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Title: "Urban energy commons", shared renewable generator sizing and electricity consumption behavior change

Abstract: The 'energy transition' has been framed as a problem of supply of sustainable forms of energy, but increasing demand particularly for electricity, suggests the need for an alignment of demand behaviour with the changed capacity and reduced reliability of a renewable electricity supply. Since the majority of final energy consumed is consumed in the home or in transport, it is desirable to approach the problem of demand as an urban behaviour change problem with the potential for the overflow of benefits to change consumption habits more broadly. The current work covers the deployment of a networked in-home energy management display to three groups of five adjacent neighbours (each) in Melbourne, Australia in 2018. The display, which was made for this study, delivered 'group messages' which simulated that the supply of electricity was unreliable and rivalrous; specifically it reported on co-owned, shared renewable resource that offset grid supplied electricity. The study cites a case study of the use of group messages (specifically community-as-consumer) for urban water demand management, which has halved water demand in Melbourne (Liubinas 2012). The study in-home displays allowed occupants to issue positive- and negative- reinforcement to other group members (with identity blinded) with certain methodology from Ostrom (1994) and Fehr and GÃ¤chter (2000). The displays were all utilised by participants and group electricity demand (collected half-hourly), adjusted via controls, was reduced by the signals. An expected result where the display would also cause changes in time-of-use (to align better with solar productivity) was not observed. Some effects of the intervention itself were analysed for Hawthorne effects from a lead-up period to the in-home display deployment, and this found a limited potential for some study effects. The study was not able to rigorously or separately test the impact of specific signals, but this is discussed as desirable in future work. The results are discussed as potentially important for urban energy sharing microgrids where group behaviour effects could be harnessed as the basis of obtaining a conservative group demand profile which, as simulated in this study, would be used to numerically size a real co-owned renewable system so that it is a good "fit" with collaborative electricity demand. Such microgrids could occur 'bottom-up' without utility or government cooperation and could significantly change demand so that supply can more quickly be substituted with renewables.