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Metadata Record: https://dspace.lboro.ac.uk/2134/8875

Version: Published

Publisher: © Phillip Leicester

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A Probabilistic Determination of the Impact of FiTs on Fuel Poverty

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Abstract

Policy makers and interests groups often make claims about the benefits of distributed renewable energy technologies. For example, it is suggested that renewables may have an impact on fuel poverty (Walker, G., 2008). This is uncertain and the research outlined describes a method whereby the potential impact on fuel poverty of solar photovoltaic technology (PV), as supported by the UK Feed-in Tariffs, can be tested. It is suggested that PV targeted at lower income groups may have a higher impact on fuel poverty but only approximately 6% of a sample of households were lifted out of fuel poverty.

Method

A multivariate analysis using Monte-Carlo simulation techniques is a useful method to explore such a problem where a number of independent variables have known distributions. A number of distributions are described here:

- Annual Household Income (I)

The distribution of income by deciles is well known and is available from the Office of National Statistics. This data is from 2009.

- Total Annual Fuel Costs (F)

More affluent households use more fuel. The distribution however is not well known but will be influenced by building performance and lifestyle. Here it has been approximated using a Weibull distribution (Leicester et al., 2011).

- Peak Power Rating (R)

Typical power ratings vary widely in the UK. This data comes from an analysis of the UK FiTs register from OFGEM.

- Annual yield (Y)

Power rating is often presumed to be well known, but field trials show that PV systems can have widely varying rates. This data is from UK field trials conducted by BRE in 2006.

- Cost of grid electricity (£/kWh)

- Fraction of generated electricity used in house

Where:

\[ P = 100 \times \frac{F - \phi(R \times Y \times E)}{I} \]

Where:

\( P \) Percentage income spent on fuel
\( F \) Total annual fuel costs (£)
\( I \) Annual Household income (£)
\( R \) Peak power rating of PV array (kWp)
\( Y \) Annual yield of PV array kWh/kWp
\( E \) Cost of grid electricity (£/kWh)
\( \phi \) Fraction of generated electricity used in house

If the percentage P is 10% or more, the household is said to be in fuel poverty (Boardman, 2010). If this could be calculated for all UK households a deterministic impact of PV on fuel poverty could be predicted. However, all the variables required in this calculation are subject to uncertainty. This implies an element of risk when predicting the impact of PV on the fuel bills of a particular household and also the impact on a wider population.

Results

Two scenarios are presented. Firstly, PV is installed by mainly able to pay domestic consumers. This scenario is typical of the current diffusion of PV under the UK FiTs scheme (Boardman, A., Chitnis, M., Sorrell, S., Jackson, T., 2010). Fixing fuel poverty: Are there any links or risks? Energy Policy 38, 4514–4517.

Secondly, PV is targeted at low income groups. This resulted in 5941, out of 100,000 households removed from fuel poverty.

References