

# Special Session IV

## Special Session Basic Information:

### 专栏题目 Session Title

中文：AI 助力含绿氨/甲醇生产的综合能源系统优化运行  
英文：AI-assisted Optimal Operation of Integrated Energy Systems with Green Ammonia/Methanol Production

### 专栏介绍和征稿主题 Introduction and topics

在全球能源转型与“双碳”战略背景下，绿氨/甲醇作为氢能的高效载体和可再生燃料，是构建清洁能源体系的重要路径。含绿氨/甲醇生产的综合能源系统集成可再生能源发电、制氢、空气分离/碳捕集、氨/甲醇合成、储运及能量管理等环节，具有多源耦合、非线性强、动态性高等特点。单一环节难以充分消纳可再生能源、优化经济性与碳减排，而系统级协同与智能调度成为实现高效、低碳运行的关键。随着人工智能（AI）技术的快速发展，机器学习、强化学习、数字孪生及智能优化算法正逐步应用于综合能源系统的建模、预测与决策。AI 不仅可实现电解制氢的动态优化、氨/甲醇合成的参数自适应控制，还可在系统层面进行能源协同调度，在效率、成本、碳排放等多目标下寻求最优运行方案，从而推动绿氨/甲醇产业迈向智能化、低碳化与高可靠性的新阶段。

本专栏旨在汇聚能源工程、人工智能、系统控制及化工过程优化等领域的最新研究成果，探讨 AI 在绿氨/甲醇综合能源系统中的创新应用与未来发展趋势，推动跨学科融合与技术落地。

征稿主题（包括但不限于）：

- AI驱动的绿氨/甲醇综合能源系统优化与调度模型
- 基于机器学习的制氢及能量管理性能预测与控制
- 强化学习在氨/甲醇合成与系统协调中的应用
- AI+可再生能源协同制氢系统的能量优化策略
- 系统级多目标优化与智能决策


In the context of the global energy transition and the “dual-carbon” strategy, green ammonia and methanol, as efficient hydrogen carriers and renewable fuels, represent crucial pathways for constructing a clean energy system. Integrated energy systems incorporating green ammonia/methanol production encompass renewable power generation, hydrogen production, air separation/carbon capture, ammonia/methanol synthesis, storage and transportation, as well as energy management. These systems are characterized by multi-source coupling, strong nonlinearity, and high dynamic complexity. Single-process optimization is insufficient to fully absorb renewable energy or simultaneously achieve economic and environmental objectives, making system-level coordination and intelligent scheduling critical for high-efficiency, low-carbon operation. With the rapid advancement of artificial intelligence (AI), techniques such as machine learning, reinforcement learning, digital twins, and intelligent optimization algorithms are increasingly applied to modeling, forecasting, and decision-making in integrated energy systems. AI can enable dynamic optimization of electrolytic hydrogen production, adaptive control of ammonia/methanol synthesis, and system-level coordinated energy scheduling, seeking optimal operational solutions under multiple objectives including efficiency, cost, carbon emissions. This facilitates the evolution of the green ammonia/methanol industry toward intelligent, low-carbon, and highly reliable operation.

This special session aims to gather the latest research advances in energy engineering, artificial intelligence, systems control, and chemical process optimization, exploring innovative applications and future trends of AI in green ammonia/methanol integrated energy systems, thereby promoting interdisciplinary integration and practical technology implementation.

Topics of Interest (include but are not limited to):

- AI-driven optimization and scheduling models for integrated green ammonia/methanol energy systems
- Machine learning-based performance prediction and control for hydrogen energy management
- Applications of reinforcement learning in ammonia/methanol synthesis and system-level coordination
- Energy optimization strategies for AI-enabled renewable hydrogen production systems
- System-level multi-objective optimization and intelligent decision-making


### Special Session Chair(s):

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#### Organizer's Brief Biography

中文：何意，瑞典查尔姆斯理工大学博士后研究员，河海大学水利水电工程博士，英国帝国理工学院访问学者。主要研究方向为氢能燃料技术经济性评估，可再生能源多能互补系统优化规划。以第一作者在 *Applied Energy*, *Renewable & Sustainable Energy Reviews*, *Energy Conversion and Management*, *Energy*, *Renewable Energy* 等能源领域权威期刊发表论文 10 余篇，Google Scholar 累计引用量 1000 余次；担任 30 余 SCI 期刊审稿人。

英文：Yi He, Postdoctoral Researcher at Chalmers University of Technology, Sweden, received his Ph.D. in Hydraulic and Hydropower Engineering from Hohai University, China, and was a Visiting Scholar at Imperial College London, UK. His main research interests include the techno-economic assessment of hydrogen-based energy carriers, and optimal design of hybrid renewable energy systems. He has published over 10 papers as the first author in leading energy journals such as *Applied Energy*, *Renewable & Sustainable Energy Reviews*, *Energy Conversion and Management*, *Energy*, and *Renewable Energy*. His publications have been cited more than 1,000 times on Google Scholar. He also serves as a reviewer for over 30 SCI-indexed journals.

