Awareness of power consumption

Raising awareness of power consumption through user-friendly visualization and interactive competition

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Abstract

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1 Introduction

By the system of annual billing of electricity, in practice it is not possible for the user neither to draw conclusions from his current behavior, nor to control his influence on the power consumption. This means that consumers can only guess which patterns of behavior have a low or high impact on the electricity bill. The consumer faces the challenge of developing a quantitative sense of electric energy.

2 Objective of the research project

It is necessary to understand the short and long term effects of our behavior in a direct and quantified way. This is possible with the aid of a sufficiently disaggregated total current, since the data made available to the consumer directly allow drawing conclusions about his behavior. The objective of the research project is to raise awareness in dealing with the resource of electricity. The everyday use of electricity should become more tangible, more conscious and more quantifiable for the consumer. The result of the project is to provide a simple but effective tool to quantify one's own power consumption via easily understandable visualizations.

The basic work steps to achieve the research project were divided into the following areas:

- Data provision
- Data processing
- Data visualization

A general overview of the hardware concept and its components (data provisioning, data processing, data visualization) is illustrated in Figure 2.1.

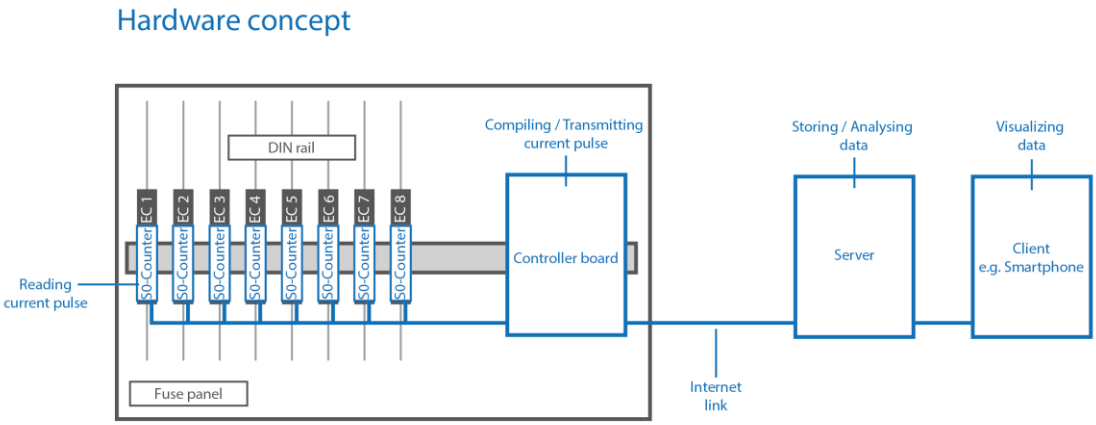

Figure 2.1 Presentation of the hardware concept

The installation of readable electricity meters allows further processing of the data in a meaningful degree of detail. Using readable interfaces on the meters, the power consumption is taken, translated into usable energy units (kWh) and transferred to a database for further processing. These steps can be implemented holistically using a programmable controller board (minicomputer).

To process the data, a suitable server for data storage and visualization was set up at the chair. In order for the data to be transferred, processed and finally visualized in a further step, the development and programming of a data logger program (controller board) as well as the creation of a database (server) was obligatory.

For the visualization of the data, a web application was developed for the research project, which enables cross-system display on almost all network- or internet-compatible devices (such as computers, laptops, smartphones, etc.).

As an initial view (dashboard) of the visualization concept, an interactive annual calendar was developed and implemented. All further detailed views (e.g. day view, weekly

view, monthly or yearly view) are directly accessible (→ Figure 2.2). At the same time, it is very easy to identify low-consumption or high-consumption days on the basis of different daytime colorations.

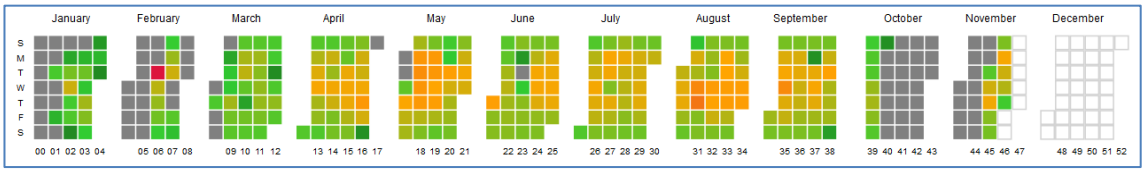

Figure 2.2 Interactive annual calendar (dashboard of the visualization concept)

Figure 2.3 exemplifies the detailed view of a selected day.

