Studies in Infrastructure and Control

Anuradha Tomar · Phuong H. Nguyen · Sukumar Mishra *Editors*

Control of Smart Buildings

An Integration to Grid and Local Energy Communities

Springer

Studies in Infrastructure and Control

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Preface

Energy systems are an essential part of buildings and facilities, which are associated with high costs, and considered key success factor of businesses and services produced from the building or facility. The next-generation electric grid needs to be smart and sustainable to simultaneously deal with the ever-growing global energy demand and achieve environmental goals. Building energy management systems are commonly used to automate all services and functions within the building, which include energy management. This book provides an overview of how efficient building energy management can be done. It also includes the grid-interactive building, their control, energy management, and optimization techniques to promote better understanding among researchers and business professionals in the utility sector and across industries. The experiences and research work shared helps the readers in enhancing their knowledge in the field of renewable energy, power engineering, building energy management, demand, and supply management and learn the technical analysis of the same in an insightful manner.

The book is divided into three sections, namely, Building Energy Management, Local Energy Community Energy Management, and Grid Interactive Building Energy Management. Section I deals with the introduction to smart building energy management systems and possible ways to achieve zero-carbon energy systems, energy monitoring, and intelligent smart buildings. It also describes how transmission and distribution networks are modeled together as an integrated network and used to do steady-state operation analysis in order to assess the interaction of these two networks. Furthermore, the influence of the increasing amount of imbalance at distribution level on the transmission network that is evoked by the increase of highly variable resources and loads at distribution level is also investigated. It focuses on solutions and technologies that can monitor and control the energy use of the building. Section I also discusses the demand side management, peak load management, and flexibility assessment. Various demand side management programs and their applications have also been covered in this section.

Section II provides an overview and elaborates on the concept of local energy communities, local energy communities, and highlights the impact on consumption and performance. It also discusses identified benefits and challenges/barriers to their

further development. It also considers the operational issues and key challenges related to smart buildings integrated with local energy communities. This section includes the energy solutions that can address the key challenges, such as reducing energy consumption during peak loading conditions. This section also provides an overview of intelligent local energy community buildings of the future from a range of perspectives and application for building services with the local energy community.

Section III provides an overview of the design, equipment, and control techniques that facilitate the interactions and summarizes the methods by which grid-interactive building load can be made flexible. AI and multi-agent-based optimization techniques have been shown for optimizing the electricity consumption in a grid-interactive building community. This section also describes how grid-interactive efficient buildings can both reduce net demand and benefit the grid through more flexible loads.

This book gives invaluable insights to its readers. All the chapters in each section conclude with a case study for better understanding of the reader. It features contributions from key opinion leaders, successful researchers, and academicians.

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