Best Social Engagement Presentation Award (in Honour of Michael Ewing), Environ 2025

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Solar photovoltaic (PV) and in particular residential PV systems are playing a growing role in the move towards a renewable energy future. For this technology deployment to continue to grow at pace in Ireland, as the principal stakeholder, the home occupier must continue to recognise the benefits. To achieve this, the current domestic energy consumption patterns, use of Behind-the-Meter (BtM) generation, and experiences of domestic users must be understood. However, residential PV systems do not operate in isolation, therefore the evolving energy market and the interests of other stakeholders, including grid operators, utilities, policymakers and other consumers must be considered. There are also a multitude of factors that can impact on the benefit to end-users of residential PV - policies such as subsidies and feed-in-tariffs along with peer effects, electricity consumption patterns, forecasting, technology, rebound effects, data visibility and demand response to name a few. This study aims to understand current real-world experiences of residential PV users in Ireland by using a bottom-up approach to undertake a deep analysis of residential electricity usage and generation data. The data collection phase of the project involved extensive surveys with solar PV home occupiers. The literature review identifies several key factors relevant to PV electricity users. Preliminary findings from our survey suggest potential evidence of the rebound effect, interest in and use of solar forecasting, the influence of peer effects, shifts in consumption behaviour, and the importance of data access, see Figure 1. Smart meter and PV system data was also collected from these homes for data analysis alongside the extensive survey results. Analysis is currently being conducted to understand the electricity usage patterns behind the meter in these homes. Some interesting preliminary findings suggest that people's motivation for installing solar PV systems may have an impact on their self-consumption rate (SCR) of their solar generation. Figures 2a and 2b show participants whose main priority was "to save money" tend to have a lower total electricity consumption (mean = 8,183 kWh) and lower SCR (mean = 50.91%) than those whose priority was to reduce carbon footprint or become more self-sufficient (means = 9,208 kWh & 63.44% respectively).

It is planned to develop a model to enable engagement for multiple levels of technological readiness BtM. This model is a crucial part of the understanding of the relationships between policy, technology and end consumer behaviour in optimising residential PV, while offering insights into how the different optimisation objectives (such as cost savings, carbon reduction or grid stability) shape optimisation strategies.

