

Special Session VIII

Special Session Basic Information:

专栏题目

Session Title

中文：电力配储及经济性研究

英文：Distribution System Energy Storage and Economic Research

专栏介绍和征稿主题

Introduction and topics

专栏介绍中文：随着全球碳中和目标的加速推进，以分布式光伏、风电为代表的可再生能源在配电网侧的渗透率持续攀升。然而，可再生能源的波动性与不确定性给配电网的安全稳定运行带来了前所未有的挑战。储能系统作为提升电网灵活性、平抑可再生能源出力波动、实现能量时移的关键技术，已成为构建新型电力系统的核心环节。在此背景下，储能不再仅仅是发、输、配环节的补充，而是深度融入“源-网-荷-储”互动体系中，发挥着至关重要的作用。与此同时，储能的配置规划、运行策略与其经济性紧密相关。如何在配电网中科学地规划储能的布点和容量，如何优化储能的充放电策略以参与电力市场，如何量化储能带来的可靠性提升与延缓电网投资的效益，以及如何设计可持续的商业模式和市场机制，已成为学术界与工业界共同关注的焦点。

本专题旨在汇聚来自高校、科研机构及电力企业的专家学者，共同探讨配电网与储能系统协同发展中的关键科学与技术问题。我们诚邀投稿，分享在配储协同规划、智能运行控制、市场机制设计、人工智能在电力系统中应用及综合效益评估等方面的最新理论研究成果与工程实践经验，共同推动储能技术在配用电侧的高效、高价值应用。

英文：Amid the accelerating global pursuit of carbon neutrality, the penetration rate of renewable energy sources, represented by distributed photovoltaics and wind power, within distribution networks is continuously rising. However, the inherent volatility and uncertainty of these renewables pose unprecedented challenges to the safe and stable operation of distribution systems. As a key technology for enhancing grid flexibility, smoothing renewable energy output fluctuations, and enabling energy time-shifting, Energy Storage Systems have become a core component in the construction of new-type power systems. In this context, energy storage is no longer merely a supplement to the generation, transmission, and distribution segments but is deeply integrated into the "Source-Grid-Load-Storage" interactive system, playing an indispensable role. Furthermore, the planning, configuration, and operational strategies of energy storage are closely intertwined with its economic viability. How to scientifically determine the siting and capacity of storage within distribution networks, how to optimize charging and discharging strategies for participation in electricity markets, how to quantify the benefits of reliability improvement and the deferral of grid upgrades brought by storage, and how to design sustainable business models and market mechanisms — these have become focal points of common interest for both academia and industry.

This Special Session aims to bring together experts and scholars from universities, research institutions, and electric power enterprises to collectively explore key scientific and technological issues in the coordinated development of distribution networks and energy storage systems. We cordially invite submissions sharing the latest theoretical research achievements and engineering practical experiences in areas such as coordinated planning of distribution and storage, intelligent operation control, market mechanism design, application of artificial intelligence in power systems, and comprehensive benefit assessment. The goal is to jointly promote the efficient and high-value application of energy storage technology on the power distribution and consumption side.

征稿主题中文：

本专题的征稿范围包括但不限于以下方向：

1、主动配电网中的储能规划与配置

考虑高比例可再生能源接入的储能优化选址定容方法

分布式储能与集中式储能的协同规划

储能系统在延缓配电网升级改造中的价值评估

2、配储系统的优化运行与控制

基于人工智能（如深度强化学习）的储能实时充放电优化策略

考虑预测不确定性的储能鲁棒优化与随机优化运行

多类型储能（如电化学、氢能）的混合管理与协调控制

3、电池本征特性与建模

电化学储能系统的老化机理与寿命预测模型

电池健康状态（SOH）与荷电状态（SOC）高精度估计

电池热特性与热失控机理研究及其在配储应用中的安全边界分析

4、电池系统集成与配储适配性

电池模组与电池管理系统在配电网侧的优化集成技术

面向配储应用场景的电池性能匹配与选型方法

再利用电池在配电网储能中的适用性评估与安全管理

5、市场机制与人工智能技术研究

促进配储系统发展的电价机制与市场监管政策

储能参与碳交易市场的路径与价值核算

人工智能技术在电力财务的应用

征稿主题英文：

The scope of this special session includes, but is not limited to, the following directions:

1. Energy Storage Planning and Configuration in Active Distribution Networks

Optimal siting and sizing methods for energy storage considering high penetration of renewable energy

Coordinated planning of distributed energy storage and centralized energy storage

Value assessment of energy storage in deferring distribution network upgrades

2. Optimal Operation and Control of Distribution-Level Storage Systems

Real-time optimal charging and discharging strategies for energy storage based on artificial intelligence (e.g., deep reinforcement learning)

Robust and stochastic optimization for energy storage operation considering forecasting uncertainties

Hybrid management and coordinated control of multiple energy storage types (e.g., electrochemical, hydrogen)

3. Battery Intrinsic Characteristics and Modeling

Aging mechanisms and lifetime prediction models for electrochemical energy storage systems

High-precision estimation of battery State of Health (SOH) and State of Charge (SOC)

Study on battery thermal characteristics and thermal runaway mechanisms, and their safety boundary analysis in distribution-level storage applications

4. Battery System Integration and Adaptability for Distribution-Level Storage

Optimization integration technologies of battery modules and Battery Management Systems (BMS) on the distribution network side

Methods for battery performance matching and selection tailored to distribution-level storage application scenarios (e.g., frequency regulation, peak shaving, load leveling)

Applicability assessment and safety management of repurposed (second-life) batteries in distribution network energy storage

5. Market Mechanisms and Artificial Intelligence Technology Research

Electricity pricing mechanisms and market regulatory policies to promote the development of distribution-level storage systems

Pathways for energy storage participation in carbon trading markets and value accounting

Application of artificial intelligence technologies in electric power finance


Special Session Chair(s):

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Organizer's Brief Biography

中文：博士，高级工程师，主要从事电力电子与变流器技术，动力电池梯次利用，人工智能与电网数字化技术等方面长期从事理论研究和工程应用实践工作。主持或参与国家级项目 3 项，国家电网公司总部科技项目 11 项，及其他单位横向课题 15 项。已申请中国发明专利 380 项，已授权 80 余项，发表高水平科技论文 30 余篇，获省部级、行业科技一二等奖 10 余项。目前担任 IEEE PELS Membership Committee-China 成员，国际 IAAST Member，中国电机工程学会电力机器人专委会委员、直流输电与电力电子专委会委员等。

英文：Ph.D., Senior Engineer, specializing in long-term theoretical research and engineering application in the fields of power electronics and converter technology, echelon utilization of power batteries, artificial intelligence, and digitalization of power grids. Has led or participated in 3 national-level projects, 11 science and technology projects at the headquarters of State Grid Corporation of China, and 15 horizontal projects with other institutions. Has filed 380 invention patents in China, of which over 80 have been granted. Has published more than 30 high-level scientific and technological papers. Has received over 10 first- and second-class provincial, ministerial, and industry-level science and technology awards. Currently serves as a member of the IEEE PELS Membership Committee-China, a member of the International Association of Advanced Science and Technology (IAAST), and a member of the China Electrotechnical Society's Technical Committee on Power Robots and the Technical Committee on DC Transmission and Power Electronics.

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Organizer's Brief Biography

中文：合肥工业大学电气与自动化工程学院教授，博士生导师，IEEE 高级会员。兼任 IEEE PES 通信与安全技术委员会（中国区）常务理事、中国机械工业教学协会自动化专业教学委员会委员等学术职务，担任 IJSNet 编委和《仪器仪表学报》青年编委。长期从事电力系统控制与自动化相关研究，在国内外重要期刊发表学术论文 100 余篇，以第一完成人获安徽省科技进步奖一等奖、中国电力科技奖一等奖等多项奖励。

英文：Professor and Doctoral Supervisor at the School of Electrical Engineering and Automation, Hefei University of Technology, and Senior Member of IEEE. He also serves as Executive Council Member of the IEEE PES Communication and Cybersecurity Technical Committee (China Chapter) and Committee Member of the Automation Specialty

Teaching Committee of the China Mechanical Industry Education Association, among other academic positions. He is an Editorial Board Member of the International Journal of Sensor Networks and a Youth Editorial Board Member of the Chinese Journal of Scientific Instrument. His research mainly focuses on power system control and automation. He has published more than 100 academic papers in leading domestic and international journals, and as the first contributor, has received several awards, including the First Prize of Anhui Provincial Science and Technology Progress Award and the First Prize of China Electric Power Science and Technology Award.