Energy implications of residential energy monitoring systems

Michael Preisel, Adriana Díaz, Florian Krautzer, and Wolfgang Wimmer
ECODESIGN company GmbH
Neubaugasse 25/2/3 1070 Vienna, Austria
preisel@ecodesign-company.com

Abstract—Smart meter roll-outs are under way and end users are increasingly installing energy monitoring systems (EMS). A comprehensive estimate of efficiency has to include the power use of the infrastructure itself as there may be trade-offs. This applied paper will present the related undertakings in the current IEA-4E Electronic Devices and Networks Annex (EDNA). It will look to describe the features of commonly available systems, present results from an energy measurement of at least one representative EMS and develop user scenarios to identify the possible range of energy consumption of these systems.

Keywords—energy monitoring system; energy consumption; IEA; 4E; EDNA

I. INTRODUCTION

The EU Energy Efficiency Directive 2012/27/EU and its national implementation in the form of national energy efficiency laws, promotes the introduction of smart meter infrastructure (SMI) and energy monitoring systems (EMS). As a result, smart meter roll-outs are under way and end users are increasingly installing energy monitoring systems (EMS) to better understand and manage the energy consumption of appliances in their homes.

In this context, the SMI consists of the smart meter (SM) and everything needed for the SM to communicate with a Distribution System Operator (DSO). The EMS on the other hand is a system used to visualise the electrical energy consumption in a household to the consumer. This information has to be accessible to the user in almost real-time and/or on-demand. The data should include the current consumption as well as logged data. Regular billing intervals (e.g. monthly) do not constitute an EMS because the data is neither available in almost real-time nor on demand.

Policy makers expect that, in the short term, these measures will increase the energy efficiency of households, by providing the user with relevant information to make more informed decisions. The hypothesis that improved feedback will have both immediate (motivational) and longer-term (learning) effects on energy use is supported by a large number of studies. On average, the effect is typically of the order of a few per cent compared with households without the feedback [1].

II. OBJECTIVES

Providing feedback on energy consumption however requires suitable hardware which has to be supplied with power. A bi-National technical comparison, undertaken between 2010 and 2012 in Austria and Switzerland regarding the energy consumption of the planned smart metering infrastructure, showed that depending on the technology, SMI can have considerable own energy consumption [2]. A comprehensive estimate of efficiency has to include the power use of the infrastructure itself, as there might be trade-offs between the energy consumption resulting from the deployment of smart metering and EMS infrastructure, and the potential gains at the consumer side.

The currently available EMS are often part of, or integrated into home automation systems which offer additional functionalities beyond energy monitoring. Positive changes from user behaviour may therefore be offset by the energy consumption of the (numerous) additional components and functions offered by these systems. This project of the Electronic Devices and Networks Annex (EDNA), of the International Energy Agency IEA - 4E [3], explores these issues and considers the magnitude of the impact of installing smart metering and energy monitoring systems. Key issues under research are:

- Identify the energy consumption ranges of the different smart metering infrastructure and energy monitoring systems as well as influencing parameters; both at the components level, and systems as a whole.
- Categorize and classify the functionality of the SMI/EMS as basis for possible comparisons
- Extrapolate the measured data into “roll-out scenarios” for different countries, to identify the scope of potential improvements. The potential for policy interventions by governments within the SMI/EMS market to encourage efficient technologies and solutions should be explored.
III. ACTIONS

The key actions in this project are:

- Researching SMI/EMS technologies and systems present in the market. This information will help classify the systems and their functionality, to enable the comparisons of their power use (such as provision of two-way communications, control, flexible tariffs, power quality monitoring, and the end user functionality for home monitoring devices such as handhelds, in-home display, or web portals).

- Measuring and reporting the energy use of different SMI/EMS technologies, so that comparisons can be made of the different implementations of these systems.

- Developing a flexible and broadly applicable assessment methodology, combining the research results with the measurement data, to extrapolate plausible scenarios and their energy consumption implications.

- Engaging with stakeholders, including manufacturers, standardization organizations, energy agencies, energy utilities, and communities/networks dealing with smart metering and energy monitoring systems.

- Identifying market trends on future energy monitoring technologies and their functionalities at an early stage so as to enhance global collaboration at the scientific and policy level.

- Identifying focus areas and scope for policy development (e.g., energy consumption relevant features and functions)

IV. OUTCOMES

This applied paper will concentrate on selected results from the EDNA project, looking at the features of commonly available EMS, and presenting results from at least one energy measurement of a representative EMS. User scenarios will be developed to identify the possible range of energy consumption of these systems.

REFERENCES


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