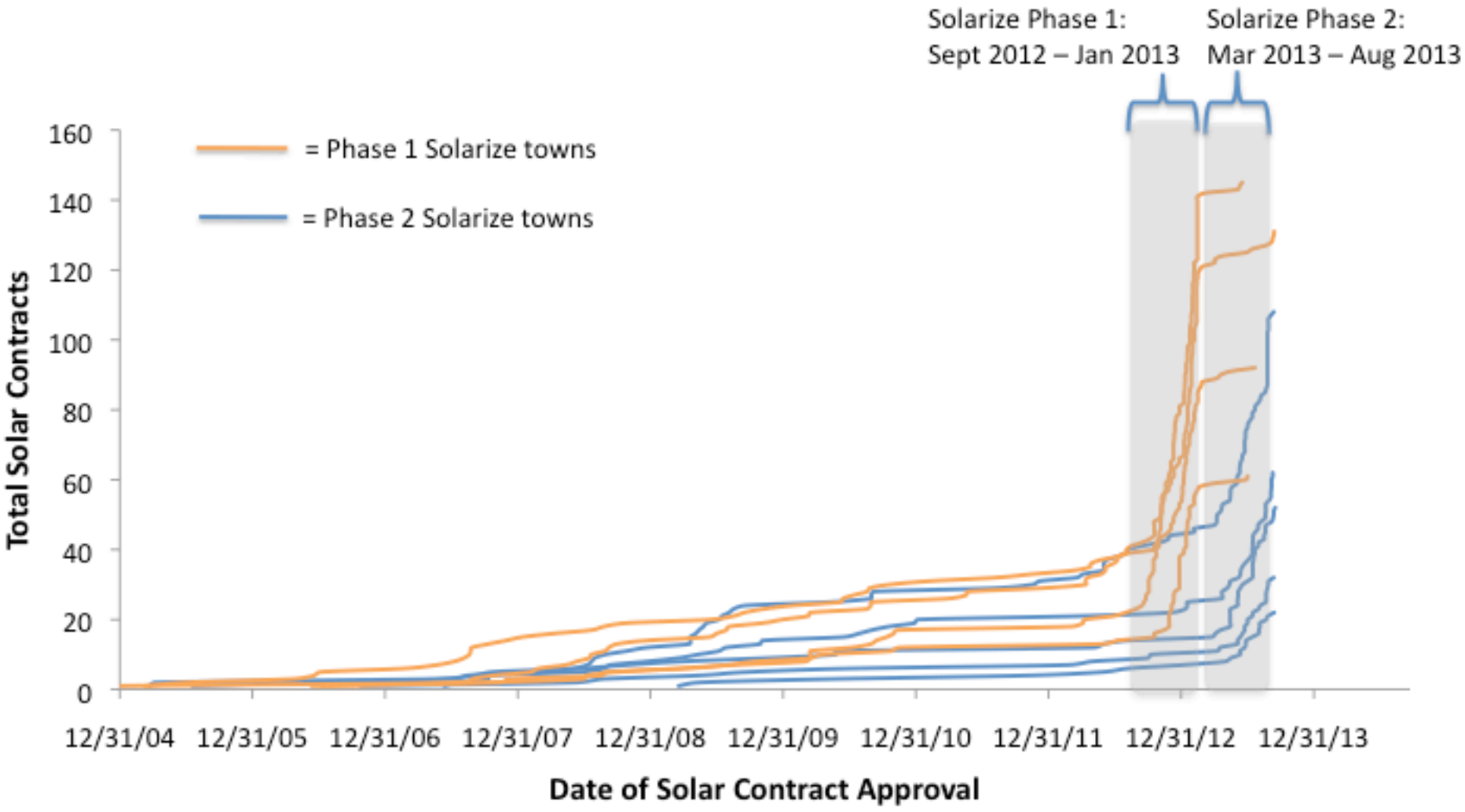
Solarize CT

- Single competitively selected installer
- Tiered group pricing
- Volunteer-driven 20-week outreach campaign
- Partnership between city governments, SmartPower, and the CT Clean Energy Finance and Investment Authority

