Energy-Efficient Buildings as Complex Socio-Technical Systems: Approaches and Challenges

Introduction to chapter:
Buildings are responsible for about 40% of energy consumption and more than 40% of greenhouse gas emissions [5,6]. With recent products available today, energy consumption in buildings could be cut by up to 70 percent [7], but it requires an integrated and collective adaptive framework to show how buildings are operated, maintained and controlled with the support of ICT-based innovation and solutions. Two key areas identified in ICT contribution for energy efficient buildings [8]: i) ICT can be instrumental in achieving more efficient use of energy through simulation, modeling, analysis, monitoring and visualization tools that are needed to facilitate a "whole building approach" for both design and operated buildings, ii) ICT will also play an essential role in facilitating the implementation of policy and in measuring its effectiveness. The ICT sector can deliver tools that are crucially needed to collect, process, and manage data, and present it in a standardized format. The main aim is to develop energy efficient frameworks to improve energy efficiency by using innovative integrated ICT techniques. These frameworks could integrate technologies from autonomic computing, context-aware computing, machine learning and service-oriented architecture, including context-dependent user expectation and profile. This could be done by including the occupants' actions and behaviors in context tacking into account the complex interlinked elements, situations, processes, and their dynamics. Building occupants might have conflicting interests because of their number and diversity. For example in energy efficient building systems, including occupants activities such as reading, watching, sleeping, could be used to minimize the building energy expenditure.

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