The Application of Energy Storage Technologies in Integrated Energy Systems: Current Status, Challenges, and Future Prospects

Professor Yingai Jin
Jilin University, China
Email: jinya@jlu.edu.cn

Abstract

Integrated Energy Systems (IES) are becoming increasingly essential for achieving high energy efficiency and ensuring stable energy supply, especially with the growing share of renewable energy sources. Energy storage technologies play a pivotal role in these systems by balancing energy supply and demand, stabilizing grid operations, and enhancing the flexibility of energy use. This study provides an overview of the current applications of various energy storage technologies, including electrochemical, mechanical, thermal, and chemical storage, in IES. The advantages and limitations of each technology are discussed, along with their specific roles in IES implementation. Additionally, key challenges related to technology, cost, and policy that impede the widespread adoption of storage solutions are identified. Finally, future trends in energy storage development are explored, with a focus on technological advancements, cost reductions, and policy frameworks that could facilitate the large-scale integration of storage technologies into IES.