The Solarize CT Towns



Cumulative Solar Growth in Solarize CT Towns



Descriptive Evidence of Success

- All Solarize CT towns so far have at least doubled their total number of residential solar PV systems
  - Maximum percent increase in total number of systems was 504%
  - Average percent increase among Phase 1 towns was 282%

- $200k of funding leveraged over $2.2 million in savings on solar PV (CEFIA 2013)

- On average, homeowners saved at least 24% on the per-watt cost of solar (CEFIA 2013)

- 20% of those who installed through Phase 1 said they had never previously considered solar (CEFIA 2013)

Motivation for Our Study

- Quantify the treatment effect of the Solarize program
  - Isolate this effect from self-selection bias

- Examine the relationship between demographics and the adoption of solar PV

Data

- Solar installation data since 2004 courtesy of the Connecticut Clean Energy Finance and Investment Authority (CEFIA)
- Demographic data taken from U.S. Decennial Census and 5-Year American Community Survey estimates
- Demographic data are interpolated quadratically to generate a 2004-2013 annual data set

Methods

Create a "synthetic control group" for our Solarize towns:

- Propensity score is generated using a logit function

$$P(y=1|\mathbf{x}) = e^{(\beta 0+\mathbf{x}\beta)}/[1+e^{(\beta 0+\mathbf{x}\beta)}]$$

y = binary indicator for Solarize towns

x is a vector of demographic variables

- Each Census block group in a Solarize town is matched to the three non-Solarize block groups with the closest propensity scores.

Methods

- Difference-in-differences analysis with fixed effects:

$$Y_{mt} = \beta_0 + \beta_1 s_m + \beta_2 T_t + \beta_3 (s_m * T_t) + \beta_i \mathbf{X}_{mt} + \mu_m + \delta_t + e_{mt}$$

Y = number of solar contracts signed in a given block group in a given month

m = market, i.e. a single block group

t = time; month for installation data and year for demographic data

s = a binary indicator variable for whether the block group was in a Solarize town

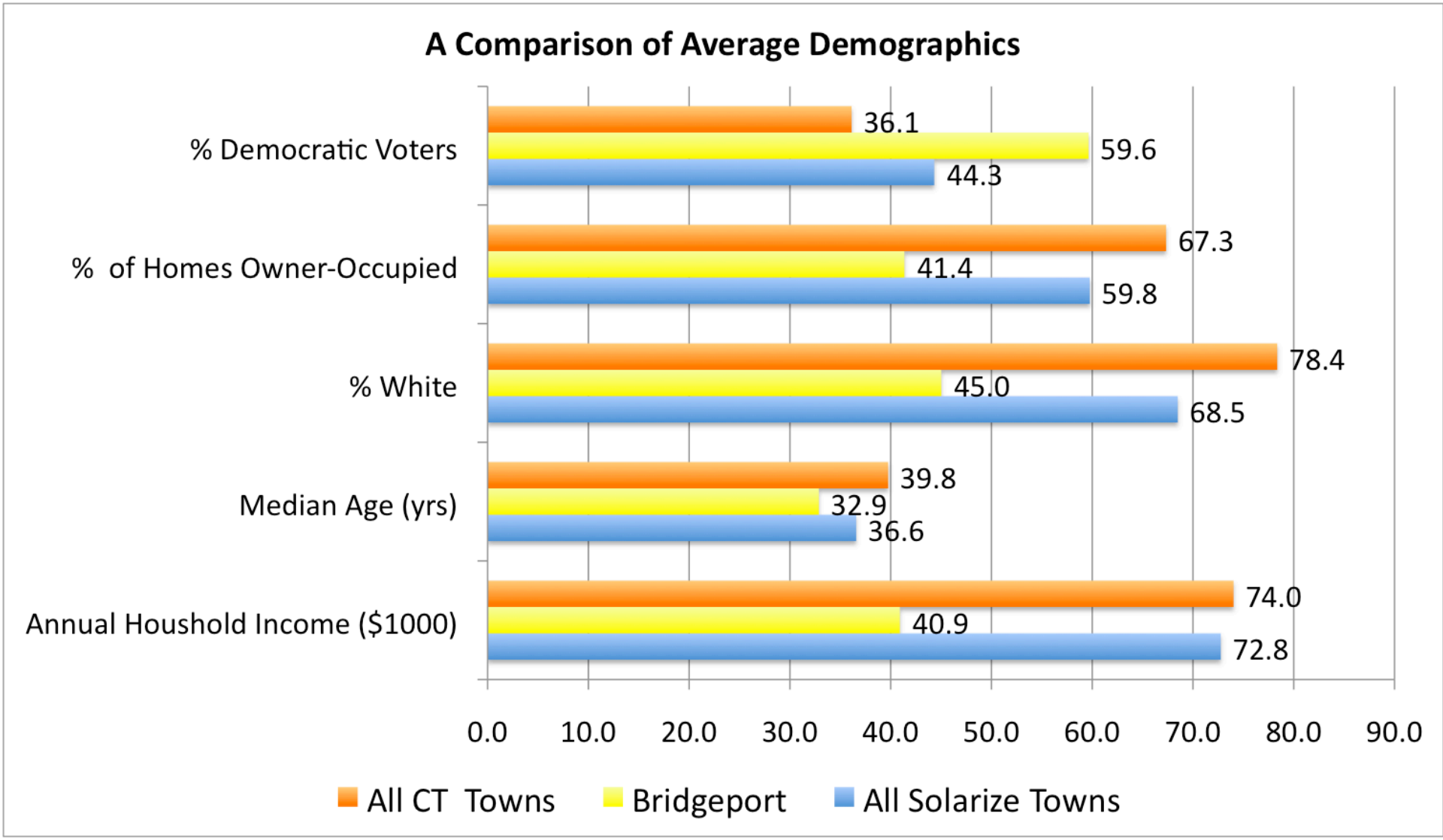
T = a binary indicator variable for whether the month fell within the time period of the Solarize campaign

