DemoGraphic

Demographic indicators and small-scale solar energy technology uptake in Brisbane, Australia: an interactive visualisation

AUSTRALIAN POPULATION STUDIES

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Introduction

As interest has increased in global low-carbon energy transitions, so too has interest in how population processes such as population ageing or urbanisation affect carbon emissions and renewable energy adoption at the local level (Balta-Ozkan et al. 2021; Liddle 2014). Local governments and communities around the world are particularly interested to understand the spatial disparities in renewable energy adoption and the complexity of demographic and socioeconomic factors behind that.

The City of Brisbane has the potential to be a small-scale solar photovoltaic (SPV) powerhouse in Australia. Brisbane has the highest SPV megawatt output potential (NationalMap 2021) and the highest solar radiation exposures of all Australian state capitals (Sommerfeld et al. 2017). Increasing SPV adoption has the potential to transform collective energy use and directly decrease Queensland's greenhouse gas emissions. Though with more than 800 megawatts of SPV installed (as of 2021), there is a high spatial variability of SPV uptake among city neighbourhoods. Researchers have begun to evaluate the impact of demographic and socio-economic factors on SPV adoption variability across Australia (Lan et al. 2021). Creating interactive and publicly available visualisations of such interrelationships is an important step to inform future equitable energy policies and planning. Publicly available platforms offer a means to provide access to a wide range of users including decision-makers and urban residents. Integration of multiple data sources provides an opportunity to reveal new insights that otherwise would remain elusive. Finally, interactive maps provide an effective tool for exploring small area data and patterns of relations between indicators.

The aim of this DemoGraphic is to present an interactive map to visually explore the interplay between selected demographic indicators and SPV uptake across postcodes in the Brisbane local government area (LGA).

Data and methods

A set of key indicators was identified during a review of literature that addresses the impact of demographic and socioeconomic factors on the uptake of SPV (Lan et al. 2021; Liddle 2014; Sommerfeld et al. 2017). Indicators were selected if they showed a positive relationship with the SPV uptake and were broken into two groups. Group I indicators consist of level of education (proportion of the population within a postcode which has obtained a tertiary qualification), household income (proportion of households within a postcode which meets or exceeds the national average weekly household income), median age (years old), and proportion of detached dwellings (proportion of total dwellings considered detached dwellings within a postcode) in each postcode. Demographic data was sourced from the Australian Bureau of Statistics (ABS) at the level of postal areas which are ABS's approximation of postcodes.

Group II represents SPV adoption (small-scale solar installation totals and total aggregated Kw output capacity per postcode) derived from publicly available postcode level data from the Australian Government's Clean Energy Regulator (2021). Only postcodes (n=76) which fall within the Brisbane LGA boundary were included.

The data was incorporated into the interactive map using R software ('flexdashboard' and 'tmap' packages) hosted on the GitHub Pages public repository (see Loginova and Wohland 2020 for instructions). The postal areas shapefile was downloaded from the ABS (2021) Australian Statistical Geography Standard website. The map can display indicators individually as well as in combination. Group I (demographic choropleth maps) and Group II (proportional symbols reflecting SPV adoption) indicators can be overlayed to visualise the geographical interplay. The interactive map can be explored using this link: https://qcpr.github.io/brisbaneSPV/.

Key features

There is a clear spatial pattern to SPV uptake in Brisbane. Postcodes in inner city as well as outer suburbs have low SPV uptake, while the highest SPV uptake can be observed in inner suburbs. The highest values (above 6,000 small-scale SPV installations and SGU rated output higher than 25,000 kW) are found in six inner suburbs, with three postcodes on the southside (4109, 4122, 4152) and three on the northside (4034, 4017, 4053) of the river (Figure 1). Areas of highest population densities (inner city) have some of the lowest SPV uptake.

Individual indicators showed varying strengths of relationship to SPV uptake. Neither of age, income, education, and dwelling indicators demonstrate a clear pattern of SPV uptake. Currently, based on the visual representation of the interactive map, Brisbane fits into a theory increasingly recognised in the literature which argue that 'middle' is best. Areas most conducive to SPV uptake consist of a demographic makeup where middle income, middle housing density, and middle age ranges are most prevalent (Bondio et al. 2018; Best and Trück 2020; Lan et al. 2021). According to the study by Bondio et al. (2018) that surveyed more than 8,000 households in Queensland, SPV adopters are more likely to be middle-class households. In the 'middle' suburbs, SPV offers the greatest incentives with enough flexibility to hurdle some of the practical barriers to SPV such as upfront costs or roof space. Practical and socioeconomic barriers to SPV uptake appear to be greatest at the lowest (high capital cost barriers) and highest (low appeal beyond the benefits as an electricity cost-saving measure) ends of most demographic indicators (Bondio et al. 2018). Postcodes at neither ends of the spectrum, seemingly provide a demographic context whereby the motivations and means of adopting SPV result in higher installation totals. Therefore, a more nuanced understanding of specific population dynamics and settlement patterns is important for more efficient and equitable policy measures and planning that target adoption of the renewable technologies.

