

# **„Welfare and redistribution in residential electricity markets with solar power”**

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## **Abstract**

Solar energy production has experienced an exponential growth worldwide over the last decade, mostly driven by government subsidies and declining solar panels’ production costs. This is environmentally desirable, but an increasing number of households with solar power raises two challenges for regulators: network financing and vertical equity. First, these households still require network energy, leaving the fixed grid maintenance costs unchanged. However, producing their own energy, they contribute less to grid costs, mostly financed with consumption-based tariffs. Second, these households are usually richer, shifting the burden of grid costs onto low income ones. In this paper we address these challenges proposing alternative tariff schemes that incentivize solar photovoltaic (PV) adoptions, while guaranteeing the sustainability and equitable distribution of network costs. We use a unique matched dataset on energy consumption, income, wealth, and building characteristics for around 180,000 households in the Canton of Bern (Switzerland) in 2008-2013 to estimate models of energy demand and PV installation. Using counterfactual policy experiments we propose an optimal tariff design where the regulator achieves vertical equity, subject to a minimum green-energy target and a network financing constraint. We find that it is optimal for the regulator to stimulate PV adoption subsidizing solar panels’ fixed costs, financing this subsidy with an increase in both fixed grid fees and variable grid charges.