Summary

Addressing climate change is a central challenge to society. More than a third of the total final energy is consumed in private households, especially for heating, and this in turn emits substantial amounts of climate-damaging CO_2. This dissertation focuses on the dynamics of everyday heating processes in private households after the implementation of new heating technology. Additionally, it addresses the question to what extent ecologically sustainable changes can be initiated in a targeted manner. For this purpose, heating in passive houses and so-called smart homes is investigated.

The research is based on a practice-theoretic approach, which is described in detail and has been refined for the subsequent empirical analysis. The Social Practices approach (according to Schatzki and Reckwitz) is quite frequently used as a theoretical framework for investigations in Environmental and Consumption Sociology. According to the approach, practices are a series of collectively shared, internalized, bodily-mental routine activities that are based on, and held together by, materiality, skills, and meaning. A practice represents a specific configuration of these various elements, integrating them into one unit. Changes can be detected particularly with regard to these individual elements, their composition and their links. Hence, this dissertation analyzes heating as a Social Practice and focuses on the transformation of heating practices in the transitional phase from conventional contexts of living to living in passive houses and smart homes.

The selected method comprises a multi-perspectival and process-analytical approach. The qualitative analytical framework and the investigative design are each described in detail. The perspectives of residents of passive houses or smart homes as well as those of various experts (architects, (building) technicians, project coordinators and representatives of energy supply companies) were integrated into this study. Thus, it becomes apparent that numerous questions emerge not only about heating forms in daily life, but also about who contributes to the specific design of new heating solutions and what that contribution looks like in detail.

33 individuals were interviewed for the study – 21 residents and twelve experts. Residents described their daily heating practices before and after the transition to a passive house or smart home and experts were primarily

interviewed regarding their professional experiences with both heating forms. In addition, a pilot project on smart heating was scientifically accompanied over the course of two years. The interviews and additional material were evaluated based on the Qualitative-Reconstructive Interpretation Process from the Documentary Method according to Bohnsack (2014 [1991]).

Individual, independent subchapters center on empirical discussions of five central aspects, or elements, of daily heating practices. They are (1) radiators, (2) ventilation, (3) the experience of coziness and (thermal) comfort, (4) the feelings of being in control and losing control, and (5) the process of successfully recruiting participants. Various relevant dynamics of change in daily heating habits are described and analyzed based on these five aspects and elements.

Based on developments surrounding radiators, it is emphasized in how substantial a manner experiences that were gathered over the years by residents affect their current heating practices in passive houses and smart homes.

An analysis of ventilation processes in the context of new heating settings shows how substantially the application of new heating technology can change the relations between (in part previously independent) practices. In addition, shifts in larger practice arrangements can be traced. Based on the theme of ventilation, the difference between the formation of routines and of habits is illustrated, as well.

Based on changes in the experience of coziness and comfort in the transitional phase from conventional living contexts to passive houses and smart homes, the varying usage and definitions of the terms 'coziness' (*Behaglichkeit*) and 'comfort' (*Komfort*) as well as overall increased expectations regarding thermal comfort are presented. In addition, unintended effects of successful thermal insulation and its impacts on residents' levels of comfort are highlighted.

The analysis of a changing experience of being in control in the transitional phase from conventional living contexts to passive houses and smart homes underlines that the feeling of losing control and of an increased dependence on technology is associated with various aspects and that coping with respective feelings of losing control can take on various forms. Furthermore, it can be illustrated that the interpretation of the role of new technology and its implementation differs significantly between experts and users.

Several very different paths of how users decided on passive houses and intelligent heat controls are uncovered. Thus, this investigation con-

tributes to an understanding of the conditions under which new heating forms can thrive.

Overall, the analysis of the interview material within the framework of Social Practice Theory has shown that the following points are central to a comprehensive understanding of a classification of practices as well as of associated processes of change:

- Historical aspects of Social Practices are highly significant and should always be incorporated into analyses of said practices. The example of heating illustrates this in a twofold manner: Firstly, the current manifestation of heating practices is determined by the historical development of abstract practices; secondly, the respective individual living and heating biographies influence current practices. Only an incorporation of history allows for a comprehensive understanding of the current status and both historical aspects entail and delimit the direction of (further) change of a practice such as heating as a collective activity.
- Moreover, it turns out that elements that were formerly integrated in a practice in a stable fashion can frequently detach from that practice due to accidental disruptions or intentional interventions. From that point on, they can develop and change at different paces independently of another. In the case of heating, the investigation has shown that the contents of the meaning component have changed considerably slower than other central elements of the practice of daily heating.
- In addition, it could be shown that co-evolutionary processes play a vital part in the change of practices. The analysis of heating practices in passive houses and smart homes illustrates this in a twofold fashion: On the one hand, the dependent development of heating technology and (thermal) comfort conventions uncovers a process of co-evolution based on dependencies between the different elements integrated in a uniform practice. On the other hand, co-evolutionary processes are detected between different, more or less loosely linked practices in the form of intertwining and reciprocal adaptation of heating (and ventilation) to additional practices.
- This dissertation shows that there are different causes for the change of practices: Change can originate within a practice – in which case each element associated with that practice can be the cause. Change can also be affected externally, e.g., by means of shifts in the composition of elements, intertwined practices or the emergence of entirely new elements that were previously not integrated.
- The select examples that were investigated showed the different extents and forms of change: passive heating is representative of a fundamental

change – we can speak of a radical, or basic, innovation and at the level of practical action we can therefore refer to a social innovation. The transition toward smart heating, by contrast, constitutes an incremental change or rather a purely technological innovation, or improvement.

- Beyond that, the analysis illustrates that many different actors contribute to a change of practices. It is shown that not only the activities of the residents that directly control the heating process are critical to the status of daily heating but also that the technology used as well as the activities of many actors such as architects and technical experts influence the design of a heating solution and therefore the heating process itself.
- Unintended side-effects and rebound effects are essential to the analysis of Social Practices. This is highlighted in the dissertation at hand by means of concrete examples that are highly significant to the topic of deliberate interventions with regard to measures that increase energy efficiency and conserve resources.

Overall, the changes that became evident in the material helped identify suitable starting points for political interventions in daily practices. These 'hints' or insights can help design interventions to be circumspect and effective. They are summed up in the conclusion. Moreover, the outlook discusses possible ways of investigating heating practices and the application of the Social Practices approach in more depth.

Based on this dissertation, the Social Practices approach can be evaluated as a fruitful theoretical framework for researching and analyzing daily energy consumption in private households as well as the investigation of associated change phenomena.

Overall, this dissertation uses the heating of residential spaces as an example to show that a qualitative analysis of interview materials from the Social Practices perspective delivers valuable insights into energy consumption. Thus, it also becomes clear that research in social sciences yields significant contributions to climate research.