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Solar Feed-In Tariffs: Examining fair and reasonable retail rates using cost avoidance estimates

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ABSTRACT

Growing Solar Photovoltaic (PV) electricity systems in geographically diverse regions presents a complex policy problem for governments. During 2013-16, the Queensland government in Australia, examined establishing a fair and reasonable retail Feed-in Tariff (FiT) policy, noting it regulates state retail electricity consumption prices. A combined cost avoidance and stakeholder analysis was applied to show that determination of a fair and reasonable FiT for all stakeholders, while aspirational, is difficult to achieve. Typically, agreement on a fair tariff rate will depend on stakeholders' relative position in energy supply chains (service providers, retailers, suppliers, customers, advocates), and interpretations of fairness that can be shaped by competition in the supply area. Also, increases in financial benefits to PV customers might be considered unreasonable by non-PV customers and retailers that experience increases in electricity prices and operating costs. Importantly, the application of a retail FiT in regional and isolated areas requires careful energy policy design, taking account of network losses, remote and isolated customer metering, cost effective network control technologies, and diesel generator operating limits. The study also observed that shifting funding of FiT schemes from electricity distributors to competitive retailers will likely have negative consequences for retail FiT offerings and PV customer servicing.

1. Introduction

Feed-in Tariff (FiT) policies are world leading instruments in Renewable Energy (RE) investment (REN21, 2016). Importantly, scholars have shown that FiT policies can expand energy diversity, contribute to emissions reductions (Couture et al., 2010; Mendonca et al., 2010; Bull et al., 2011), and deliver social and economic change (e.g. increased RE jobs and green employment opportunities, expanded RE systems manufacturing and industry growth, socially conscious energy use) (Mendonca, 2007a; Solangi et al., 2011; Zhao et al., 2011). However, these policies can also deliver less predictable results, with examples of lower than expected RE manufacturing and employment growth (del Rio and Gual, 2007; Cornfeld and Sauer, 2010) and high public costs (Martin and Rice, 2013) highlighting the potential for imperfections in FiT design and implementation (Frondel et al., 2008; Buckman and Diesendorf, 2010). Thus, while important for RE development, FiT policies may also render varying and sometimes unexpected outcomes for RE stakeholders.

In this study, we seek to explore and contrast what constitutes a fair and reasonable retail FiT for small scale solar PV systems using the geographically diverse state of Queensland, Australia as a setting. The retail FiT would be funded by competitive electricity retailers, as opposed to other feed-in schemes that are funded by governments or network service providers (QCA, 2013), or potentially from levies paid by fossil fuel generators (Tabatabaei et al., 2017). In doing this, our analysis examines some of those policy design parameters and assumptions associated with electricity export benefits, assesses network and electricity charges and cost shifting aimed at reducing high public costs (Olmos and Pérez-Arriaga, 2009), and exposes interpretations of FiT policy stakeholders' views in objective and subjective dimensions (Eid et al., 2014; Sommerfeld et al., 2017). Our research goals focus on improvements in retail FiT policy design, and determining whether a FiT policy can be fair and reasonable across stakeholders, particularly in such a geographically diverse state as Queensland (Eid et al., 2014; EPRI, 2014). Importantly, our results should inform enhanced public policy considerations and discourse, and assist with improved tariff instrument designs.

However, given some of the aforementioned variations in policy outcomes, and often vigorous debate among stakeholders over what constitutes fair and reasonable tariffs, it is important to establish an

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understanding of the terms *'fair'* and *'reasonable'* for this study. Thus, using regulatory protocols and terminology, fair was posited as 'being legally just, efficient and appropriately equitable' (Gielissen et al., 2008; QPC, 2016); while reasonable was termed a sum that is 'as much as is appropriate or sensible (in context)' (QCA, 2013; Oxford Dictionaries, 2015). Conjointly, these meanings provided an objective (regulatory based) and subjective (appropriateness based) foundation for examining FiTs, consistent with Council of Australian Governments (COAG) First National Principle for FiT Schemes: *'Micro renewable generation to receive fair and reasonable value for exported energy'*, where payments are equal to the value of that energy in the relevant energy market, subject to export timing (COAG, 2012). Accordingly, we have used these meanings as the basis for our analysis and research.

Importantly for this research, the Queensland Solar Bonus Scheme (QSBS) has supported substantial investment in solar PV (e.g. 517988 installed solar PV systems with 1786546 kW capacity, 3.45 kW average size systems as at June 2017) (Commonwealth of Australia, 2017). This considerable systemic growth provides a foundation for policy research and offers great impetus to expand our studies of less examined retail FiT policy designs, while interpreting and integrating multiple stakeholder perspectives. The rest of this article will discuss the theoretical background, research method, a discussion of our analyses and observations, and close out with concluding statements and energy policy implications.

2. Theoretical background

Extant FiT policy research has a rich tradition in economic and environmental studies (Menanteau et al., 2003; Haas et al., 2004; Komor and Bazilian, 2005; Jager-Waldau, 2007; Rickerson et al., 2007; Butler and Neuhoff, 2008), showing that sustained and secure long term tariffs have allowed individuals to confidently invest in RE, having regard to improved energy efficiency, emissions reductions, and enhanced environmental performance and protection (Rowlands, 2005; Mitchell et al., 2006; Jager-Waldau, 2007; Butler and Neuhoff, 2008; del Rio Gonzalez, 2008; Fouquet and Johansson, 2008; Couture and Gagnon, 2010; Schaffer and Bernauer, 2014). Other positive spin-offs from the application of sound FiT policies include limiting electricity price rises, increasing energy security, and improving energy user behaviours (Rathmann, 2007; Cornfeld and Sauer, 2010; Couture et al., 2010; Dıez-Mediavilla et al., 2010; Frondel et al., 2010). As these studies show, economic, environmental and social benefits are largely accruable and important to individual, community and industry stakeholders.