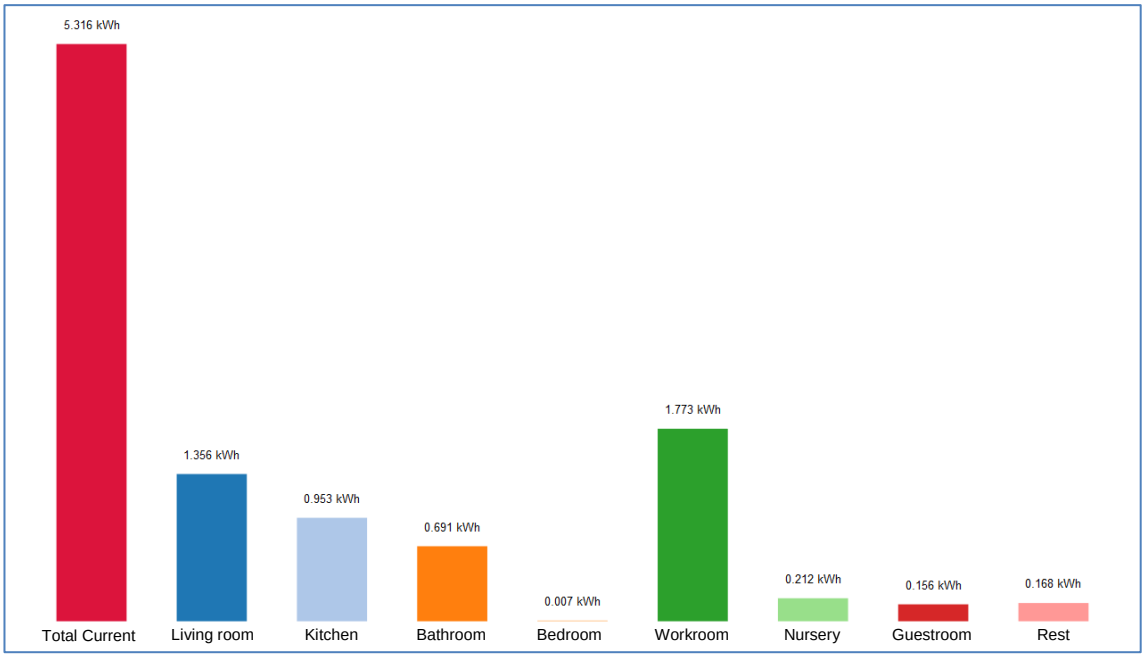

Figure 2.3 Day view bar graph in kWh per power circuit

As an alternative to the bar graph, further graphs were developed (→ Figure 2.4, Figure 2.5)