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中文：杨阳，澳门大学助理教授，新加坡国立大学工业工程与管理系博士。近年来在 *Nature Energy*、*Nature Communications*、*IEEE Transactions on Power Systems* 等国际顶级期刊发表学术论文十余篇（含 ESI 高被引论文 1 篇）。已获授权专利 1 项，软件著作权 2 项。曾荣获国际系统可靠性与安全会议 SRSE 2021 最佳学生论文奖、2023 年 *IEEE Transactions on Power Systems* 杰出审稿人奖、新加坡国立大学校长奖学金、法国外交部艾菲尔优秀奖学金、国家奖学金等。研究方向：电力系统运行与优化、电力系统频率安全、社会-技术耦合系统等。

英文：Dr. Yang Yang is an Assistant Professor at the University of Macau and holds a Ph.D. from the Department of Industrial Systems Engineering and Management at the National University of Singapore. He has published over ten academic papers in top-tier international journals, including *Nature Energy*, *Nature Communications*, and *IEEE Transactions on Power Systems*, with one paper recognized as an ESI Highly Cited Paper. He holds one authorized patent and two software copyrights. Dr. Yang has received several prestigious awards and honors, including the Best Student Paper Award at the International Conference on System Reliability and Safety (SRSE 2021), the Outstanding Reviewer Award from *IEEE Transactions on Power Systems* in 2023, the President's Graduate Fellowship from the National University of Singapore, the Eiffel Excellence Scholarship from the French Ministry for Foreign Affairs, and the Chinese National Scholarship. His research interests include power system operation and optimization, frequency security in power systems, and socio-technical systems.

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中文：李正茂博士是芬兰阿尔托大学的助理教授，博士毕业于新加坡南洋理工大学。他的研究主要聚焦于基于人工智能的多能源系统优化，涵盖电力、热能与绿氢的协同集成，应用领域包括韧性能源网络、智能微电网以及低碳航运系统等。已在 *IEEE Transactions on Smart Grid*、*Applied Energy* 等顶级期刊发表论文 70 余篇，论文总引用次数超过 4300 次，并多次入选高被引论文名单。现担任 IEEE 及 IET 期刊的副编辑，并主持或联合主持了 10 余个国际期刊特刊。曾获 2025 年 IEEE TSG 最佳论文奖，并连续多年入选“全球前 2% 顶尖科学家”榜单。

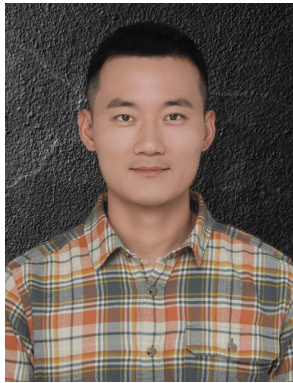
英文：Dr. Zhengmao Li is an Assistant Professor at Aalto University, Finland, and received his Ph.D. from Nanyang Technological University, Singapore. His research focuses on AI-driven optimization of multi-energy systems integrating electricity, heat, and green hydrogen, with applications in resilient energy networks, smart microgrids, and decarbonized maritime systems. He has published over 70 journal papers in top-tier venues such as *IEEE Transactions on Smart Grid* and *Applied Energy*, with more than 4300 citations and multiple Highly Cited Papers. He serves as an Associate Editor for IEEE and IET journals and has led over 10 international special issues. He received the IEEE TSG Best Paper Award (2025) and has been listed among the World's Top 2% Scientists for consecutive years.

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中文：鞠立伟博士是华北电力大学的副教授，其研究方向包括能源系统建模与决策优化、分布式能源优化利用以及综合能源系统等领域。已在 *Applied Energy*、*Energy Conversion and Management* 等国际顶级期刊发表论文 50 余篇，其中多篇为高被引论文。主持了多项科研项目，包括国家自然科学基金面上项目和北京市社会科学基金重点项目等。多次获得省部级科研奖励，如山西省科学技术奖、河南省科学技术奖等。入选爱思唯尔“中国高被引学者”榜单，并连续多年入选“全球前 2% 顶尖科学家”榜单。

英文：Dr. Liwei Ju is an Associate Professor at North China Electric Power University. His research focuses on energy system modeling and decision optimization, distributed energy optimization utilization, and integrated energy systems. He has published over 50 journal papers in top-tier venues such as *Applied Energy*, *Energy Conversion and Management*, with multiple Highly Cited Papers. He has led several research grants, including the general program funded by the National Natural Science Foundation of China and the key program funded by the Beijing Social Science Fund. He has received multiple provincial and ministerial awards, including the Shanxi Science Technology Award and Henan Science Technology Award. He has been selected as the Highly Cited Chinese Researchers in Elsevier and has been listed among the World's Top 2% Scientists for consecutive years.



