How Much Do Labels Actually Matter for Electricity Savings? Singapore's Case for Residential Air-Conditioner Purchases and Usage Behaviour.

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Overview

In Singapore, the Energy Labelling Scheme (MELS) is designed as a complimentary tool supporting the Energy Performance Standards (MEPS), aimed towards harnessing the power of choice to raise the energy savings potential of an energy efficient appliance purchase. The MEPS and MELS have both been revised once each since 2008 to ensure that air-conditioner models available in the market adhere to stricter Coefficient of Performance (COP) values. Here, in this study, we attempt to quantify the actual savings realized by the purchase of energy efficient air-conditioners (AC) with a natural experiment. The quantification of actual energy savings from space cooling has been studied before, notably in the US[1], UK[2], and Mexico[3]. In particular, we utilize household surveys, as well as monthly and daily electricity demand profiles to identify the time-varying impact of such a purchase on consumption. We conclude that Rebound effect exists for new AC purchases, and varies across household size and dwelling types.

Methods

Our analysis focuses on the preliminary analysis of household surveys and monthly electricity billing information collected from a sample of 268 out of 670 residential households between January 2014 to October 2016, across a period of 34 months. Out of these 268 households, 108 purchased an energy efficient air-conditioner after 2008, which is when the MELS was first introduced. Out of these 108, 20 of them purchased a new efficient air-conditioner within the billing collection period. We use a fixed-effects (FE) and Difference-in-Differences (DID) approach to identify the actual percentage savings from a new AC. We then compare actual savings with theoretically assumed savings based on the coefficient of performance (COP) improvements on each label category for the purchased ACs to identify the direct Rebound Effect. Households are analysed based on average effect across the whole sample, as well as across dwelling types and geographical location.

We also utilize daily load profiles for both AC and total household consumption to identify the presence of indirect rebound, where households could engage in more non-AC electricity usage assuming they are aware of savings from their new AC purchase. Our analysis accounts for cross-sectional household characteristics, environmental awareness, geographical differences, as well as bill payment methods in addition to price and income.

Results

We find that actual savings differ from theoretically assumed savings, with the Rebound Effect being 2-8%. In addition, middle income families with bigger household size and condominiums save more energy than other household types. Electricity consumption also reverts to a lower steady state just 3-4 weeks after the purchase. An interesting finding that accompanies this research suggests that automatic bill payments may contribute to lower energy savings.

Conclusions

Our analysis suggests that the actual energy savings is lower than engineering estimates by 2-8%, suggesting the need to identify further behavioural interventions to reduce this actual-theoretical gap. In particular, the cost of electricity from AC use should be made more salient to consumers to address the potential effects of automatic bill payments as one possible barrier to the savings potential of EE appliances.

References

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