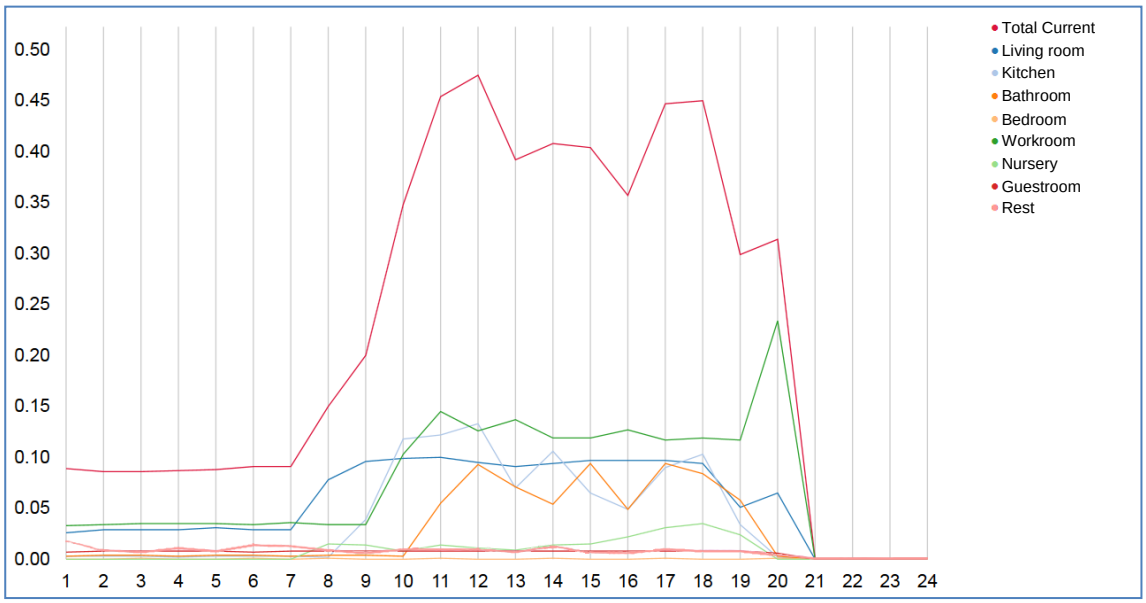

Figure 2.4 Day view line graph in kWh per power circuit and hour

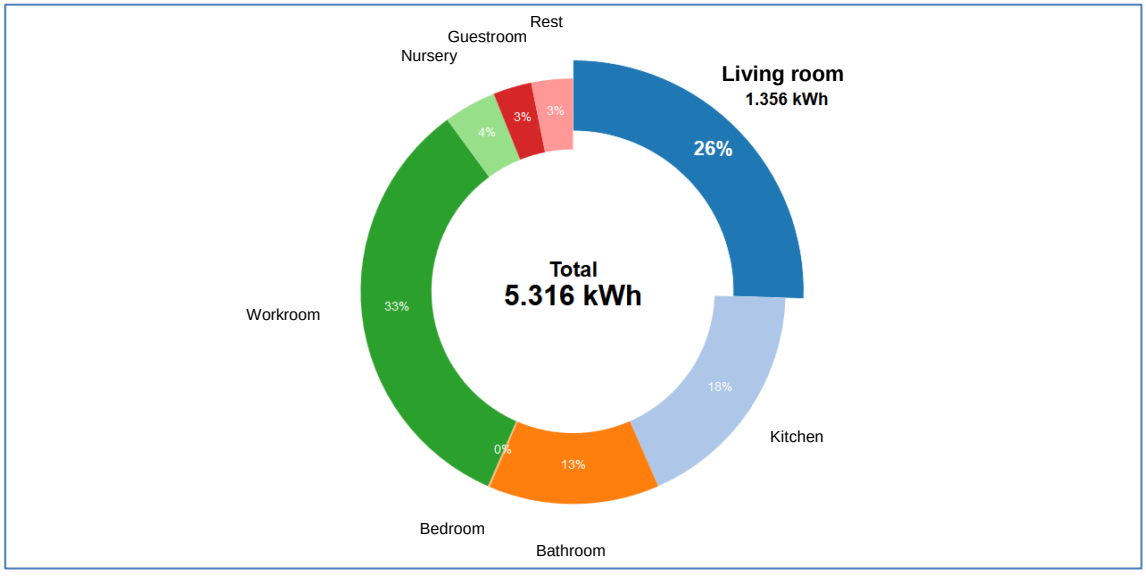

Figure 2.5 Day view pie graph, percentage distribution per power circuit

Which corresponding effects a particular user behavior entails, or with which equivalent electricity consumption would be approximated in other areas, is shown in Figure 2.6. The time reference (hour, day, month or year) is freely selectable. Using examples from other areas which are more accessible, the user's individual power consumption is illustrated or approximated.

