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Renewable Energy Zones: generator cost allocation under uncertainty

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Renewable Energy Zones (REZs) are crucial in Australia's National Electricity Market, aimed at coordinating multiple renewable projects to minimize marginal transmission costs, encroachment on private land, environmental and agricultural objectives and cultural sites. REZs remain essential despite Australia's vast landscape.

Different Australian states have adopted varied approaches to REZ implementation. The Queensland region pursued 'merchant REZs,' which involve non-regulated augmentations extending from the transmission backbone, and largely underwritten by generator user charges rather than end-users via the Regulatory Asset Base. The model facilitated rapid deployment, with three REZs planned, developed, and energized within four years, adding a cumulative 4.5GW hosting capacity. At the time of writing, two additional REZs, each with a capacity of approximately 2.5GW, were under development.

Despite its success, the Queensland model faces challenges. REZs necessitate multiple projects to connect before the transmission infrastructure reaches financial viability. However, wind and solar projects take years to develop and secure financing, making simultaneous generator commitments a matter of chance. Additionally, as REZs extend further from the transmission backbone, transmission costs (and generator user charges) increase. As a result, over time we should expect REZ user charges to exceed the generators' credible capacity to pay.

This article addresses three critical questions: (1). How should REZ costs be efficiently allocated among connecting generators with varying locations and transmission network asset requirements? (2). How should user charges and cost recovery be managed under

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uncertainty, particularly with transient idle capacity? (3). How should user charges be structured if REZ costs surpass generators' credible capacity to pay?

The approach in this article identifies REZ transmission assets, their capital costs, and the optimal mix of connecting generators. Queensland's wind and solar complementarity suggests the efficient generation capacity will always exceed REZ transmission network transfer capacity. Employing the Shapley value method, the article defines fair user charges and extends previous work on managing idle capacity amid rising capital costs. These charges are bound by the capacity of generators to pay. To policy mechanisms are deployed to deal with any shortfall, viz. (1) concessional financing to help with transient idle capacity, and (2) allocating any residual to the Regulatory Asset Base on the basis that any such REZ is welfare maximising.