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The large-scale feed-in tariff reverse auction scheme in the Australian Capital Territory 2012, to 2016

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ABSTRACT

Feed-in tariffs offer renewable energy developers investor certainty but often at the cost of overly generous subsidisation. Reverse feed-in tariff auctions can overcome this problem but can be adversely affected by non-delivery risks, high auction costs and locational concentration. Between 2012 and 2016, the Australian Capital Territory Government in Australia conducted reverse auctions for the feed-in tariff rights to 640 MW of large-scale solar or wind generating capacity, the first such reverse auction program undertaken in the country. The auctions were used to meet a 100% by 2020 renewable electricity target. The auctions came to be assessed on a number of criteria, including local engagement and economic returns, rather than being narrowly focused on delivery risk and feed-in tariff price. Although the auction's successful projects were relatively concentrated, the auctions were successful in delivering significant local economic benefits as well as decreasing average feed-in tariff prices that declined by 23% for wind and 58% for solar over the period of the auctions driven, in part, by lower internal rates of return and lower interest rates. The delivery of projects and project commitments, and potential locational concentration, are key challenges that other reverse auction users may face.

1. Introduction

Australia has significant fossil fuel resources that historically have been the source of most of its electricity supply. In 2015–16, black and brown coal generated 63% of national electricity output while natural gas generated a further 22% [1]. However, Australia also has significant renewable energy resources. It receives the highest amount of solar radiation per unit of area on earth [2] and has one of the best wind resources in the world [3].

The paper is concerned with the early development of a 100% by 2020 renewable electricity target, and a reverse auction allocation process of feed-in tariffs for renewable electricity generators to support the target, by one of the sub-national governments of Australia, the Australian Capital Territory Government (ACT). It outlines the evolution of its renewable electricity and reverse auction policies as well as the assessment method and outcomes of the 4 reverse auctions it held between 2012 and 2016 that allocated feed-in tariff (FiT) entitlements for 640 MW of large-scale wind and solar generation capacity. The ACT is located in southeastern Australia that includes the nation's capital, Canberra, and has a population of around 410,000 [4].

Australia has used its large fossil fuel resources to develop a large amount of fossil fuel based electricity generation but has developed relatively little renewable electricity generation. The national renewable share of electricity generation reached a peak of 23% in 1965 before declining to about 9% in 2000 [5]. By 2015–16, the share had recovered to 14.8%, still well below its mid-1960s peak [1]. Australia's emphasis on fossil fuel based energy development has left it with high total and per capita levels of greenhouse gas (GHG) emissions. In 2014, it emitted 590 MtCO2e (excluding land-use change emissions), the thirteenth highest national level of GHG emissions [6]. In 2014, Australia's per capita emissions were 3.1 times the average European Union level of per capita GHG emission and 4.0 times the global average [6]. In 2017, electricity generation accounted for 35% of the country's GHG emissions (including land-use change and forestry) [7].

FiTs are a form of price-based renewable energy support mechanism often argued to be effective at reducing renewable electricity development risks [8,9] [10]; [11–15]. However, their reduced developer risk can come at the expense of generous levels of subsidy [16,17]. Like similar reverse auction schemes used in other countries, the ACT reverse auction scheme mitigated the risk

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of generous subsidisation by using a competitive process to award FiT entitlements to those proposals that received high assessed scores [18].

There have been many studies on the effectiveness of the use of FiTs [11] [12,13,19,20]; [21]; [60]. The use of competitively allocated FiTs has been the subject of further studies [18,22–25]; [26]. In addition, there have been analyses of the reverse auction process used in the United Kingdom's Non-Fossil Fuel Obligation program ([27,28,61]. There have also been reviews of Australia's renewable energy scheme [29–35]. In addition, the use of FiTs and carbon pricing schemes in Australia have been examined [36–38] as have scenarios under which the country could transition to 100% renewable electricity supply [39–41].

This paper contributes to knowledge by analysing the implementation of the FiT reverse auction scheme in the ACT across the 5 years of its operation. It adds to an earlier published review of the first 2 years of the reverse auction scheme [42], which only considered the first reverse auction held by the ACT. This paper compares the processes and outcomes of all 4 of its reverse auctions including FiT price drivers. The paper references data collected by the scheme's administrators, the Environment, Planning and Sustainable Development Directorate (EPSDD), an agency of the ACT Government.

