

# Special Session XIII

## Special Session Basic Information:

### 专栏题目

### Session Title

中文：人工智能驱动的电力系统可持续发展

英文：Advances in Sustainable Development of Power Systems with Artificial Intelligence

### 专栏介绍和征稿主题

### Introduction and topics

中文：

随着可再生能源渗透率的不断提高，全球电力系统的可持续发展在规划与运行层面正面临新的挑战。风能和太阳能是推动能源转型的主要驱动力，但其固有的不确定性特征改变了系统动态特性并重构了运行规则。这种影响贯穿电力系统全电压等级、覆盖多重技术维度，既包括主电网侧的大规模可再生能源并网，也涉及配电系统及用户侧分布式发电的广泛接入。可以预见，电力系统的可持续发展将从根本上改变电力工程的系统化设计理念和人类用电方式。

近年来，人工智能研究领域取得的引人瞩目进展为电力系统发展提供了新的技术路径。学术界已涌现大量关于人工智能在含高比例可再生能源电力系统规划与运行中应用的科研成果。然而，理论探索与工程实践之间仍存在显著鸿沟：当前主流机器学习算法多源于计算机科学与工程领域，其在电力系统应用场景中的性能、效率、可靠性与可解释性尚未得到针对性优化。本专栏旨在通过人工智能在电力系统规划运行中的创新应用研究弥合这一差距，重点征稿方向包括但不限于：

- ✓ 电力系统规划运行中的模型-知识-数据混合驱动技术；
- ✓ 融合物理信息的神经网络在电力系统运行分析计算中的应用；
- ✓ 基于人在回路思想的电力人工智能技术；
- ✓ 基于深度学习的可再生能源发电功率预测与可调容量分析；
- ✓ 基于深度强化学习的电力系统运行与调控技术；
- ✓ 元学习与联邦学习在电力系统规划运行中的应用；
- ✓ 基于人工智能的电力市场设计与多智能体博弈；
- ✓ 基于人工智能的电力系统稳定分析与控制；
- ✓ 人工智能大模型与知识推理技术在电力系统中的应用；
- ✓ 其他新一代信息技术与人工智能技术在电力系统中的应用。

英文：

With the increasing penetrations of renewable energy generations, the sustainable development of power systems around the globe is facing new challenges in terms of planning and operations. Wind and solar energy are the major driving forces for the development, but they also introduced uncertainties, changed the system dynamics, and revised the operation principles. These impacts are on all voltage levels in power systems and at multiple fronts, including the

large-scale renewable generations in the bulk grid and distributed generations in distribution systems before and behind the meters. In the foreseeable future, the sustainable development of power systems will fundamentally change how power engineering approaches the systems and how people use electricity.

In recent years, the fascinating progress in artificial intelligence research has attracted wide attention. This also provides a potential solution direction for power systems development. Numerous studies have been published in scientific journals in terms of the applications of artificial intelligence in power systems planning and operations considering renewable energy penetrations. However, there is still a gap between the theoretical research in academia and the challenges faced by engineers in the power industry. The majority of current machine learning algorithms are originally designed for tasks in computer science and computer engineering field. As a result, the performance, efficiency, reliability, and interpretability of the machine learning algorithms are not optimized for power system applications. In this Special Session, we are aiming to bridge this gap with new advances in the applications of artificial intelligence in power systems planning and operations. The topics include, but not limited to, the following:

- ✓ Model-Knowledge-Data Hybrid-Driven Technologies in Power System Planning and Operations;
- ✓ Applications of Physics-Informed Neural Networks (PINNs) in Power System Operational Analysis;
- ✓ Human-in-the-Loop AI Frameworks for Power Systems;
- ✓ Deep Learning-Based Renewable Energy Generation Forecasting and Dispatchable Capacity Analysis;
- ✓ Deep Reinforcement Learning (DRL)-Enabled Power System Operation and Control;
- ✓ Meta-Learning and Federated Learning for Power System Planning and Operations;
- ✓ AI-Driven Electricity Market Design and Multi-Agent Game Theory;
- ✓ AI-Based Power System Stability Analysis and Control;
- ✓ Large-Scale AI Foundation Models (e.g., GPT, Deepseek) and Knowledge Reasoning in Power Systems;
- ✓ Next-Generation IT & AI Solutions for Power Systems.

