SOLAR PV AND ENERGY POVERTY IN AUSTRALIA'S LOW-INCOME AND LOW-WEALTH HOUSEHOLDS

Mara Hammerle, Australian National University, +61420618579, mara.hammerle@anu.edu.au

Overview

Several new approaches in Australia and around the world seek to expand access to solar photovoltaics (PV) among households who have traditionally been less able to pursue micro-generation possibilities. For example, a policy in the state of Victoria provides financial support to households who have a combined gross household income of less than AUS$180,000 per year, while the Australian Capital Territory has introduced a policy to support pensioners to install solar panels on their rooftops. Providing subsidies to these households can theoretically result in welfare and efficiency gains (Allcott, Knittel and Taubinsky 2015).

However, questions remain regarding the impacts of these policies on vulnerable households who benefit from them. One potential impact is a decrease in the incidence of energy poverty. A household is said to experience energy poverty if it is unable to maintain a minimum level of domestic energy services that satisfy social and biological requirements (Bouzarovski and Petrova 2015). Thus far, research has yet to quantify the impact of access to solar PV on the likelihood that vulnerable households experience energy poverty. Research on this topic could enable policymakers to better understand the impacts of their policies, thus improving decisions on how best to allocate government funds.

Over the past decade, household energy costs have risen sharply in Australia, with electricity and gas prices increasing by 76 percent and 53 percent in real terms between 2008 and 2018, respectively (Phillips 2018). Analysis of the data used in this paper reveals that 9.7 percent of Australian households are unable to consistently pay utility bills on time, while 2.3 percent are unable to heat their homes adequately. While energy poverty is not a problem for most Australians, those most likely to experience it face disadvantages such as living in remote communities, having lower levels of English language proficiency, and living with disability and/or long-term illness.

Methods

The paper conducts a retrospective analysis to understand the impacts of solar PV on energy expenditures and energy poverty for vulnerable Australian households. In this paper, a household is defined as being "vulnerable" if its equivalised household disposable income and/or net wealth is in the lowest three deciles. The paper asks two research questions. First, are vulnerable Australian households with solar PV less likely to experience energy poverty? Second, do the impacts vary for different types of energy poverty?

The paper uses household-level survey data from the Australian Bureau of Statistics (ABS) 2015-16 Household Expenditure Survey and Survey of Income and Housing. These datasets are the most recent national Australian sources to combine information on solar PV and energy expenditures for the same households. Using Geographic Information Systems, I also incorporate data from the Australian Bureau of Meteorology on cooling degree days and solar exposure in a household's geographical area.

I use regressions that control for a suite of potential confounders and also use entropy balancing and instrumental variable (IV) approaches. The IV approach uses the average solar exposure per month in a household's geographical area to instrument for a household's solar PV capacity, while controlling for the number of cooling degree days. The dependent variables are either weekly energy expenditures or binary variables representing different types of energy poverty. The first objective measure of energy poverty is the ten-percent-rule, referring to whether a household spends more than 10 percent of after-housing cost disposable income on energy (Boardman 1991). The second objective measure is the low-income high-cost indicator, which requires households to be both low-income and have energy expenditures greater than the national median (Hills 2012). I also use two subjective energy poverty measures based on whether a household states that they are (1) unable to heat their home or (2) pay their bills on time due to financial constraints. It is useful to combine different measures of energy poverty as they do not always identify the same households as energy poor (Middlemiss and Gillard 2015). The treatment variables are either a binary variable for whether a vulnerable household has solar PV or the size of the solar PV system in kilowatts.

Results

I find that solar PV predicts an approximately A$3 reduction per kilowatt in weekly energy expenditures on average for households in the lowest three income and/or wealth deciles. It is also associated with a reduction in the likelihood a vulnerable household will experience energy poverty of around 2.5 percentage points per kilowatt according to the ten-percent rule and by approximately 5 percentage points per kilowatt based on the low-income high-cost indicator. I do not find statistically significant results for the subjective measures.

The vulnerable households in the dataset have an average solar PV system size of 2.8 kilowatts, conditional on having solar PV. Based on the average system size, a A$3 per kilowatt reduction in energy bills amounts to around A$8.40, or 22.3 percent of the average energy expenditures of non-solar households, per week. Per year, the average vulnerable household benefits from an approximately A$436.80 reduction in energy bills. This yearly figure is roughly similar in magnitude to that estimated by the Australian Competition & Consumer Commission, which is A$515.92 in real terms for 2015-16 (ACCC, 2018). The ACCC figure is somewhat higher than the figure estimated in this paper, reflecting the fact that vulnerable households have smaller system sizes than other Australian households, on average.

Conclusions

Uptake of solar PV is expected to increase in Australia and worldwide due to low solar PV module prices, allowing households to use energy services at essentially zero marginal cost (apart from forgoing payments for exports to the grid). As this uptake continues, it is essential that policies are created and improved to ensure that households who face considerable market barriers are also able to participate in the energy transition. Without such policies, there is a danger for increasing levels of rooftop solar and other microgeneration possibilities to exacerbate existing inequalities.

The results of this paper provide some insights into the types of impacts that policies that extend access to solar PV to vulnerable households are likely to achieve. For example, they show that the policies are likely to reduce the energy expenditures and probability that a vulnerable Australian household will experience objective measures of energy poverty. These insights are likely to find strong interest among policymakers and other groups.

References

ACCC (2018). Restoring electricity affordability & Australia's competitive advantage. Technical report, Australian Competition & Consumer Commission.

Allcott, H., Knittel, C., and Taubinsky, D. (2015). Tagging and targeting of energy efficiency subsidies. *American Economic Review,* 105(5): 187-91.

Boardman, B. (1991). *Fuel poverty: From cold homes to affordable warmth*. Belhaven Press, London, 1st edition.

Bouzarovski, S. and Petrova, S. (2015). A global perspective on domestic energy deprivation: Overcoming the energy poverty-fuel poverty binary. *Energy Research & Social Science*, 10: 31-40.

Hills, J. (2012). Getting the measure of fuel poverty: Final report of the Fuel Poverty Review. CASEreport (72). Centre for Analysis of Social Exclusion, London School of Economics and Political Science, London, UK.

Middlemiss, L. and Gillard, R. (2015). Fuel poverty from the bottom-up: Characterising household energy vulnerability through the lived experience of the fuel poor. *Energy Research & Social Science*, 6: 146-154.

Phillips, B., 2018. Energy stressed in Australia. Technical report, ACOSS and the Brotherhood of St Laurence.