


# Chapter 6


## Energy–Efficient Wireless Communication Systems Powered by Renewable Energy Sources

**S Balaji**

 <https://orcid.org/0009-0001-3817-9793>


*Department of EEE, KCG College of Technology, India*

**G. Soorya Priya**

 <https://orcid.org/0000-0003-2450-664X>


*Department of EEE, Loyola Institute of Technology, India*

**C. Amali**

 <https://orcid.org/0000-0002-3560-3384>


*Department of ECE, SRM Valliammai Engineering College, India*

**Ibrahim Hayatu Hassan**

 <https://orcid.org/0000-0001-5522-8465>


*Department of Computer Science, Ahmadu Bello University, Zaria, Nigeria*

**N. Kanniyappan**

 <https://orcid.org/0000-0002-3560-3384>

*Department of ECE, Jerusalem College of Engineering, India*

**V. S. Veena**

 <https://orcid.org/0009-0009-1125-1327>

*Department of EEE, St. Peters College of Engineering and Technology, India*

### ABSTRACT

*The fast growth of wireless communication technologies needs reliable and long-lasting power sources to reduce their negative effects on the environment and ensure that service is always available. Renewable energy sources are clean, long lasting, and often decentralized, which makes them a possible replacement for fossil fuels. This chapter looks at how to combine wireless communication systems with renewable*

DOI: 10.4018/979-8-3373-3541-4.ch006

*energy sources. It focuses on design issues, problems, and real-world uses. It has a flowchart that shows how to put the plan into action and a comparison of different renewable energy sources that are used in wireless communication.*

## **INTRODUCTION**

Wireless communication has redefined global connectivity by facilitating information to be transmitted with ease over long distances without the use of physical infrastructure. Wireless communication networks are in perpetual demand solely due to the advent of devices and the Internet of Things (IoT). Fossil fuel-driven generators or grid power typically powers wireless communication systems. However, particularly in remote or off-grid areas, these sources of power are usually characteristically linked with supply shortages, running costs, and environmental degradation. Renewable energy sources (RES) like solar, wind, biomass, and small hydro are green forms of energy for powering wireless communication infrastructure. A green-by-design 6G is the consensus of recent surveys and white papers: more stringent energy KPIs, standardized carbon accounting, AI-native control of power and radio assets, and integration with smart grids and IIoT. They place a strong emphasis on open benchmarking, harvester-aware scheduling, RIS/beamforming with power-aware targets, and consensus on sleep-maximization, (Alsamhi et al., 2024). Energy independence is improved, running costs are minimized, and carbon footprints are reduced by these sources. By combining RES sizing and network function placement, green O-RAN approaches maintain radio availability in the face of changing generation while simultaneously managing traffic, compute load, and energy to stabilize service. Early “green cellular” work evolved into concrete RES-powered radio access architectures that combine solar/wind generation, batteries, and grid interaction. Recent studies formalize power flows at base stations (BSs) with storage and show how procurement/dispatch policies affect both energy cost and carbon intensity across multi-BS networks. These models typically treat BSs as prosumers in microgrids, optimizing grid purchases vs. renewable/battery usage while meeting QoS, and reveal the value of temporal arbitrage and uncertainty-aware control (Ben Rached et al., 2025). This chapter provides an exhaustive review of wireless communication systems with renewable energy power, including a discussion of the benefits, drawbacks, and potential applications. This chapter address the UN SDG goals 7 and 9 for energy efficient and eco-friendly wireless communication systems

26 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: [www.igi-global.com/chapter/energy-efficient-wireless-communication-systems-powered-by-renewable-energy-sources/393704](http://www.igi-global.com/chapter/energy-efficient-wireless-communication-systems-powered-by-renewable-energy-sources/393704)

## Related Content

---

### On the Effects of Organizational Culture on E-Learning Readiness: An Iranian Experience

Seyed Yaghoob Hosseini, Khodakaram Salimifardand Shahrbanoo Yadollahi (2012). *International Journal of Social Ecology and Sustainable Development* (pp. 42-52). [www.irma-international.org/article/effects-organizational-culture-learning-readiness/69539](http://www.irma-international.org/article/effects-organizational-culture-learning-readiness/69539)

### Climate Change Effects, Adaptation, and Mitigation Techniques in Tropical Dry Forests

G. N. Tanjina Hasnat (2020). *Handbook of Research on the Conservation and Restoration of Tropical Dry Forests* (pp. 42-64). [www.irma-international.org/chapter/climate-change-effects-adaptation-and-mitigation-techniques-in-tropical-dry-forests/240107](http://www.irma-international.org/chapter/climate-change-effects-adaptation-and-mitigation-techniques-in-tropical-dry-forests/240107)

### ICTs for Business Enterprise Mobility: Mobile Communications, Mobility and the Creation of Sustainable Value

Per Andersson, Susanne Sweetand Christopher Rosenqvist (2010). *Organizational Communication and Sustainable Development: ICTs for Mobility* (pp. 1-18). [www.irma-international.org/chapter/icts-business-enterprise-mobility/38548](http://www.irma-international.org/chapter/icts-business-enterprise-mobility/38548)

### Development of a Research Framework for Green IT Enablers using Interpretive Structural Modelling

Sania Khan, Abdul Razak Honnutagiand Mohammed Shahid Ahamed Khan (2015). *International Journal of Green Computing* (pp. 1-13). [www.irma-international.org/article/development-of-a-research-framework-for-green-it-enablers-using-interpretive-structural-modelling/149453](http://www.irma-international.org/article/development-of-a-research-framework-for-green-it-enablers-using-interpretive-structural-modelling/149453)

### Grid Computing: Enabled Resource Management Models

Ileana Dumitru (2014). *International Journal of Sustainable Economies Management* (pp. 67-78). [www.irma-international.org/article/grid-computing/122384](http://www.irma-international.org/article/grid-computing/122384)