Balancing environmental incentives and fairness in household electricity distribution tariffs

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BACKGROUND

- Electricity distribution has been revolutionised by a range of technological innovation, in particular distributed generation and electric vehicle charging. By adopting renewable energy systems such as solar photovoltaic (PV) to generate their own electricity, households both make an important contribution to the transition towards cleaner energy and enhance the flexibility potential of the distribution network.
- Various incentives have encouraged renewable energy generation by households. For example, net metering schemes that typically oblige utilities to buy any excess generation from self-generating households. However, such generous incentive schemes may leave any legacy and forward-looking costs uncovered, putting burdens on either the Distribution System Operators, or households who have not installed micro-generation. Ironically, such issues are exacerbated if the incentives have successfully stimulated extensive solar PV penetration, and tariffs feature a high component of per kWh charge. The co-existence of distributed generation and volume-based network tariffs triggers discussions on distributional fairness even in the absence of net metering schemes.
- The potential conflicts between sustainability, cost recovery and fairness raise the importance of understanding the likely distributional impacts of introducing tariff reforms, with and without incentive schemes such as net metering.
- The timeliness of this paper is demonstrated by the European Commission's recent call for "a fair deal for consumers", alongside an increase both in energy efficiency and in the share of renewable sources. In the UK, Ofgem has consulted on removing certain incentive schemes for distributed generation and changes to network tariffs that recover both forward-looking and residual costs "so that costs are shared fairly now and in the future".

METHODOLOGY

- We discuss relevant concepts of fairness in the context of tariff design/reform of a changing electricity distribution network. We review the major existing charging methodologies (including tariff components and charging bases) and their applications, both in Europe and in North America.
- We then simulate bills under different tariff scenarios for 'notional' households whose energy use profiles and ability to self-generate vary, within a stylised model where the costs of the distribution system are held constant.

KEY FINDINGS

- Our simulation results demonstrate how a tariff based mostly on volumetric consumption offers strong incentives to encourage deployment of renewable energy systems, but may substantially increase the bill burdens of households without solar PV.
- Such trade-off between incentives to self-generate and distributional concerns is aggravated by net metering.
- When the tariff becomes more nuanced and cost-reflective, such as through a capacity component or a Time-of-Use (ToU) element, then any cost reduction from self-generation

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depends on how peak demand is affected by self-generation. If self-generating consumers typically rely on the general grid for peak time supply, capacity and ToU tariffs do not guarantee savings for micro generators, and therefore can provide appropriate consumption signals while providing some mitigation of redistributive concerns.

POLICY ISSUES

- Our findings illustrate the potential tension between designing electricity tariffs to maximise incentives for adopting cleaner energy generation and potentially adverse distributional effects, especially in a system where distribution costs change little as a result of new patterns of use, and the cost of the incentives are met by other consumers within the system (i.e. there are few external subsidies).
- The combination of volumetric tariffs and incentive schemes can be appropriate when few households use solar PV and the policy priority is to promote the deployment of renewable energy in the residential sector. However, as solar PV installers scale up and the policy priority turns to reducing distributional burden and specific cross-subsidies, incentive schemes such as net metering may require modification so that tariffs become more cost-reflective and distributionally fair, especially given that some of the non-adopters may have been excluded from participation by lower income, wealth or dwelling rights.
- The challenge is not just how to redesign distribution tariffs so that they incorporate and incentivise the wider changes to the electricity system, but how to estimate the associated aggregate and distributional impacts on different consumer groups and confront any adverse consequence, especially for vulnerable consumers. This may suggest a gradual and smooth transition, even if it delays adaption to changes and benefits for the overall system.

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