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中文：郑晓东博士分别于 2015 年、2020 年在华南理工大学获得工学学士、工学博士学位。曾在中国南方电网电力调度控制中心、新加坡南洋理工大学、南方电网科学研究院、西安交通大学、美国南卫理公会大学等机构开展学术研究和研发工作。目前研究兴趣主要包括新能源电力系统经济运行（风光不确定性、储能调控建模等）和计算机算法（分布鲁棒优化、通用量子计算等）。主持国家部委、央企、全国重点实验室、广东省和广州市的科研项目多项。近五年发表论文三十余篇，获发明专利授权十余项，获省部级和行业科技奖励数项。

英文：Dr. Xiaodong Zheng received his Bachelor's and Ph.D. degrees in Engineering from South China University of Technology in 2015 and 2020, respectively. He has conducted academic research and technological development at institutions including the China Southern Power Grid Dispatching and Control Center, Nanyang Technological University (Singapore), China Southern Power Grid Research Institute, Xi'an Jiaotong University, and Southern Methodist University (USA). His current research interests mainly include the economic operation of renewable energy power systems (such as wind and solar uncertainty, energy storage regulation modeling) and computational algorithms (including distributionally robust optimization and general-purpose quantum computing). He has led multiple research projects funded by national ministries, central enterprises, national key laboratories, as well as Guangdong Province and Guangzhou Municipality. Over the past five years, he has published more than 30 papers, been granted over 10 invention patents, and received several provincial and industrial science and technology awards.

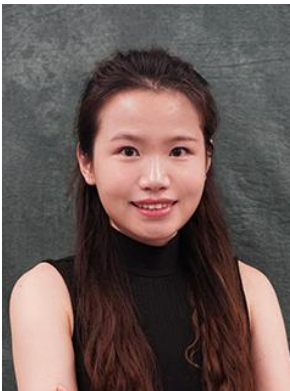


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英文：Chao Deng is a Professor and Ph.D. supervisor at the Advanced Institute of Carbon Neutrality Technologies, Nanjing University of Posts and Telecommunications, and a recipient of the National Science Fund for Outstanding Young Scholars (Overseas). He received his Ph.D. in Engineering from Northeastern University (China) and conducted postdoctoral research at Nanyang Technological University (Singapore) from 2018 to 2021. His research focuses on the security control of cyber-physical systems and secondary control in smart grids. He has published more than 50 SCI-indexed papers, including 10 ESI Highly Cited Papers, with over 5,000 citations on Google Scholar. He received the IEEE SMC Society Best Journal Paper Award (2022), was nominated for the Zhang Si-Ying Award at the 2023 CCDC Conference, and won the Second Prize of the Natural Science Award from the Chinese Association of Automation (2024). He is a Senior Member of IEEE, a Member of the Chinese Association of Automation, and serves as an Editorial Board Member of the Journal of Control and Decision.



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中文：林凡凡目前担任浙江大学-伊利诺伊大学厄巴纳香槟分校联合学院（ZJUI）的助理教授。她于2023年在新加坡南洋理工大学（NTU）和丹麦技术大学联合获得博士学位，研究方向为电力电子与人工智能（AI）的交叉领域。在进入学术界之前，林博士曾在新加坡创办人工智能初创公司。她曾获得多项荣誉，包括2023年南洋理工大学研究生院创新与创业奖，以及2022年IEEE工业应用学会论文二等奖。此外，她还积极参与IEEE电力电子学会的各项活动。她的研究兴趣包括基于人工智能的电力变换器设计与全生命周期管理，以及能源系统中负责任且可信赖的人工智能研究。

英文：Fanfan Lin is currently Assistant Professor at Zhejiang University-University of Illinois Urbana-Champaign Institute (ZJUI). She received the joint Ph.D. degree with the interdisciplinary research in power electronics and artificial

intelligence (AI) from Nanyang Technological University (NTU) Singapore, and the Technical University of Denmark, in 2023. Prior to her time in academia, Dr. Lin was an AI startup founder in Singapore. Dr. Lin has been recognized with multiple awards, including the 2023 NTU Graduate College Innovation and Entrepreneurship Award and the Second Prize Paper Award from the IEEE Industry Applications Society in 2022. In addition, she contributes to IEEE Power Electronics Society activities actively. Her research interests include AI-based power converter design and lifecycle management, responsible and trustworthy AI for energy system.