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CONTEXT AND BACKGROUND

In response to the effects of carbon emissions on climate change, many governments seek to increase the amount of electricity generated from clean and renewable sources. To encourage investment in such generation, many policymakers offer supports to renewable energy generators. In the absence of any supports, renewable energy generators would only receive the wholesale electricity price for each unit of electricity generated. Wholesale electricity prices vary significantly. This is due to uncertain weather patterns and variable commodity prices such as gas and oil. This poses a significant risk for investors as low electricity prices may lead them to making a loss.

For many governments, Feed-in Tariffs (FiTs) are the preferred policy support mechanism for renewable electricity. FiTs are extra monies given to electricity generators to supplement the wholesale electricity price they receive. FiTs may also reduce the risks associated with low electricity prices by offering a guaranteed set payment per unit of electricity generated. However, FiTs cannot eliminate the risk associated with uncertain electricity market prices, but rather transfer it to a counterparty. This counterparty is typically electricity consumers who must cover the cost of FiTs, and the risk associated with them, through extra charges on their consumption. While FiTs will encourage investment in renewable energy, setting them at an overly generous level places an excessive burden on consumers. The aim of this research is to address this trade-off fairly and efficiently.

[1] This Bulletin summarises the findings from: Mel T. Devine, Niall Farrell and William T. Lee, "Optimising feed-in tariff design through efficient risk allocation", *Sustainable Energy, Grids and Networks*, Vol. 9, 2017.
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There are many types of FiTs for renewable energy. For example, a flat-rate FiT design guarantees renewable energy investors a fixed price per unit of electricity generated, regardless of the level of wholesale prices. This policy is risky and potentially costly for consumers. They are exposed to the uncertain nature of wholesale electricity prices as, if prices are low, they must make up the difference with the guaranteed price investors receive.

Another FiT design is a price premium FiT, where renewable energy investors receive the wholesale price plus an extra premium for each unit of electricity generated. This policy is less risky for consumers as they only pay the premium, a fixed amount, and are not exposed to the fluctuations of wholesale prices. However, too much risk cannot be placed on investors as this would provide a disincentive for investment in renewable energy generation.

CONTRIBUTION OF THE RESEARCH

In this research, we develop a methodology to efficiently set FiT levels, e.g., how high a FiT guaranteed price or a FiT premium should be. We also compare different FiTs and identify the most appropriate designs under varying levels of risk appetite (or aversion) for both investors and consumers. We consider the aforementioned flat-rate and premium FiTs as well as FiTs that divide the risk between investors and consumers. A case study for the Irish electricity market is considered as part of the analysis.

The results show that flat-rate FiT designs are the preferred policy choice when consumers are not risk averse whilst price premium FiT designs are preferred when investors are not risk averse. When consumers and investors are both risk-averse, FiT designs that divide the risk associated with uncertain wholesale electricity prices are preferred. However, the results also show that investor preferences are more influential than those of consumers.

Determining the most efficient FiT design is of increasing importance as renewable deployment grows and the associated costs account for a larger share of consumers' bills. Furthermore, increased renewable deployment potentially increases consumer exposure and aversion to uncertain wholesale electricity prices. Consequently, this research suggests that the most appropriate FiT design changes as the importance and cost of renewable energy deployment grows. Current policy should anticipate this and put in place flexible legislative measures to accommodate changes in preferred specification for FiT contracts issued in the future.

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