X = a vector of demographic variables

μ = block group fixed effects

δ = month fixed effects

The Bridgeport Anomaly



Phase-specific Regression Results

	(1) PSM	(2) PSM caliper	(3) CEC controls
Phase 1 During	0.574***	0.575***	0.562***
	(0.122)	(0.122)	(0.122)
Phase 1 Post	0.120***	0.121***	0.108***
	(0.0318)	(0.0317)	(0.0281)
Phase 2 During	0.576***	0.578***	0.537***
	(0.101)	(0.101)	(0.0997)
Phase 2 Post	0.387***	0.385***	0.335**
	(0.106)	(0.106)	(0.104)
Adjusted R-squared	0.139	0.139	0.086

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Solarize CONNECTICUT℠

Demographic controls included average household income, median age, size of housing stock, percentage of whites in the population, percent of houses that are owner-occupied, and percentage of the population that is registered democratic. The only control that had any significance was percentage of whites at 1-5%. Bridgeport is excluded from this analysis.

Pooled Solarize Regression Results

	(1) PSM	(2) PSM caliper	(3) CEC controls
Solarize during	0.577***	0.579***	0.553***
	(0.0850)	(0.0850)	(0.0830)
Solarize post	0.135***	0.136***	0.124***
	(0.0397)	(0.0397)	(0.0283)
Adjusted R-squared	0.138	0.138	0.085

