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Proposal 1: Has the SAHS scheme effectively driven the adoption of residential solar systems among low-income areas in California?

Context and policy question

The SASH program, under the California Solar Initiative (CSI) was structured to provide qualifying single-family homeowners incentives to install solar technology. The program offered an upfront incentive of $3 per watt of capacity installed for eligible homeowners (those living in "affordable housing" homes and with a household income of 80% below their area median income). Under the original SASH program, GRID Alternatives installed systems on over 5,200 homes in California between 2009 and 2017. We want to explore how the SASH program has accelerated the adoption of solar rooftop systems among low-income households in California and whether its design reached marginalized communities that were left out in the renewable energy market.

Data sources:

- Unit of observation: Zipcode area-year (or county-year), panel data of zip code areas in California between 2009 and 2017
- Dependent variable (Y): Number of installations under the SASH program. Installations probably would be determined at the household level.
  - Distribution of SASH installations across California over the program lifetime at the zip code area (or county) level (2009-2017):
- Main explanatory variable (X): Share of households eligible for SASH incentive (under 80% of area median income)
  - Income and demographic information at zip code area (or county) level (ACS)
- Other controls and explanatory variables:
  - Total installations of the residential solar system in California between 2009 and 2017, aggregated at the zip code area level (over 700k)
  - Average solar irradiation at zip code area/county level

Empirical strategy:

- The treatment studied, eligibility to access SASH incentives, is uniform over time and across zip code areas. Thus, the share of households eligible for the SASH incentive is used as the main explanatory variable based on their income level.
- We will compare the number of installations under SASH in areas with more eligible households (thus, lower-income) compared to higher-income areas.
- We will use time-fixed effects to account for time-dependent confounding factors that affect all areas in California similarly, e.g., decline in residential solar system costs.
- We will use entity-fixed effects to control for area-specific confounding factors that are constant across zip code areas (counties), e.g., average annual solar irradiation.
- We will use a set of controls related to the characteristics of the system installed (e.g., size, whether its cost was fully or partially covered by the incentive)
- Challenges to internal validity might include the representativeness of the eligibility share towards the actual population eligible (including the "affordable housing" requirement), limited information about how the awareness of the project was conducted, etc.

Figure 1: Distribution of SASH installations between 2009 and 2016

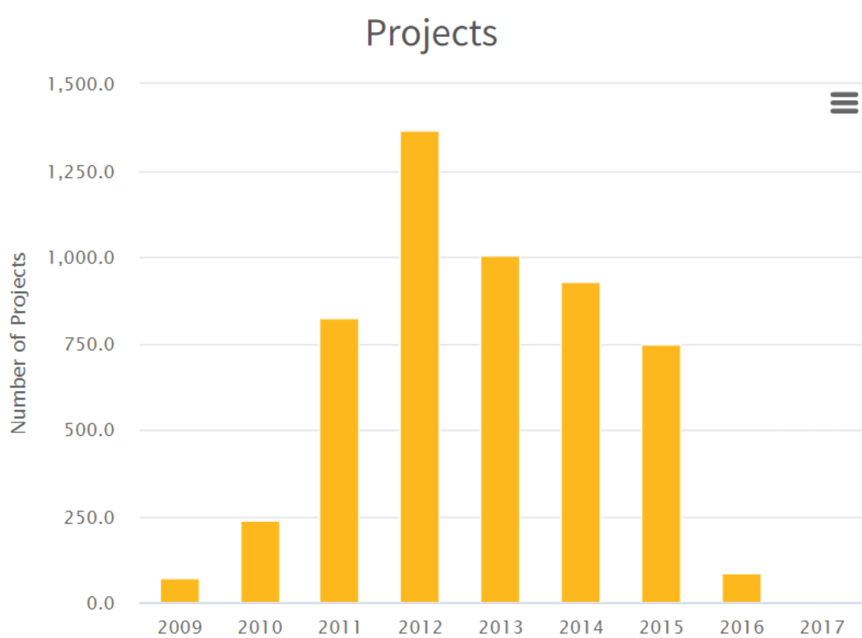
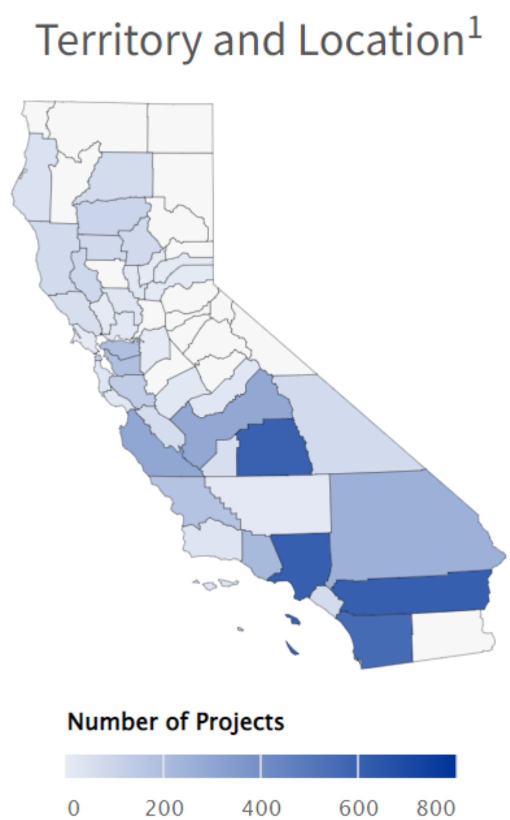


Figure 2: Distribution of SASH installations across counties in California



Proposal 2: How did Double U-Save rebates and Household Utilities Credit top-up (subsidies for utility bills) for lower-income households affect Singaporean energy consumption during the pandemic?