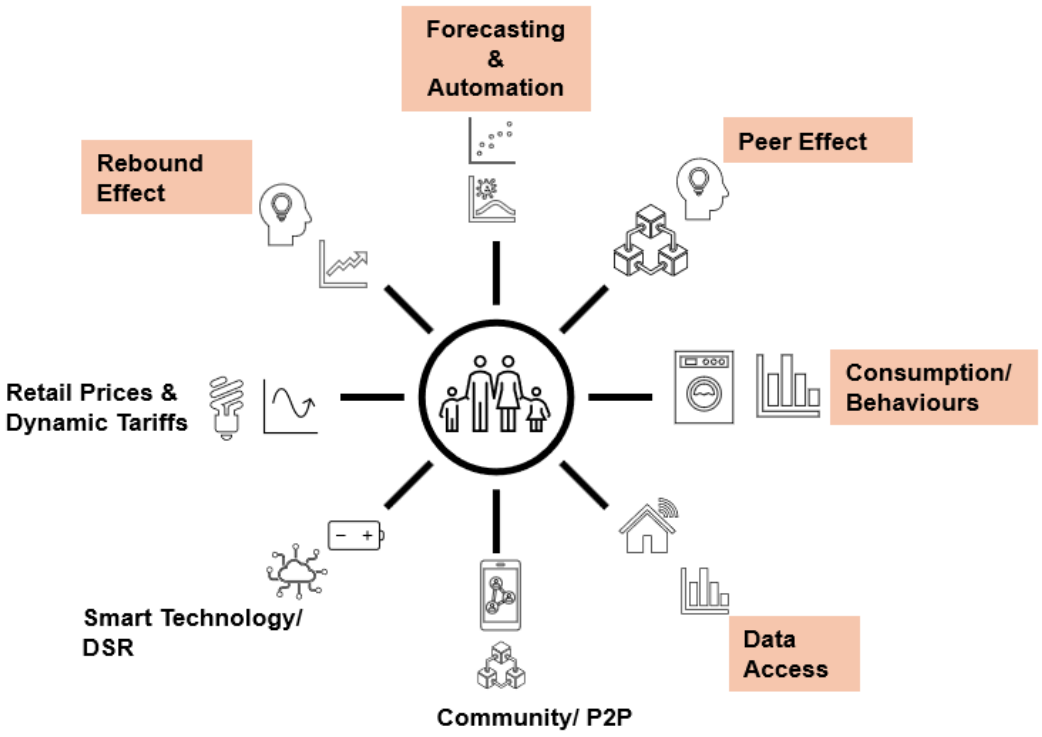

Figure 1: Factors affecting PV use in homes also evident in survey results

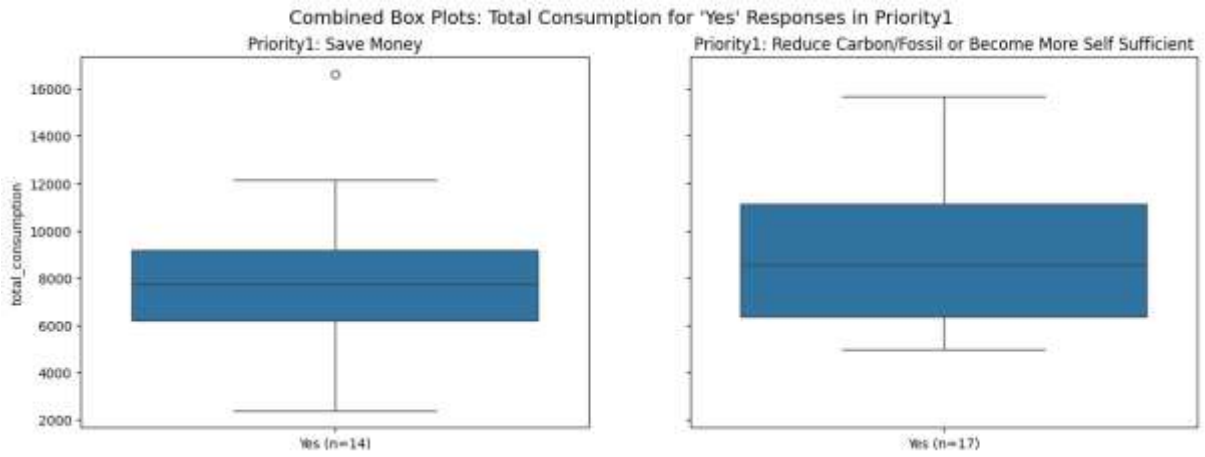

Figure 2a: Range of Total Consumption by Priority for Install

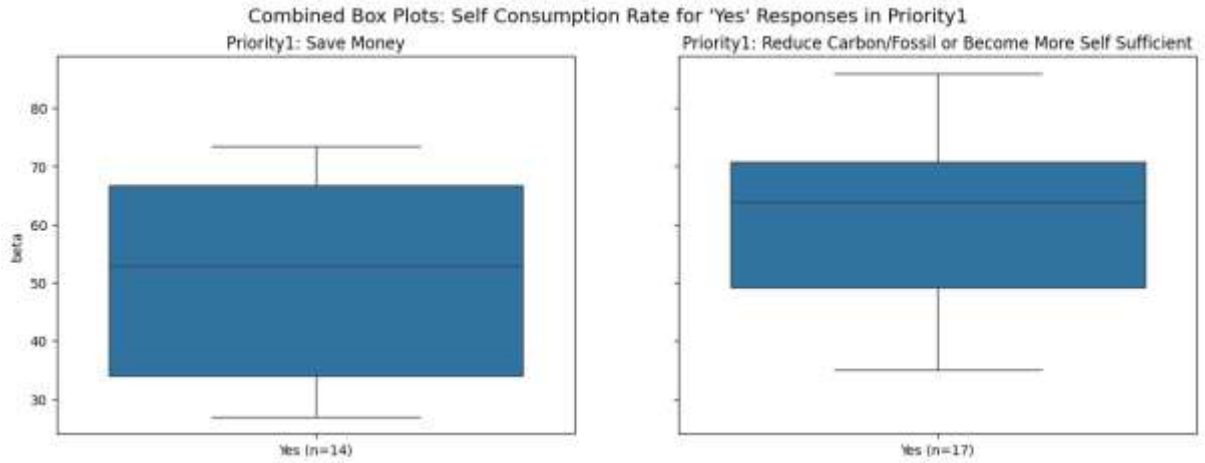

Figure 2b: Range of SCRs by Priority for Install

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For more information on the InVEST project or to sign click https://sirig.mtu.ie/invest

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