## Special Session Chair(s):

	姓名 <b>Name</b>	赵俊华
	称谓 <b>Prefix</b>	教授
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### Organizer's Brief Biography

中文：赵俊华教授现任香港中文大学（深圳）理工学院教授，同时担任港中大（深圳）-国家电网智能电网研究院联合智慧储能研究中心执行主任、深圳高等金融研究院能源市场与能源金融实验室主任、深圳市人工智能与机器人研究院研究员。他长期从事智能电网、电力市场、低碳转型及人工智能领域的研究工作。赵俊华教授已在国内外知名期刊和国际会议上发表 300 余篇研究论文，其中包括《Joule》（Cell Press）1 篇、《Patterns》（Cell Press）1 篇、《Scientific Data》（Nature 出版集团）2 篇、《Engineering》（中国工程院院刊）1 篇，另有 60 余篇论文发表于 IEEE 汇刊系列。所发表论文累计被引用 17000 余次，H 指数达 65（据 Google Scholar 统计）。

赵俊华教授于 2023 年当选英国工程技术学会会士（IET Fellow），同年获评“中国智能计算科技创新人物”，2021 至 2023 年连续入选“爱思唯尔中国高被引学者”，2023 年获国际金融论坛（IFF）“全球绿色金融奖”，2022 年获广东省电力科学技术杰出贡献奖。其研究成果对行业产生重要影响，曾作为专家组核心成员参与中国首个省级电力现货市场（广东）和首个区域电力现货市场（南方区域）建设，主导设计中国首款跨境碳交易金融产品。此外，他参与研发的多个软件系统已成功应用于纽约联合爱迪生公司、香港电灯集团、广东省能源集团、中国海油集团、大唐国际发电公司等国内外知名能源企业。

英文：Prof. Junhua Zhao is currently a professor at the School of Science and Engineering, The Chinese University of Hong Kong (Shenzhen). He is also the Executive Director of CUHKSZ - CSIJRI Joint Centre of Smart Energy Storage, the Director of the Energy Market and Energy Finance Laboratory at Shenzhen Finance Institute (SFI), and a researcher at Shenzhen Institute of Artificial Intelligence and Robotics for Society (AIRS). He has been engaged in research on smart grid, electricity market, low-carbon transition, and artificial intelligence for a long time. Prof. Junhua Zhao has published 300+ research papers in famous domestic and international journals and international conferences, including one in Joule (Cell Press), one in Patterns (Cell Press), two in Scientific Data (Nature Publishing Group), and one in Engineering (Published by the Chinese Academy of Engineering). More than 60 papers have been published in IEEE Transactions. The published papers have been cited 17000+ times, and the H-index is 65 (according to Google Scholar statistics).

Prof. Junhua Zhao was elected as IET Fellow in 2023. He was named as the Intelligent Computing Innovator of China in 2023. From 2021 to 2023, he was consecutively selected as “Elsevier Highly Cited Scholar of China”. He received the International Financial Forum (IFF) “Global Green Finance Award” in 2023, the Outstanding Contribution Award of Electric Science and Technology of Guangdong Province in 2022. The research results have had an important impact on the industry. He served as an expert group member of China's first provincial electricity spot market and the first regional electricity spot market, and participated in the design of China's first cross-border carbon trading product. In addition, several software products he participated in were successively applied to Consolidated Edison Company of New York, The Hongkong Electric Company, Guangdong Energy Group, China National Offshore Oil Corporation, Datang International Power Generation Company, etc.

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中文：刘翌，副教授，北京交通大学优秀主讲教师。获北京市科学技术学会“青年人才托举”工程资助，担任北京电机工程学会能源互联网专委会秘书长。近年来围绕多源协同的输配电网优化调度、电力系统暂态功角/频率安全稳定分析与控制、数字智能技术在电力系统中的应用等方面开展研究与实践工作。主持国家重点研发计划项目子任务、国家自然科学基金面上项目、国家自然科学基金青年基金、国网公司总部科技项目课题等科研项目十余项，发表学术论文 50 余篇，获 IEEE 国际会议最佳论文、最佳报告，相关论文进入《电力系统自动化》、《高电压》等期刊论文“双高”榜单，获中国电建科技进步一等奖、日内瓦发明奖金奖等科研奖励。

