

# Innovations in the Design of Smart Grid Systems for Future Cities

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## Abstract

The Smart Grid (SG) is the next generation power network composed of intelligent nodes that can operate, communicate, and interact autonomously to efficiently deliver electricity to all stakeholders. It features interconnections of power equipment to enable two-way flow of information and electricity so as to integrate unconventional power sources, manage demand, and efficiently balance supply and demand in real-time.

Consequently, the residential consumer space will be transformed by the introduction of these technologies. The Singapore University of Technology and Design (SUTD) has designed and deployed a residential smart grid tested to conduct end user based experiments to better understand and design this complex system. Here we present insights from the research project on information structure, end user experience research and initial technology development. Through these innovative design insights, there could be potential for great improvements of user acceptance and adoption of these technologies into their spaces.

Particular insights include coverage of residential (private) and shared (public) spaces. As with any new large scale, complex system, there exist many challenges that need to be addressed. Related to these challenges, we introduce efforts of how the test bed at the SUTD has experimented with system architecture, with emphasis on flexibility, privacy and scalability. We find that the information structure should be one of a partially distributed network. We have also initiated research on end user experiences, technologies and expectations in this space.

Studies are being conducted to examine the avenues on how people use electricity coupled with technology development on spatial and temporal tracking of electricity consumption.

**Keywords:** Smart Grid, system architecture, innovations