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Title: Energy efficiency and flexibility: How behavioral change can be triggered with Smart Meter€" lessons from Germany

Abstract: Among the global challenges of climate change in the 21 century rank the decrease of energy consumption and the decarbonization of energy production. Both challenges entail a change of user behavior in a way that 1) energy is used efficient to decrease the energy consumption and 2) energy is used more flexible to benefit the power grid as this is a core requirement of any energy production model with a high share of renewable energy. So the question arises, what motivates users to change their behavior reasonable and sustainable to face these challenges? Discovergy is an independent metering operator in Germany. Through advanced smart metering systems, we offer our customers real-time monitoring, feedback and forecasts on their electricity consumption and production levels. Using real-time data with 2-second granularity, we are able to reliably identify the most relevant appliances by their consumption patterns like fridge, washing machine, oven, dish washer. Furthermore, we simultaneously visualize production and consumption data in real-time and forecasts to inform behavioral decisions such as: What appliance should I run / turn off to maximize self-consumption? What is the optimal time to use an appliance? With these services, we enable our customers to get detailed information on how much energy they use and what constitutes their consumption behaviour. In this way we want to help motivate behavioural change to a lowered, more efficient and flexible energy consumption.   Many customers have been able to reduce their electricity consumption by 15% and more, all with minimal impact on their daily routine and quality of life. This was achieved by

- reducing stand-by and always-on consumption
- turning-off lights and appliances when they are not being used
- replacing inefficient appliances such as old fridges, pumps, light bulbs, etc.
- identifying inefficiently working appliances such as iced fridges, clogged pumps, etc.

And we expect to be able to increase self-consumption (as percentage of the total consumption) by 10% and more for a typical household again with minimal impact on daily routine and quality of life. We further try to enhance customers motivation for behavioral change by imitation and group effects. We examining what forms of benchmarking and social comparison can improve results even further and how to maintain high levels of user engagement and energy efficient behavior in the long run. Thus, we try to scale up energy efficiency and flexibility to face the global challenges of climate change.