

# SMART ENERGY MANAGEMENT

A Computational Approach

By Kumud Singh

**E**nergy management from the point of view of power generation and distribution has been driving the power sector till last decade. However, with gears shifted towards efforts to enhance energy efficiency by incorporating advanced measurement tools, optimization algorithms and control, SMART energy Management is an emerging and intriguing field for Electrical engineers. And the Authors of this book introduce a fairly new branch of electrical engineering in a most simplistic manner supported by case studies to bring out the practical aspects. The focus of the book is on computational approach to the problem of energy efficiency enhancement, and it traverses through the topic by espousing data driven approach & in-network processing for some of the critical energy saving requisites. The harmonious amalgamation of Electrical engineering concepts & Computational Science methodologies sets it as interesting read for the target audience.

**Chapter 1** of the book introduces the concept of smart buildings and smart grid and familiarizes the reader to computational techniques in energy management. This establishes a platform and motivates the reader to delve deeper into the field of Smart energy management.

**Chapter 2** confers time-criticality and latency requirement for critical real-time monitoring of Smart Electrical grid by data dissemination and processing. It also provides ephemeral background information on electrical grid, power flow and grid stability so as the readers belonging to branch other than Electrical Engineering do not feel left out in distinctly understanding the goals of energy management. Case study on data dissemination for Bus angle monitoring for Indian Electrical grid further allows the reader to understand optimization with data driven approach for meeting Quality of Service (QoS) requirements in a better way.

**Chapter 3** is dedicated to energy management systems for modern buildings with a case study discussing the hardware architecture design, characterization of building loads, communication protocols and algorithms for inferring the state of building and responding using hybrid sensing.

**Chapter 4** explicates solutions and methodologies for achieving thermal comfort in buildings following a smart cycle of energy management. It elaborates the thermal conditioning requirements, thermal conditioning resources, challenges for providing thermal comfort and different ways to approach thermal modeling and thermal characteristics of modern buildings/ building materials. It presents an adaptive hybrid approach in thermal modeling of spaces and schemes to adapt to changes in ambient temperature, peak demand and occupancy levels for small, medium and large buildings spaces.

**Chapter 5** elucidates techniques for the learning based sequencing systems in which occupancy data can be embedded in schedule based HVAC control systems to derive optimal schedules and dynamically adapt the learned schedules to serve as energy efficient systems for smart buildings.

**Chapter 6** addresses the need for judicious exploitation of renewable energy resources, in particular from Solar Energy perspective and methodologies for deriving its full generation potential. Authors suggest a hybrid approach utilizing Dynamic array reconfiguration as well as Current injection for full generation potential. Authors present the advantages of the suggested approach with an example and results of an experimental validation on a prototype system. This makes it easier for the reader to comprehend the challenges for deriving maximum potential of solar energy under partial shading and varying insolation conditions.

The last chapter of the book, **Chapter 7** discusses energy management during power deficit. It drives home the point of smarter ways to prevent complete blackouts. Controlled distribution of power, its frame work, optimization formulation and solution strategies are discussed. The chapter also discussed Non-intrusive load monitoring for evaluating energy conservation options and influencing the consumer's to be energy conscious and grid friendly.

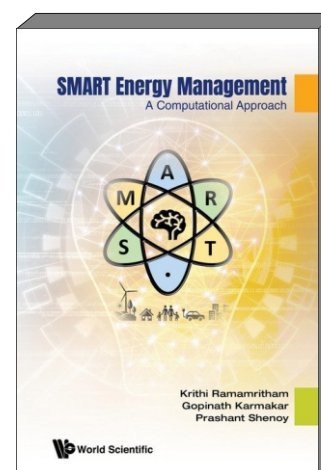
The book takes a pragmatic approach to address key areas in energy management. Some of the figures and tables may be enlarged to make it more comprehensible in future editions. Being an emerging field, it is no easy task to cover an ocean of interesting problems of smart energy management, however authors remains faithful in explaining the issues and methodologies to deal with few captivating energy issues in the present world scenario. Relevant background material is exquisitely merged in the form for appendices.

**I would recommend this book** for practicing engineers working in the field of energy management, researchers focusing on research trends and optimization algorithms for increasing energy efficiency and moreover to all electrical engineering graduates who want to learn and enter the field of Smart energy management being touted as the future of power sector.

## Smart Energy Management – A Computational Approach

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