

# Special Session XV

## Special Session Basic Information:

### 专栏题目 Session Title

中文：数据驱动的负荷侧响应资源聚合建模、潜力预测与调控支撑技术  
英文：Data-Driven Aggregation Modeling, Potential Forecasting, and Control Support Technologies for Demand-Side Resources

### 专栏介绍和征稿主题 Introduction and topics

中文：随着新型电力系统建设持续推进，高比例新能源接入带来的功率波动性、不确定性和负荷快速变化，对系统灵活调节能力提出了更高要求。负荷侧响应资源具有规模大、分布广、类型多、响应快等特征，是支撑源网荷储协同运行、提升系统灵活性和促进新能源消纳的重要资源。然而，用户侧资源在响应行为、可调边界、持续时间、舒适度约束和参与意愿等方面存在显著差异，导致其聚合建模、响应潜力预测和调控支撑仍面临较大挑战。

本专题聚焦数据驱动的负荷侧响应资源聚合建模、潜力预测与调控支撑技术，围绕居民、商业建筑、工业负荷、电动汽车、空调负荷、储充一体化设施等多类型用户侧资源，探讨基于人工智能、概率预测、优化建模和物理机理融合的方法体系，推动负荷侧资源由被动响应向主动支撑能力转变。

征稿主题包括但不限于：

- 负荷侧响应资源的行为特征识别与数据驱动建模
- 多类型柔性负荷的聚合等值建模与可调边界表征
- 面向虚拟电厂的负荷聚合潜力预测与不确定性量化
- 考虑用户行为与舒适度约束的需求响应建模方法
- 建筑、工业、电动汽车等典型负荷的灵活性评估与响应能力预测
- 数据驱动与机理约束融合的负荷聚合建模方法
- 面向配电网运行和新能源消纳的负荷侧调控支撑技术
- 负荷侧资源参与辅助服务、电力市场和需求响应的运行决策方法

英文：

With the rapid development of new-type power systems, the increasing penetration of renewable energy introduces significant variability, uncertainty, and fast-changing net load profiles, creating an urgent need for enhanced system flexibility. Demand-side response resources, characterized by large scale, wide distribution, diverse types, and fast response capabilities, are becoming essential flexibility providers for source-grid-load-storage coordination, renewable energy accommodation, and secure system operation. However, demand-side resources exhibit heterogeneous response behaviors, adjustable boundaries, duration limits, comfort constraints, and participation preferences, posing substantial challenges to aggregation modeling, response potential forecasting, and operational support.

This special session focuses on data-driven aggregation modeling, potential forecasting, and control support technologies for demand-side response resources. It aims to promote advanced methods based on artificial intelligence, probabilistic forecasting, optimization, and physics-informed modeling for various user-side resources, including residential loads, commercial buildings, industrial loads, electric vehicles, air-conditioning loads, and integrated charging-storage facilities. The session seeks to support the transition of demand-side resources from passive response to observable, measurable, assessable, and dispatchable flexibility resources.

Topics of interest include, but are not limited to:

- Data-driven behavior identification and modeling of demand-side response resources
- Aggregated equivalent modeling and flexibility boundary characterization of heterogeneous flexible loads
- Response potential forecasting and uncertainty quantification for virtual power plants
- Demand response modeling considering user behavior and comfort constraints
- Flexibility assessment and response capability prediction of buildings, industrial loads, and electric vehicles
- Hybrid data-driven and physics-constrained modeling methods for load aggregation
- Demand-side control support for distribution network operation and renewable energy accommodation
- Operational decision-making for demand-side resources participating in ancillary services, electricity markets, and demand response programs

## Special Session Chair(s):

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### Organizer's Brief Biography

中文：田玉婷，博士，中国科学院深圳先进技术研究院碳中和技术研究所高级工程师，IEEE Senior Member，四川省海外高层次人才。主要从事电力系统规划运行、储能与负荷侧灵活性资源建模、电力系统可靠性/稳定性/韧性评估及电力市场等研究工作。

英文：Dr. Yuting Tian is a Senior Engineer at the Institute of Technology for Carbon Neutrality, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences. She is an IEEE Senior Member and a recipient of the Sichuan Overseas High-Level Talent recognition. Her research interests include power system planning and operation, energy storage and demand-side flexibility resource modeling, power system reliability, stability and resilience assessment, and electricity markets.

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### Organizer's Brief Biography

中文：张涵，博士，国网四川电科院新技术应用研究所高级工程师，ISO TC 268、ITU-T SG5/SG20 注册专家。主要从事电力系统规划运行、负荷侧响应资源的行为特征识别与数据驱动建模、数据驱动与机理约束融合的负荷聚合建模方法等研究工作。

英文：Dr. Han Zhang is a Senior Engineer at the Institute of New Technology Application, State Grid Sichuan Electric Power Research Institute. He is a registered expert of ISO/TC 268 and ITU-T SG5/SG20. His research interests include power system planning and operation, behavior characterization and data-driven modeling of demand-side response resources, and hybrid load aggregation modeling that integrates data-driven approaches with physical mechanism constraints.

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## Organizer's Brief Biography

中文：陈振，博士，成都理工大学副研究员/高级工程师。主要从事人工智能驱动的大电网智能调控、新能源电力系统安全稳定分析与控制等研究工作。

英文：Dr. Zhen Chen is an Associate Researcher / Senior Engineer at Chengdu University of Technology. His research interests include AI-driven smart dispatch and control of large power grids, as well as security, stability analysis and control of power systems with renewable energy.