There are a range of limitations associated with this Demographic that require noting. First, it reports on four demographic and socioeconomic indicators, recognising that the effect of various population and non-population processes is inherently more complex. Inclusion of other indicators, such as political preferences or installation costs, would further enrich the understanding of spatial disparities in the adoption of renewable technologies. It is also recognised that demographics and a specific indicator's level of influence changes over time (Sommerfeld et al. 2017). The interactive map format has the flexibility to keep up with these changes. Regular updates or additions to the data can maintain a current representation of the interrelationship between demographics and SPV adoption.

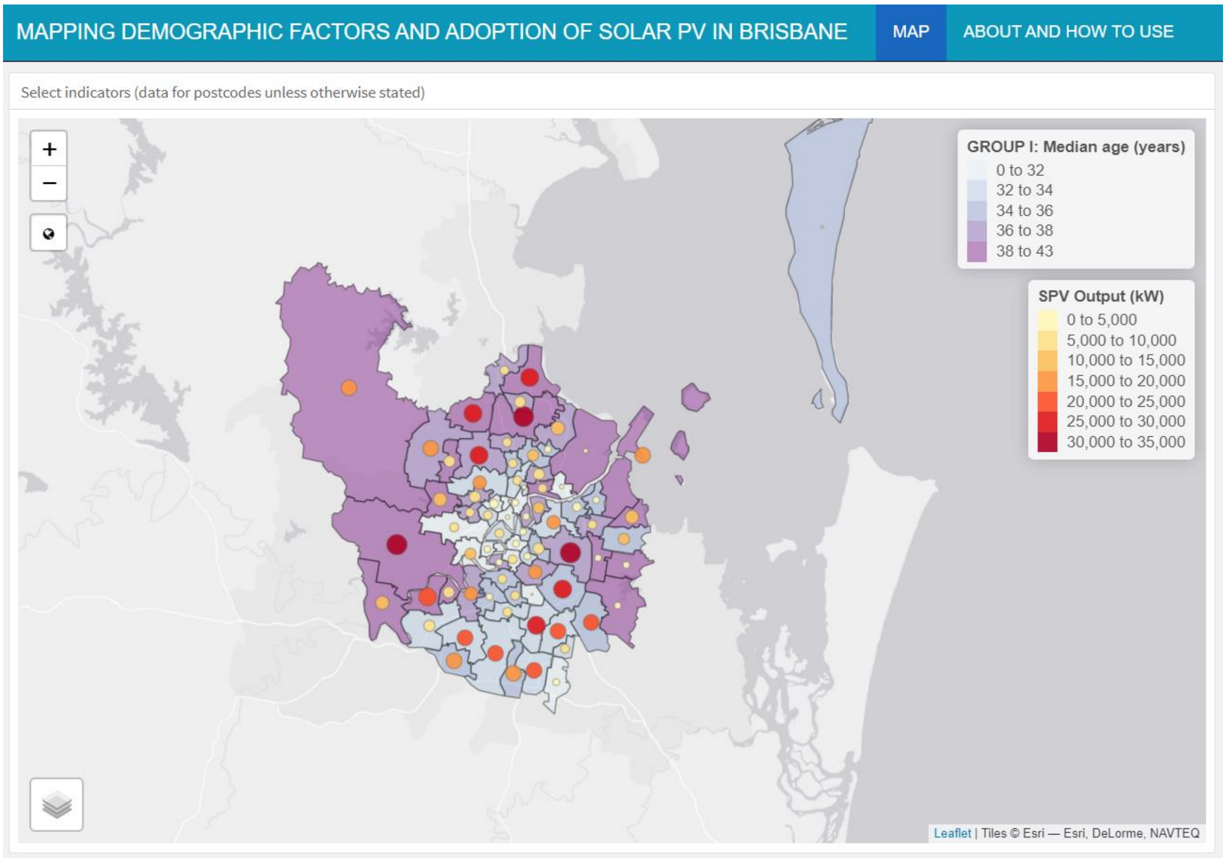

Figure 1: Geographical interplay between median age and SPV output, kW.

Source: authors' dashboard at https://qcpr.github.io/brisbaneSPV/

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