Does disaggregated electricity feedback reduce domestic electricity consumption? A systematic review of the literature

Average energy reductions

We examine twelve studies on the efficacy of disaggregated electricity feedback. The weighted-average energy reduction across these studies is 4.5%. There is a lot of uncertainty associated with the existing evidence and many subtleties and caveats. For full details, please see Kelly and Knottenbelt 2016.

Biases

4.5% is likely to be a positively-biased estimate of savings achievable across the entire population because all twelve studies are likely to over-estimate the true energy reductions in a way we term “vip-o-late bias.” Hence we must treat the effect of disaggregated feedback on the general population. The average opt-in rate is 18%. Hence a crude estimate of the population-wide energy reductions with disaggregated feedback is 18% ± 0.7%. Many of the studies are prone to multiple other sources of bias.

Disaggregated versus aggregate feedback

Disaggregation may not be required to achieve these energy reductions. Aggregate feedback also drives 3% reductions (Davies et al., 2013); and the four studies which directly compared aggregate feedback against disaggregated feedback (McCalley & Midden 2002, Krishnamurti et al., 2013, Churchwell et al., 2014, Sokoloski 2015) found that aggregate feedback is at least as effective as disaggregated feedback, possibly because web apps are viewed less often than in-home displays (in the short-term, at least) and because some users do not trust fine-grained disaggregation (although this may be an issue with the specific user interface studied).

Disaggregation has many uses beyond those discussed here. But, on the specific question of promoting energy reduction in the general population, there is no robust evidence that current forms of disaggregated feedback are more effective than aggregate energy feedback.

Energy enthusiasts

Disaggregated electricity feedback may help a motivated subgroup of the population (‘energy enthusiasts’) to save more energy but fine-grained disaggregation may not be necessary to achieve these energy savings. HEA achieved 6.1% reductions despite using coarse-granularity disaggregated feedback.

Effectiveness may increase in the future

The effectiveness of disaggregated feedback may increase if: • The general population becomes more energy-conscious (e.g. if energy prices rise or concern about climate change deepens); • Or if users’ trust in fine-grained disaggregation increases; • Or if innovative new approaches or alternative disaggregation strategies (e.g. disaggregation by behaviour rather than by appliance) out-perform existing feedback.

More field studies required?

• Need large, opt-out, randomised controlled trial.
• Compare agg. feedback on HVAC vs. disag. feedback on HVAC.
• Compare (agg. on HD with disag. on wifi) vs. agg. on HD.
• Compare fine-grained versus coarse-grained disag. feedback.

References