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

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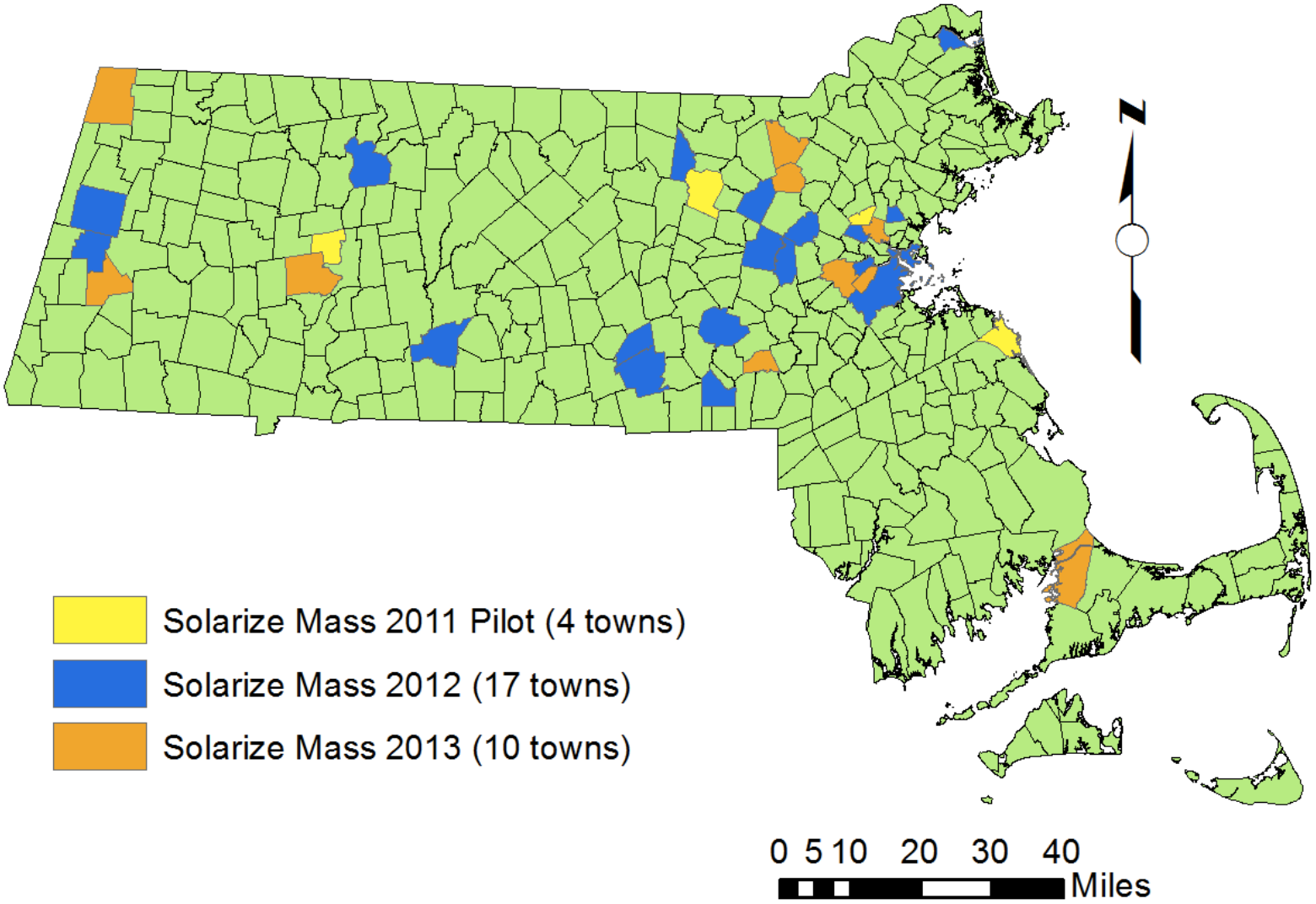
Conclusions

- Participating in Solarize CT increases installations by about 0.6 installations per block group per month during the five-month-campaign.
  - This translates to on average 44 additional installations due to the program over the full campaign.
- Solarize CT appears to continue to boost solar growth after the campaign ends.
- Solarize campaigns are a complement to more traditional, individual-focused subsidies.

Next Steps

- Investigate the potential applicability of the Solarize model to other clean energy technologies
- Further examine the cost-effectiveness of the Solarize model
- Conduct similar analyses on the results of the Solarize Mass program

Solarize Mass



Thanks to the US DOE Sunshot Initiative for funding this study… and THANK YOU for your interest!

Pooled Solarize Regression Results Including Bridgeport

	(1) PSM	(2) PSM caliper	(3) CEC controls
Solarize during	0.577***	0.579***	0.553***
	(0.0850)	(0.0850)	(0.0830)
Solarize post	0.135***	0.136***	0.124***
	(0.0397)	(0.0397)	(0.0283)
% White	0.00101	0.00103*	0.000613**
	(0.000513)	(0.000515)	(0.000221)
Adjusted R-squared	0.138	0.138	0.085

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Demographic controls are average household income, median age, size of housing stock, percentage of whites in the population, percent of houses that are owner-occupied, and percentage of the population that is registered democratic. Percent white is the only control with any significance.