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DER adopter analysis using spatial autocorrelation and information gain ratio under different census-data aggregation levels

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Abstract-

Residential consumers have been adopting distributed energy resources (DER) like photovoltaics (PV), electric vehicles (EV) as well as electric heating, ventilation and air conditioning devices (HVAC) in recent years – thus substantially reshaping power systems. This study is dedicated to the analysis of such adopters in continental Portugal, using both spatial analysis tools and census data with information theoretic criteria. Results suggest that the current uptake of EV, PV, and HVAC is characterised by spatially auto-correlated adoption patterns. The analysis of census variables, on the other hand, reveals that Portuguese EV, PV, and HVAC adopters exhibit a few surprising, unrecorded characteristics compared with previous studies. Comparing different dataset resolutions, EV and HVAC adopters are found to be most similar across all three aggregation levels considered. Results further show that fewer adopter groups tend to own both EV-HVAC and PV-HVAC, reducing per se synergy potentials that may arise behind the metre. One of the main outcomes from this work is that studies describing energy technology adopters using census variables might receive very unstable results across different data aggregation levels. This may lead to adverse effects on studies' conclusiveness and energy policy design choices.

Index Terms- electric heating; HVAC; distributed power generation; photovoltaic power systems; electric vehicles

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