

Electricity meter cooperating with the cloud application

1. Purpose of the exercise:

The exercise aims to familiarize students with the parameters and possibilities of measuring the parameters of the power network by an electricity meter cooperating with a cloud application.

2. Tasks to be completed:

- To configure the connection between the energy meter and cloud computing.
- To implement an application monitoring energy consumption.
- To implement a simplified energy management system in the building.
- To analyze energy consumption patterns.

3. Theoretical introduction

Digital energy meters, also known as smart meters or AMI (Advanced Metering Infrastructure), are technologically advanced devices that enable communication between electricity consumers. In contrast to traditional meters, they enable real-time data collection, processing, and transmission of energy consumption data.

In studying a smart energy meter that works with cloud services, the critical concept is using cloud infrastructure to store and process energy consumption data. The energy consumption data collected by the smart meter can be sent to the cloud, where it is stored and processed.

An essential aspect of the study is analyzing the collected data on energy consumption. Thanks to cloud services, it is possible to use advanced analytical algorithms to analyze this data. This way, it is possible to identify energy consumption patterns, detect anomalies, forecast future energy needs, and develop optimal energy management strategies. In addition, cloud services allow access to this data from any place and device, making it easier to monitor and manage electricity at various levels: individual, household, enterprise, or even at the power grid level.





Figure 1. Energy meter with the possibility of remote reading

Integrating smart energy meters with cloud services opens up new opportunities for effective energy management, cost optimization, increasing energy awareness, and supporting sustainable development. It is beneficial not only for energy consumers but also for energy service providers who can better understand and adapt to the needs of their customers.

The exercise will explore the possibilities of collecting, analyzing, and managing energy consumption data using cloud infrastructure.

4. Guidance questions - check yourself

- What are the main benefits of using smart energy meters cooperating with cloud services?
- What are the differences between AMI and a classic electricity meter?
- What are the potential challenges of implementing smart energy meters and their integration with cloud services?
- What types of data can be collected with a smart energy meter? What information can be extracted from them, and how can they be used for effective energy management?

What is the importance of data security and privacy in smart meters and cloud services?

What security measures can be implemented?

- What are the potential applications of energy data analytics in the context of smart meters and cloud services? What are the benefits of such an analysis?
- What could be the potential socio-economic impacts related to developing smart energy meters and cloud services in the context of energy efficiency and sustainability?

5. Exercise program

- A. Via a web browser, connect to the energy meter (the teacher provides data necessary for connection)
- B. Familiarize yourself with the energy meter management application's user interface and available widgets.
- C. In the "Management" tab, personalize data on the user, groups, and costs according to the instructor's instructions.
- D. Via a web browser, connect to the cloud service <https://sitemanager.ability.abb> (the teacher provides data necessary for connection)
- E. Familiarize yourself with the user interface and available widgets of the cloud application.
- F. In the "Explore -> Connectivity" tab, check the status of the meter's connection to the cloud service.
- G. Energy consumption monitoring application

Create a new dashboard for the most effective energy consumption monitoring from the energy meter interface and the cloud application. The task is to design and create a dashboard that allows users to monitor and control energy consumption in real-time. Use smart meter data and cloud services to create a user interface displaying current energy consumption and generating reports and analyses.

- H. Building an energy management system



The task is to develop a building energy management system that uses smart energy meters and cloud services. Identify energy optimization areas such as lighting, heating, air conditioning, etc., and propose management strategies considering user preferences, energy costs, and environmental impact.

I. Analysis of energy consumption patterns

Collect energy consumption data from your smart meter and use cloud services to analyze this data. Identify energy consumption patterns over different periods (e.g., daily, weekly, seasonal) and look for correlations between consumption and other factors such as weather or working hours. Apply data visualization techniques to understand the results better.

J. Forecasting energy consumption

Use historical data on energy consumption to be implemented in a forecast model that predicts future energy demand.