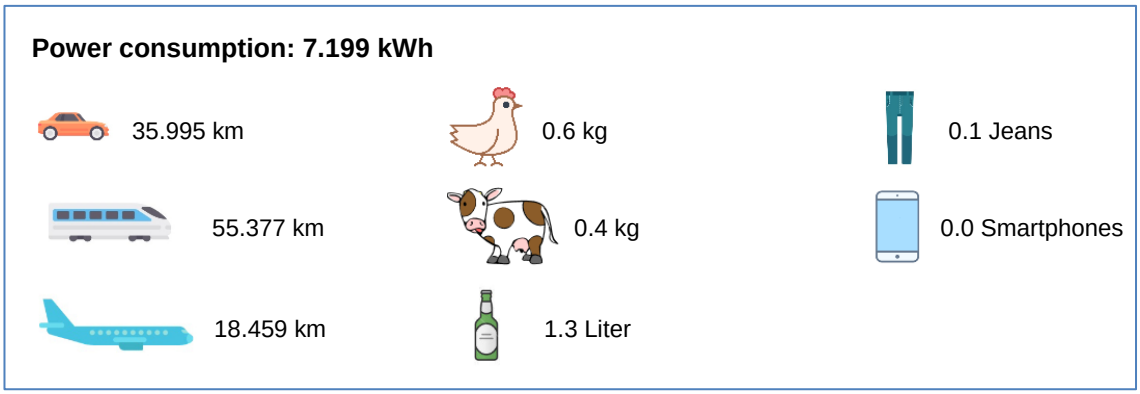

Figure 2.6 Exemplary equivalence relations of power consumption of a user on a selected day

Figure 2.7 illustrates the incorporation of the average own power consumption compared to all project participants (e.g. households) on a selected day.

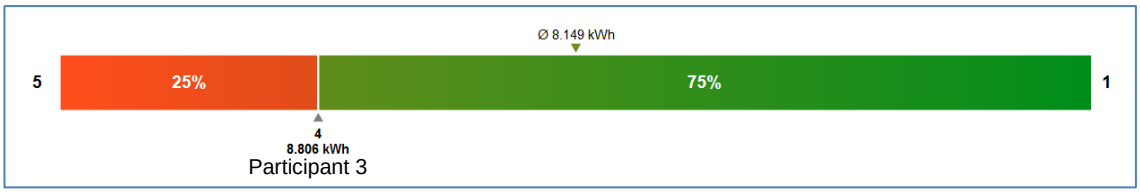

Figure 2.7 Comparison (ranking) among all participants on a selected day (e.g. participant 3)

The possibility of participating in specific and freely chosen competitions aims to use the sensitization on different levels, whereby people in different everyday situations are reached. Situationally-adapted competitions combine similar groups of people, such as pupils from an educational institution, office workers or private households. They compete with each other. Through appropriate bonuses for the front rankings (e.g. issued by the community, the school, the employer, the parents, etc.), competitions also have

a playful character. Thus they can increase the duration of participation in the web application, on the one hand, and strengthen willingness to influence its individual power consumption on the other hand. The visualization of a competition is realized on the basis of a dynamic bar graph (→ Figure 2.8).

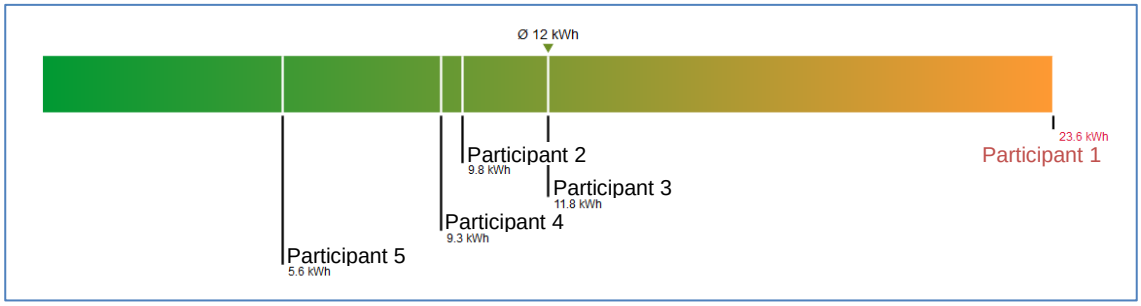

Figure 2.8 Comparison and ranking (competition) among all participants within the competition on a selected day

3 Summary

Within the scope of the project a possibility for the visualization of power consumption data was investigated and created. The meaning of this application is to raise awareness in dealing with the resource of electricity.

The measures developed within this research project deliberately do not aim to automate processes, but rather to sensitize the consumer himself. The results of this research project based on the developed methods or visualizations (e.g. detailed views, comparisons with other participants, equivalence relations and competitions) render power consumption more easily understandable. Furthermore, rankings and competitions are also a playful way to make each user's electricity consumption more tangible.

4 Key data

Title: Awareness of power consumption

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List of Figures

Figures