英文：Dr. Liu is currently an associate professor, Excellent Lecturer at Beijing Jiaotong University. He received the “Youth Talent Support” project of the Beijing Association for Science and Technology. He serves as the Secretary-General of the Energy Internet Committee of the Beijing Institute of Electrical Engineering. In recent years, he has been engaged in research and practical work in areas such as the optimal scheduling of multi-source coordinated transmission and distribution networks, the transient security and stability analysis and control of power system angular frequency, and the application of digital intelligent technology in power systems. He has hosted more than ten scientific research projects including sub-tasks of the National Key Research and Development Program, National Natural Science Foundation of China general programs, National Natural Science Foundation of China youth funds, and science and technology project topics of the State Grid Corporation headquarters. He has published more than 50 academic papers and received the Best Paper and Best Report at IEEE international conferences. His related papers have entered the “Double High” list of journals such as “Automation of Electric Power Systems” and “High Voltage”. He has been awarded the First Prize for Science and Technology Progress of China Electric Power Construction Corporation and the Gold Medal of the Geneva Invention Exhibition, among other scientific research awards.



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### Organizer's Brief Biography

中文：乔骥，现任中国电力科学研究院人工智能研究所数据智能技术研究室主任，入选北京市科协青年人才托举工程、北京市科协卓越青年工程师培养计划、国家电网有限公司青年人才托举工程。研究方向为基于人工智能的电力系统预测分析与辅助决策方法。承担国家自然科学基金-青年科学基金项目、国家自然科学基金-智能电网联合基金重点项目、科技创新 2030-“新一代人工智能”重大项目等多项重大项目。发表 SCI/EI 检索论文 50 余篇，申请发明专利 50 项，参编专著 1 部，编制标准 4 项，获中国电工技术学会科技进步二等奖 1 项，电力科技创新奖二等奖 1 项，中国电力科学研究院科技进步奖一等奖 2 项。

英文：Ji Qiao is the director of the Data Intelligence Technology Research Office at the Artificial Intelligence Research Institute of China Electric Power Research Institute. He has been selected for the Youth Talent Support Project of the Beijing Association for Science and Technology, the Cultivation Plan for Outstanding Young Engineers of the Beijing Association for Science and Technology, and the Youth Talent Support Project of State Grid Corporation of China. His research focuses on the prediction analysis and auxiliary decision-making methods of power systems based on artificial intelligence. He has undertaken a number of major projects, including the National Natural Science Foundation of China and the Major Project of "New Generation of Artificial Intelligence" under the Science and Technology Innovation 2030. He has published more than 50 papers indexed by SCI/EI, applied for 50 invention patents, participated in compiling one monograph, formulated 4 standards, and won one Second Prize of the Science and Technology Progress Award of the Chinese Electrotechnical Society, one Second Prize of the Electric Power Science and Technology Innovation Award, and two First Prizes of the Science and Technology Progress Award of China Electric Power Research Institute.



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中文：丁振桓，博士，安徽大学助理教授，研究方向为电力系统优化与控制、储能系统、人工智能及大数据在电力系统中的应用。主持国网公司总部科技项目及其他项目 2 项，以第一作者/通信作者公开发表 SCI 和 EI 收录论文 20 余篇。担任 PCMP 期刊编委及 IEEE Transactions on Power Systems、IEEE Transactions on Sustainable Energy、IEEE Transactions on Industrial Informatics、Applied Energy 等多本国内外期刊审稿人。

英文：Dr. Zhenhuan Ding is an assistant professor in Anhui University, his research area are power system optimization, energy storage, and AI/big data applications in smart grids. He has led 2 State Grid Corporation research projects and published 20+ SCI/EI papers as first/corresponding author. He servers as an assistant editor in Protection and Control of Modern Power Systems, and as a reviewer of IEEE Transactions on Power Systems、IEEE Transactions on Sustainable Energy、IEEE Transactions on Industrial Informatics、Applied Energy.



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中文：工程师，博士，长期从事新型电力系统协同规划、人工智能在电力系统中的应用等研究工作。

英文：As an engineer and doctor, he has been engaged in the research work of collaborative planning under the new power system and application of artificial intelligence in electrical engineering.