Special Session III

Special Session Basic Information:

专栏题目 **Session Title**	中文：AI 赋能的主动配电网与虚拟电厂优化控制 英文：AI-Empowered Optimization and Control in Active Distribution Grids and Virtual Power Plants

专栏介绍和征稿主题
Introduction and topics

中文：分布式能源、电动汽车和柔性工业负荷的激增正在将传统配电网转变为主动配电网（ADN）。同时，虚拟电厂（VPP）已成为聚合这些异构资源参与电网互动的关键机制。然而，可再生能源的随机性和用户行为的复杂动态，给 ADN 和 VPP 的稳定性与经济运行带来了巨大挑战。本专题聚焦于人工智能与电力系统控制的交叉领域。旨在探讨深度强化学习、多智能体系统、生成式 AI 等先进范式，如何释放需求侧资源的灵活性，并优化配电网与虚拟电厂之间的协同。

英文： The rapid proliferation of distributed energy resources (DERs), electric vehicles, and flexible industrial loads is transforming traditional distribution networks into Active Distribution Networks (ADNs). Concurrently, Virtual Power Plants (VPPs) have emerged as a critical mechanism to aggregate these heterogeneous resources for grid participation. However, the stochastic nature of renewables and the complex dynamics of user behavior pose significant challenges to the stability and economic operation of both ADNs and VPPs. This special session focuses on the intersection of Artificial Intelligence (AI) and power system control. It aims to explore how advanced AI paradigms — such as Deep Reinforcement Learning (DRL), Multi-Agent Systems (MAS), and Generative AI — can unlock the flexibility of demand-side resources and optimize the coordination between distribution grids and VPPs.
Data-driven aggregation and baseline estimation for Virtual Power Plants (VPPs).

Topics of Interest
Data-driven aggregation and baseline estimation for Virtual Power Plants (VPPs).
虚拟电厂的数据驱动聚合与基线负荷评估

Deep Reinforcement Learning (DRL) strategies for voltage/VAR control and network reconfiguration in ADNs.
用于主动配电网电压/无功控制及网络重构的深度强化学习策略

Coordination and game-theoretic interaction between Distribution System Operators (DSOs) and VPP aggregators.
配电网运营商与 VPP 聚合商之间的协同与博弈交互

AI-based predictive maintenance and fault diagnosis for key equipment in smart distribution grids.
智能配电网关键设备的基于 AI 的预测性维护与故障诊断

Uncertainty modeling and forecasting of renewable generation and flexible loads using generative models.
利用生成式模型对可再生能源及柔性负荷进行不确定性建模与预测

Transfer learning and federated learning for privacy-preserving data utilization in power systems.
电力系统中用于隐私保护数据利用的迁移学习与联邦学习

Resilience enhancement of ADNs/VPPs against extreme weather or cyber-attacks via intelligent control.
通过智能控制提升 ADN/VPP 抵御极端天气或网络攻击的韧性

Special Session Chair(s):

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Organizer's Brief Biography

中文：副教授，硕士生导师，担任电力工程系副主任、电力碳减排研究所所长。以第一/通讯作者发表 SCI TOP 论文 9 篇，EI 检索论文十余篇，他引超过 2500 次，其中 1 篇入选 ESI 高被引论文，2 篇入选 F5000 学术论文，4 篇入选知网高被引论文。担任《电力建设》《湖南电力》期刊青年编委。主持河北省青年拔尖人才项目、智能电网 2030 项目子课题等横纵向项目 8 项。

英文：Dr. Chen is an Associate Professor and Master's Supervisor. He serves as the Deputy Head of the Department of Electrical Engineering and the Director of the Institute of Electric Power Carbon Emission Reduction. He has published 9 top-tier SCI papers and over 10 EI-indexed papers as the first or corresponding author. Among these publications, one was selected as an ESI Highly Cited Paper, two were recognized as F5000 Top Academic Papers in China, and four were listed as CNKI Highly Cited Papers. He currently serves as a Youth Editorial Board Member for the journals *Electric Power Construction* and *Hunan Electric Power*. Additionally, he has presided over 8 research projects, including the Hebei Province Top Youth Talent Project and a sub-project of the "Smart Grid 2030" Program.

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Organizer's Brief Biography

中文：英国杜伦大学博士，英国 Exeter 大学博士后，同济大学博士后，上海市海外高层次人才，长期致力于人工智能与智能电网交叉领域研究，以第一/通讯作者发表 SCI/EI 论文 20 余篇，包括 IEEE TSG、TSE、TII、TIM、TAI 等 Trans.系列期刊 7 篇，担任 Nature Energy 及 Trans 期刊审稿人，EI 期刊《智慧电力》青年编委，IEEE PES 会议宣传主席等，并作学术报告，主持包括上海市科委、教委等资助 AI 赋能项目近十项。

英文：He received his Ph.D. degree from Durham University, UK, and subsequently conducted postdoctoral research at the University of Exeter, UK, and Tongji University, China. He is a recipient of the Shanghai Overseas High-Level Talent Program. His research interests lie at the intersection of artificial intelligence and smart grids. As the first or corresponding author, he has published more than 20 SCI/EI-indexed journal papers, including seven articles in IEEE Transactions journals such as TSG, TSE, TII, TIM, and TAI. He serves as a reviewer for Nature Energy and multiple IEEE Transactions journals, and as a Young Editorial Board Member of an EI-indexed journal. He has also served as Publicity Chair for IEEE PES conferences and delivered invited academic talks. He has led nearly ten AI-empowered research

projects funded by the Shanghai Municipal Science and Technology Commission and the Shanghai Municipal Education Commission, among others.