

# Improve Privacy by Negotiating Data in the Future Electric Energy System

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## Abstract

The main goal of this PhD project is to build a system that gives residential consumers' transparency in what information there are collected about them and put them in a position where they control the dissemination of personal data.

Data collected from meters inside the residential houses will in the future energy system (also known as the *Smart Grid*) provide valuable information of how and when electricity is used. Generally, the more data that can be collected, the better the energy service providers can predict and guide residential consumers about their electricity usage. This can help the electrical grid operators with integrating renewable energy sources like wind and solar energy, instead of non-sustainable energy sources such as coal and oil.

But make no mistake, the data collected provide detailed insight about our personal behavior. This can not only reveal the type of equipment that is used and what time it is used, but can ultimately reveal the type of persons we are. Information about, what is our favorite television program and what time you typically leave the house, are some of the things researchers have extracted from main meter data. Linking this will more granular data from sub-meters installed and other information already available on the Internet about you, generate a dangerous cocktail that threatens the individual's privacy.

The awareness about the privacy concerns have generated a road block for other smart grid systems. Proposed privacy-aware systems assume that the data from the meters can be aggregated on a trusted third party. While this gives some computational advantages, recent privacy disclosures have shown us that having this assumption might be hard to achieve. Instead, privacy recommendations have suggested us to built privacy *into* the system and give the consumer control of data dissemination.

Since grid operators have an alternating demand on the information necessary for balancing the grid and energy service providers only provide as good a service as the data allowed them, data accuracy and precision have a certain value in time. The price for that value can be therefore be negotiated between residential consumer and grid operator, just like the price of electricity is negotiated. The higher demand for control and monitoring from grid operator's side, the higher deduction of the electricity price can the residential consumer demand. The PhD project will leverage this concept and implement a system that supports both the grid operator and residential consumer.

The outcome of the project results in a home device connected to the Internet and a service running in the cloud. The bargaining process between the home device and cloud service is based on:

- Price for the electricity
- CO<sub>2</sub> emission footprint for buying electricity
- Necessary time resolution of sub-meter data.