# Industrial PhD project: Data-driven models for energy advising leading to behavioral changes in SMEs and residences

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### **Project Description**

With the increasing installation of smart meters for measuring electricity consumption and with the possibility to access these data [Engrosmodellen], there is a huge potential to give energy



Your personal energy assistant

**DTU Compute** Department of Applied Mathematics and Computer Science



advice directly to the consumers based on in depth analysis of their own data.

In cooperation with SEAS-NVE the focus in this project is to develop models describing the underlying occupant behaviour based on time series of electricity consumption with hourly time resolution. This is used for direct energy advice to residences and small and medium sized enterprises (SME's) through the mobile app Watts.

## **Research Objectives**

- To develop statistical models for analysis of hourly measures of electricity consumption in residences and SMEs.
- To develop statistical models for classifying and describing occupant behavior in residences and SMEs.
- To develop statistical models for forecasting electricity consumption in single residences and SMEs. Both short-term and long-term load



#### With deep knowledge of the

Watts is a digital energy assistant and is the first app on the market that lets the users react proactively on their energy consumption.

On the basis of developed data-driven models Watts understands the distinctive energy profile for every user. Using this information Watts can identify and explain deviations from the personal energy profile so timely notifications can be made.



forecast.

- To develop statistical models for disaggregation of the measured consumption in separate components, like heating and base-load.
- To investigate the effect of direct energy advice based on the developed models. And to explore the possibilities of using gamification in order to achieve energy savings.

## **Project Parties**

DTU Compute, section of Dynamical Systems: Core competences comprises time series analysis and return maps, stochastic and nonlinear systems of differential equations, including partial differential equations, adaptive and stochastic control theory and parameter estimation. The focus is both on deterministic and stochastic dynamics covering a broad range of applied and industrially relevant topics, spanning from applied contributions to more theoretically oriented research. energy profiles, predictions can assist the users in performing proactive actions to save energy and based on insights derived from the data provide intelligent advice to help optimize the energy behavior in the household.

The product is built as a cloud-service and is developed in an agile way using value proposition design and close interaction with end users.



SEAS-NVE: One of the largest energy and fiber companies and the largest cooperatively owned Energy company in Denmark. Situated in Svinninge and Haslev, their primary supply area is west and south Zealand.

ITU: Center for Computer Games Research at ITU is Denmark's only scientific center for computer games research. The researchers have backgrounds in the humanities, computer science and sociology. They deal with subjects such as theoretical game analysis, game aesthetics, ethnographic studies of game communities, game design theory, artificial intelligence and game experience.

Figure : The current distribution of the 24.000 Watts users in Denmark