However, complementary research has also shown that FiT schemes can engender potential problems and operational difficulties for stakeholders including high infrastructure charges, increased administrative burdens, delayed PV system grid connections, high public costs, and inequitable windfall payments and revenues for industry and retail consumers able to benefit from the scheme (Haas et al., 2004; Komor and Bazilian, 2005; Ringel, 2006; Frondel et al., 2008; Dusonchet and Telaretti, 2010; Lipp, 2011; Yatchew and Baziliauskas, 2011). Some of these problems have been witnessed in several countries, such as Australia and Spain, and reflect the downside of deficiencies in FiT policy designs and implementations. Hence, relevant to this study, tariff designs can present a 'wicked policy problem' where industry development and employment (Frondel et al., 2008), equitable electricity prices (Mitchell et al., 2006), efficient energy markets (Ritger and Vidican, 2010; Yatchew and Baziliauskas, 2011), and socially responsible energy use (Tamas et al., 2010) must be finely balanced. Consequently, great care must be taken in the implementation and ongoing monitoring of these funded tariff programs.

In the spatial context, FiT policies and schemes are also critically informed by technical and technology parameters, including net and gross metering and infrastructure; transmission and distribution network hardening and robustness; diverse and remote grid access (including network loss adjustments); and isolated power networks that utilize older and legacy technologies (Pietruszko, 2006; Mendonca, 2007a, 2007b; De Shazo and Matulka, 2009; Couture et al., 2010; Mendonca et al., 2010; Bull et al., 2011). In addition, tariffs must reflect the diversity of the network in terms of isolated and off-grid systems, different energy technologies and their associated production costs, and energy demand profiling and shaping in distribution networks (Zahedi, 2006, 2009, 2010; Fouquet and Johansson, 2008; Plater, 2009; Mendonca et al., 2010; Ritger and Vidican, 2010). In sum, we note that these types of important technical and technology based issues form an intrinsic part of this study and, in the broader context, play a pivotal role in determining policies and tariff rates.

Specific to this setting, the FiT modelling in the study will be shaped by factors such as the opportunities to offer location based tariffs (Ayompe and Duffy, 2013); risk sharing between retailers and customers (Bauner and Crago, 2015; Satchwell et al., 2015); tariff setting mechanisms (i.e. market-based versus government regulated) (White et al., 2013); tariff model components (e.g. cost shifting/sharing, synchronous changes) (Satchwell et al., 2015); and PV customers' electricity systems (Hirvonen et al., 2015). There is also potential for different types of variable and sliding scale FiT designs to grow small scale solar PV energy supply and storage capacity, and expand distributed generation networks in local areas and regions (del Rio Gonzalez, 2008; Naci Celik et al., 2009; Mabee et al., 2012; Hirvonen et al., 2015). Thus, as reflected in the above extant literature, we would re-emphasize that FiT policy schemes are complex instruments that must take account of multiple social and technical factors, include a wide range of community, industry and government stakeholders' views and positions in the energy supply chain; and where possible should also address broader government and economic policy objectives (Couture et al., 2010).

3. Method

The research has been executed using a cost avoidance based policy analysis (Weimer and Vining, 2005), coupled with structured analysis of FiT stakeholders' data (Denzin and Lincoln, 2011; Martin and Rice, 2013; Miles et al., 2014). The study used this combinative analysis to illustrate the theory, use and impact of cost avoidance tariff setting simulations and methods (Couture and Cory, 2009; Pyrgou et al., 2016), while building into the cumulative tradition of FiT research (Freeman et al., 2004; Yatchew and Baziliauskas, 2011; Mabee et al., 2012). Consequently, archival documents, audited economic data and technical information provided by the state government and FiT stakeholders were analysed and integrated into the cost avoidance simulation (a spreadsheet based simulation program was developed to conduct the calculations, see later discussion) and stakeholder analysis research process (Weimer and Vining, 2005; Couture and Cory, 2009).

Stakeholder responses to an inquiry on fair and reasonable pricing of electricity generated by small scale solar PV were provided by the state regulator (QCA, 2013). Written statements were obtained from 22 small PV customers, 10 Non-Government Organisations (NGOs) (e.g. RE industry, electricity suppliers, retailers and consumer advocates), and 10 business firms (e.g. electricity generator, integrated energy firms, electricity distribution providers, solar PV manufacturers and installers, RE consultants) (QCA, 2013). Importantly, while acknowledging that the relatively small sample was limited to the 42 responses provided to the public inquiry, these stakeholders' statements represented a key set of data that was analysed, interpreted and integrated with the cost avoidance analysis to round out the research study (Denzin and Lincoln, 2011; Yanow and Schwartz-Shea, 2011).

Following Corley and Gioia (2004), a three part data structure was created using the QSR NVIVO Version 10 software (Walsh, 2003) with stakeholders' statements coded to: (i) the interpretation and calculation of a fair and reasonable FiT (financial benefits to retailers, risk sharing between retailers and PV customers, and impacts on retail customers); (ii) the approach to setting FiT rates (i.e. free market and/or