

# Testing of a Powerline-Based Pilot System for Load Control and Smart Metering

## Master Thesis 2023

### Graduate



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**Introduction:** Decentralised power generation and increasing electrification in the areas of mobility and heat place considerable demands on the power grid of the future. In order to avoid expensive grid expansion, solutions are to be found through grid optimisation.

As part of the pilot project OrtsNetz, EKZ collaborates with ETH to investigate the possibility of controlling customer loads in the municipality of Winkel. The goal of load control is to reduce the peaks in the grid. EKZ is providing the system for smart metering and load control based on Powerline Communication (PLC). PLC gateways, load switching devices and the corresponding IT systems were newly developed for the project. The entire system will go into operation in autumn 2023 and must be tested extensively in the laboratory beforehand.

**Approach:** This thesis investigates the implementation of load switching at the customer's premises for the OrtsNetz project. Working with EKZ and external partners, a concept for the concrete implementation of load switching is developed. The concept is based on already defined hardware components. Suitable additional hardware components and installation variants are examined, and a test setup is developed and implemented. Necessary software interfaces with all the partners involved are defined, developed and implemented. Furthermore, in collaboration with the company Neuron AG, the developed software components from EKZ and ETH including artificial intelligence are integrated in the Load Control Service Agent.

The main objective of this thesis is to test and optimize the system prior to its installation in the field. The testing should ensure a smooth installation of the system at the customer's site, and enable a successful start of the field tests. Test procedures are defined for all critical functions. The system is tested in two stages. During the first stage, individual device functions and device-to-device interfaces are tested. During the second stage, all required functionalities are tested over the entire existing communication path from the cloud to the customer's devices. In summary, this thesis describes and tests the design of the components and software that are installed at the customer's premises. Thus, the thesis forms the basis for the installation and operation of the devices in the field.

**Conclusion:** In the course of the thesis, the system design was defined in collaboration with all the partners involved. With the exception of the cloud infrastructure, i. e. the Load Control Master Agent, which was not part of this thesis, the implementation of all necessary components for the operation of the pilot tests could be realised. A test setup was planned, implemented and successfully used for all tests. In addition, test procedures were developed for all relevant functions. The test procedures include the

function in normal operation and the behaviour in case of errors such as communication interruptions or power failures. The final tests showed that the implemented system works and can therefore be installed at the customer's premises as it runs in the test setup. Once the Load Control Master Agent has been completed by EKZ, the system is complete and can be operated as planned. The development of the load control and metering system has therefore been successful and the pilot test OrtsNetz can be started as planned.

Load control and metering at the customer. Load control devices on the left. Smart meter on the right. Own presentation



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### Subject Area

Energy and Environment

### Project Partner

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