Context and policy question

During the pandemic, the Singaporean government provided Doubled U-Save rebates* (they increased the amount by SGD$200 per household) and a Household Utilities Credit top-up to offset their utility bills in 2020. These subsidies amount to 8 to 10 months' worth of utility bills for the average household living in 1- and 2-room Housing and Development Board (HDB) flats, and about 4 to 6 months' worth of utility bills for those living in 3- and 4-room HDB flats. Our initial hypothesis is that due to the high cost of energy utilities, vulnerable consumers use less energy and therefore less air-conditioning than what they would need (hidden energy poverty). The subsidies will allow us to check for differential energy usage increases among low-income households during the pandemic compared to higher-income households not subject to the rebate.

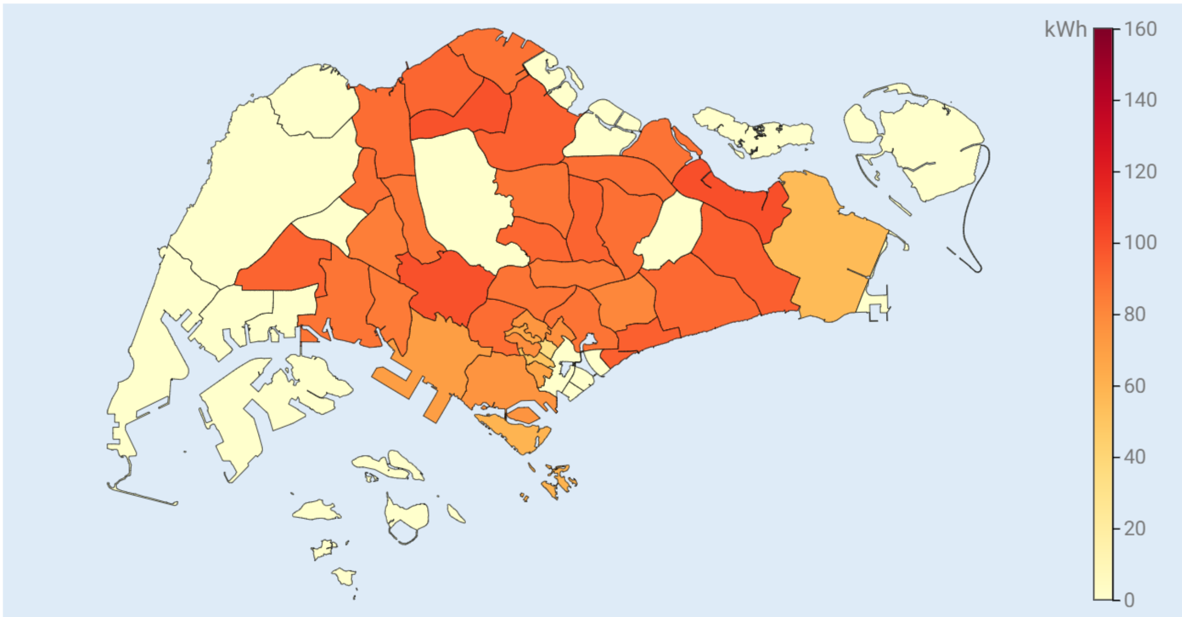
Data sources:

- Unit of observation: Planning area-month, panel data of housing planning areas in Singapore per month covering pre-pandemic and pandemic period until June 2021.
- Dependent variable (Y): Average monthly energy consumption by household, indexed to basis pre-pandemic year (e.g. 2019)
    - Average Monthly Household Town Gas Consumption by Dwelling Type (monthly kWh, from 2005 to H1 2021)
- Main explanatory variable (X): Receipt of energy subsidies (living in specific planning areas, HDB housing, serving low-income Singaporeans).
- Other controls and explanatory variables:
    - General energy sector statistics
    - Income level, dwelling type and size

Empirical strategy:

- The treatment studied, receiving, is applied to all households in HDB (lower-income) areas. Our control group is the households living in non-HDB areas or condos (higher-income), which were not subject to these subsidies.
- We will compare the evolution of energy consumption trends (indexed to pre-pandemic years) of treated HDB planning areas compared to non-treated higher-income areas.
- We could use time-fixed effects to account for time-dependent confounding factors that affect all planning areas similarly, e.g, an increase in electricity tariffs.
- We could use entity-fixed effects to control for area-specific confounding factors that are constant across planning areas, e.g., electricity demand level.
- We can use a set of controls for the differences between HDB and non-HDB areas, such as average income, to account for different energy consumption trends in response to the pandemic (e.g. possibility of remote working)
- Challenges to internal validity might include the fact that HDB areas include both lower-income and middle-upper-income Singaporeans, and thus the effect of the increase in demand among low-income households could be diluted.

Figure 3. Average household energy consumption by planning area in 2020.



*Data for 2022 is as at Jun-22.