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Warm glow from green power: Evidence from Australian electricity consumers [☆]

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ABSTRACT

Green electricity products are increasingly made available to consumers in many countries in order to address a number of environmental and social concerns. Most of the literature on this green electricity market focuses on consumers' characteristics and product attributes that could affect participation. However, the contribution of this environmental consumerism to the overall environmental good does not depend on participation alone. The real impact relies on market participation for green consumers (the proportion of green consumers) combined with the level of green consumption intensity – the commitment levels, or proportion of consumption that is green. We design an online interface that closely mimics the real market decision environment for electricity consumers in Western Australia and use an error component model to analyze consumers' choice of green electricity products and their commitment levels. We show that product attributes have limited impact on the choice of green products; however, there is still great potential for better participation by improving the design of green electricity programs. When green products are selected, most respondents select the minimum commitment possible, and this is insensitive to the premium being charged on green power, suggesting that we are largely observing a buy-in 'warm glow' for carbon mitigation.

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Introduction

The past few decades have witnessed a significant increase in the demand for and supply of “environmentally friendly” or “green” products. Market research on consumers' behavioral patterns involved in green product choice has shown an increasing percentage of consumers in many countries willing to buy green products ([Landor Associates, 2011](#)). However other market studies have also indicated that consumers may be only willing to purchase green products with preferred attributes within certain constraints. In particular, they may have a threshold price or payment level beyond which they are no longer willing to purchase green products ([Blamey et al, 2001](#)). In contrast, academic research in the area only focuses on the factors and attributes that influence consumers' choice of green products, or the extensive margin. Very little research looks at the level of commitment, or the intensive margin, defined here as the proportion of an individual's use of a product that is ‘green’.

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The environmental impact as a result of green consumption not only depends on consumers' choice of environmentally friendly products, but also the level of commitment. For instance, the contribution of residential rooftop solar panel adoption to a clean energy supply (and its associated public environmental good) depends on the size (capacity) of each installation as well as the number of installations. [Andreoni \(1989, 1990\)](#) argued that consumers derive “warm glow” utility from the contribution to the environmental good (which is pure altruism and is linked to the level of commitment). [Kahneman and Knetsch \(1992\)](#) also argued that the “warm glow of moral satisfaction” increases with the size of the contribution.

On the other hand, stated preference studies often found an “embedding” effect, where values do not appear to be sensitive to the scale of provision. [Nunes and Schokkaert \(2003\)](#) find that accounting for a lump sum “warm glow” (that is gained irrespective of contribution level but may vary across individuals) leads to “cold” measures of WTP that pass scope and adding up tests. [Kotchen and Moore \(2008\)](#) also infer a “lump sum” benefit from reduced conventional energy use that is consistent with “the existence of social and psychological benefits of the green-electricity program that are unrelated to electricity consumption” (p. 212). [Jacobsen et al. \(2012\)](#) find evidence of a “buy-in” mentality ([Rose-Ackerman, 1982](#)), where purchasers of green electricity are concerned not about their overall level of emissions, but simply “buy-in” to the program at the minimum quantity possible, with 45% of respondents exhibiting that behavior. The amount that consumers are willing to pay has been found to be highly non-linear in the percent of energy that is generated from renewables ([Farhar, 1999](#)) and customers are more concerned about the concept of consuming green energy than its actual environmental impact ([Goett et al., 2000](#)). [Jacobsen et al. \(2013\)](#) also find that community-level rewards can be effective in promoting consumer participation in green electricity programs, but the size of the reward itself appears less important. Overall, the literature has suggested a two-component warm glow effect: a buy-in warm glow irrespective of commitment level and a contribution warm glow that depends on the commitment level.

The relative magnitude of the two warm glow effects has significant implications for the consequences of programs ([Harbaugh, 1998](#)). If a buy-in “warm glow” effect plays a dominant role, the actual contribution to the environmental good may be limited even if there are a substantial number of green consumers. During the second quarter of 2013, Synergy (the principle supplier of energy to households in Perth, Western Australia) sold green electricity to 5649 residential customers, which represents a roughly one percent penetration at the customer level ([Synergy, 2013](#)). However the latest quarterly statistics on actual green electricity sale to these green customers translates to a mere 31% average commitment level ([GP, 2013](#)) (assuming a representative household with 18-unit consumption per day). As a result of the low commitment level, the actual contribution to the environmental good is much less than the penetration level often considered at the customer level.

Consumers' decision making at the commitment level will have significant implications for the actual impact of policies that aim to promote pro-environmental behaviors. It is thus important to study both consumers' choice of green products (participation) and their commitment levels. In this paper, we study both elements of consumers' behavior in green electricity programs in Western Australia. We design a survey that closely mimics the real decision context facing consumers in Western Australia and use an error component discrete choice model to investigate both consumers' choices of products and commitment levels. The model allows us to investigate the circumstances under which both the buy-in “warm glow” effect and the contribution “warm glow” effect manifest themselves. In particular, it investigates whether the characteristics of the green energy program affect these behaviors. We also compare the implications of the model with historical data on engagement with green energy programs in WA. The rest of the paper proceeds as follows. Section “[Background and literature](#)” provides the background of Australian green electricity programs and reviews relevant literature. Section “[Modeling approach](#)” describes our experimental design. Section “[Results](#)” introduces our statistical model. We present results in section “[Discussion](#)” and conclusions in the last section.

Background and literature

The option to purchase green electricity products is increasingly available to consumers in many countries. For instance, nearly 850 utilities in the US currently offer green electricity programs ([DOE, 2015](#)). In Australia, there are about 40 accredited green electricity schemes provided by utility retailers in Australia ([GP, 2015](#)). The willingness of consumers to pay for green electricity or actual participation in the green electricity market has been investigated in a large number of countries including the US ([Farhar and Houston, 1996](#); [Wiser, 2007](#); [Kotchen and Moore, 2007](#); [Conte and Jacobsen, 2014](#)), Australia ([Mewton and Cacho, 2011](#), [Ivanova, 2012](#)), Sweden ([Ek and Söderholm, 2008](#)), Norway ([Navrud and Bråten, 2007](#)), Finland ([Salmela and Varho, 2006](#)), UK ([Scarpa and Willis, 2010](#); [Diaz-Rainey and Tzavara, 2012](#)), Germany ([Menges et al., 2005](#)), Canada ([Rowlands et al., 2003](#)) and Japan ([Nomura and Akai, 2004](#)). Most of these studies address two questions: (1) what motivates consumers to participate in green electricity programs? (2) how do consumers' characteristics and a product's attributes (e.g. energy sources and payment mechanisms) affect participation? For instance, [Conte and Jacobsen \(2014\)](#) provide a recent summary of revealed-preference studies of US green electricity programs. Most have focused on consumer participation in such programs with the exception of [Jacobsen et al. \(2012\)](#). Conventional electricity is mostly generated from fossil fuels, which is by far the largest emitter of a number of local as well as global air pollutants, such as carbon and fine particulates. Demand for green electricity thus contributes to the mitigation of these pollutants. However, the contribution of this environmental consumerism to the overall environmental good does not depend on participation alone. If a buy-in “warm glow” effect is the dominant driver for participation, we would expect a low commitment level

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