The paper is structured as follows: Section 2 outlines the general strengths, weaknesses and design choices of reverse auction schemes, Section 3 outlines the evolution of the ACT reverse auction scheme and its design elements, Section 4 details the outcomes of the ACT auctions and Section 5 concludes the paper.

2. Overview of strengths, weaknesses and design options for reverse auction schemes

In recent years, the number of countries using reverse auction FiT schemes has significantly increased from less than 10 in 2005 to at least 67 by 2016 [43]. Their rise in popularity can be attributed to the fact that, like conventional FiT schemes, they provide revenue certainty to renewable energy developers while controlling support costs through limiting supported capacity.

Table 1 summarises the major weaknesses and potential remedies of reverse auctions [18,22]; [44]). Uncertainty about bid delivery is widely viewed as the greatest weakness of a reverse auction process [18]. The UK Non-Fossil Fuel Obligation, for example, which held 5 FiT reverse auctions between 1990 and 1998, experienced high bid prices, and high completion rates, in its early auctions but, as bid FiT prices reduced in later auctions, completion rates fell to less than half [27]. Bid delivery risk management options include the lodgement of delivery bonds and a requirement that generators prove their credentials in a prequalification stage. The other auction weaknesses can also be avoided through design although there is likely to be trade-offs between the competitiveness of submitted FiT prices and restriction of bid parameters.

Table 1
Reverse auction weaknesses and potential remedies.

Weakness	Potential remedy
Uncertainty about bid delivery	Delivery bonds, prequalification requirement
Uncertainty about the FiT prices of successful bids	Inherent feature of reverse auctions
High transaction and administration costs	Use of sealed bids, non-indexed FiT prices, streamlined bid document requirements, minimum of non-price assessment criteria
Discouragement of small to medium sized bidder participation	Use of low bid thresholds, minimisation of bid documentation
Locational concentration of successful projects in high resource quality areas	Discrimination against bid concentration

Source: [18,22] [44].

A large number of design variations can be introduced into FiT reverse auctions, including variations relating to: bidding method, FiT payment, technology coverage, use of output or capacity as key metric, prequalification requirements and number of assessment criteria. There are several ways in which bidding can be undertaken, one is through a confidential sealed-bid system. Another is through a descending-clock system where bidders have access to price information of other bids and can dynamically react to it until the FiT price descends to a point where the target capacity equals the capacity offered [18,22,23].

The most popular type of FiT payment structure is a pay-as-you-bid system in which bidders are paid according to their submitted FiT price. Other systems pay according to the FiT price of the last accepted bid or average submitted FiT prices [26]. The FiT price can either represent a fixed premium paid in addition to wholesale market earnings or a 'contract-for-difference' premium where the FiT price premium varies according to the amount of wholesale earnings [26]. The period over which a FiT that is paid to a successful bidder can also vary although 15–25 years is most common [26].

Some auctions protect bidders against exchange rate risks by nominating FiT prices in a foreign currency and some protect against inflation risk by escalating FiT prices each year according to local inflation indices [44]. With respect to technology coverage, technology specific auctions are the most popular type of auction coverage but multi-technology auctions are sometimes held [22,23] [44]; [26].

Some auctions require bids to be submitted in capacity (MW) terms, the most popular approach, while others use output (MWh) as the key metric, with minimum and maximum capacity, or generation, thresholds potentially imposed [26]. With respect to the potential imposition of prequalification requirements, such as requiring eligible bids to hold specified permits, this can assist in identifying projects with low delivery risk [26]. Many reverse auction systems assess bids on submitted FiT prices alone, which can lower support and auction transaction costs. However, other auction systems base assessment on several criteria, which can assist in boosting a bid's social acceptability as well as requiring it to promote local economic development [26].

3. Evolution of the ACT reverse auction scheme and major design elements

The ACT's reverse auction allocations of FiT entitlements were the first major use of the mechanism in Australia. The ACT Government's renewable energy policies have evolved since 2008 when it first legislated a gross FiT for small to medium sized generators of up to 200 kW, the most generous small-scaled FiT scheme in Australia at the time [37].

3.1. Policy development – greenhouse gas reduction and renewable energy targets

The 2008 FiT scheme formed part of the ACT Government's GHG reduction initiatives. In October 2010, the ACT Government passed legislation that mandated a 40% reduction on 1990 level GHG emissions by 2020 and zero net emissions by 2060. In 2016, the zero emissions target year was brought forward to 2050 then to 2045 in 2018. The target is significantly more ambitious than the current Australian GHG reduction target that aims to reduce