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ICT-based Interventions for Water and Heat Energy Conservation

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The accomplishment of the ambitious goals of the energy transition heavily depends on the use of modern information and communication technology (ICT). In fact, the use of ICT to support a sustainable development already today comprises virtually all fields of our daily lives: It spans from automation and control systems in industry, the mobility sector, and households to system that motivate and enable citizens to make decision and form habits in favour of a low environmental footprint. The majority of applications focuses on electricity, transportation systems, and space heating and include issues related to smart grids, e-mobility, and home automation. Recently, the use of ICT to promote water conservation has also gained considerable attention. This development is driven by the eminent water stress in many parts of the world as well as by the considerable amount of energy that is used for water heating in countries where water is abundant.

These workshop proceedings capture applications of ICT to promote (hot) water conservation among citizens and address the design of intelligent water networks. Topics include – in short – techniques to retrieve data on water use, descriptive statistics on water consumption behaviour, the use and impact of "low-tech" flow restrictors as a benchmark for saving technologies, and the adoption of technologies that engage users in water conservation. The contributions are briefly summarized below.

In their work on non-intrusive disaggregation of household water use, Ilya Kozlovskiy, Samuel Schöb, and Mariya Sodenkamp take high-resolution water consumption data that was collected on a household-level as input to separate consumption events into different categories. They use clustering methods, based on level set trees, to identify groups of events that are similar to each other.

Based on a large field study, Liliane Ableitner, Samuel Schöb, and Verena Tiefenbeck provide a descriptive analysis of shower data. Doing so, they help to quantify the impact of consumer behaviour and to understand what drives the variance in individuals' energy consumption. They analyze a smart meter data set comprising 5,610 individual showers and find a large variance in consumption values within and between households. This suggests that a large potential for energy savings exist. Furthermore, the authors investigate correlations between energy use, socio-demographic factors, and attitudes

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towards the environment of the test households.

Also based on a field experiment with a large number of sensor nodes, Liliane Ableitner, Samuel Schöb, and Verena Tiefenbeck shed light on the potential of mechanical flow restrictors in the shower. The authors assess the real-world influence of the flow rate on energy and water use and compare these numbers to the 45% reduction anticipated by engineering calculations. They find that users of low-flow showerheads do, indeed, take longer showers; nevertheless, they consume only 38% (1.0 kWh) less energy per shower compared to the baseline level of 2.6 kWh due to extended shower durations.

In their work “Adoption of Behavioral Feedback Devices” Anja Peters, Daniel Hanss, and Christian Sartorius investigate how consumers can be motivated to adopt feedback technologies and consequently intensify their water conservation efforts. Their study addresses an important gap in the related work by discussing several psychological factors that are believed to influence consumer adoption of feedback devices.

All submissions have been subject to a double-blind review process. The program committee consisted of Spiros Athanasiou, Athena Research Center, Anna Kupfer, Otto-Friedrich Universität Bamberg, Anja Peters, Fraunhofer ISI, Thorsten Staake, Otto-Friedrich Universität Bamberg, Thomas Stiefmeier, Amphiro AG and Verena Tiefenbeck, ETH Zurich. The program committee members herewith express their gratitude to the external reviewers.