Liudong Chen

lc3671@columbia.edu| 347 728 6670
Columbia University, 500 W 120th Street, New York, 10027

Education

Columbia University — New York, NY
Ph.D., Earth and Environmental Engineering, Advisor: Prof. Bolun Xu, (GPA: 4.09/4.0) — *2022 - Expected 2026*

North China Electric Power University — Beijing, China
Master of Science, Electrical Engineering, Advisor: Prof. Nian Liu, (GPA: 4.0/4.0) — *2019 - 2022*

University of Wisconsin Milwaukee — Milwaukee, WI
Exchange Student, Electrical Engineering, (GPA: 3.78/4.0) — *Jan 2019 - May 2019*

North China Electric Power University — Beijing, China
Bachelor of Science, Electrical Engineering and Automation, (GPA: 91.6/100) — *2015 - 2019*

Related Courses

- **Optimization and Learning Theory**: Convex Optimization, Stochastic Models, Optimization Models and Methods, Game Theory, Artificial Intelligence, Causal Trustworthy AI, Contextual Optimization
- **Energy and Sustainability**: Energy System Economics and Optimization, Machine Learning Applications for Environmental Engineering and Sciences, Intro to Carbon Management, Future Energy

Publications & Google Scholar

- **Liudong Chen**, Bolun Xu, "Prudent Price-Responsive Demands," *arXiv preprint* arXiv:2405.16356, 2024.
- **Liudong Chen**, Bolun Xu, "Equitable Time-Varying Pricing Tariff Design: A Joint Learning and Optimization Approach," *arXiv preprint* arXiv:2307.15088, 2023.
- Jianxiao Wang*, **Liudong Chen***, Zhenfei Tan, Ershun Du, Nian Liu, Jing Ma, Mingyang Sun, Canbing Li, Jie Song, Xi Lu, Chin-Woo Tan, Guannan He, "Inherent spatiotemporal uncertainty of renewable power in China", *Nature Communications*, 14, 5379 (2023).
- **Liudong Chen**, Xiangqi Zhu, Bolun Xu, Fei Ding, "Demand Side Flexibility Envelope Quantification Under Data Scarcity", *IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT), 2024*.
- **Liudong Chen**, Bolun Xu, "Saturation Effects in Equitable Demand Response Tariff Design", *North American Power Symposium (NAPS), 2023*.
- **Liudong Chen**, Nian Liu, and Jianhui Wang, "Peer-to-peer Energy Sharing in Distribution Networks with Multiple Sharing Regions," *IEEE Transactions on Industrial Informatics*, vol. 16, no. 1, pp. 6760-6771, 2020.
- **Liudong Chen**, Nian Liu, Chenchen Li, and Jianhui Wang, "Peer-to-Peer Energy Sharing With Social Attributes: A Stochastic Leader-Follower Game Approach," *IEEE Transactions on Industrial Informatics*, vol. 17, no. 4, pp. 2545-2556, 2021.
- **Liudong Chen**, Nian Liu, Songnan Yu, and Yan Xu, "A Stochastic Game Approach for Distributed Voltage Regulation among Autonomous PV Prosumers", *IEEE Transactions on Power System*, vol. 37, no. 1, pp. 776-787, Jan. 2022.
- **Liudong Chen**, Nian Liu, Liangying Liu, Xinghuo Yu, and Yusheng Xue, "Data-driven Stochastic Game with Social Attributes for Peer-to-peer Energy Sharing," *IEEE Transactions on Smart Grid*, vol. 12, no. 6, pp. 5158-5171, Nov. 2021.
- **Liudong Chen**, Nian Liu, Chenchen Li, Silu Zhang, and Xiaohe Yan, "Peer-to-peer energy sharing with dynamic network structures," *Applied Energy*, Vol. 291, Jun. 2021, 116831.
- **Liudong Chen**, Li Ma, Nian Liu, Lingfeng Wang, Zhaoxi Liu, "Parameter tampering cyberattack and event-trigger detection in game-based interactive demand response," *International Journal of Electrical Power & Energy Systems*, Vol. 135, 2022, 107550.
- **Liudong Chen**, Ying Li, Yubing Chen, Nian Liu, Chenchen Li, and Hongyu Zhang, "Emergency resources scheduling in distribution system: From cyber-physical-social system perspective," *Electric Power Systems Research*, 210, 108114, 2022.

- Nian Liu, Chenchen Li, **Liudong Chen**, and Jianhui Wang, "Hybrid Data-driven and Model-based Distribution Network Reconfiguration with Lossless Model Reduction", *IEEE Transactions on Industrial Informatics*, vol. 18, no. 5, pp. 2943-2954, May 2022.
- Yubing Chen, Nian Liu, **Liudong Chen** and Xinghuo Yu, "Region-to-Region Energy Sharing for Prosumer Clusters in Distribution Network: A Multi-Leaders and Multi-Followers Stackelberg Game," *IEEE Transactions on Energy Markets, Policy and Regulation*, vol. 1, no. 4, pp. 398-409, Dec. 2023,
- Nian Liu, **Liudong Chen**, and Chenchen Li. *U.S. Patent* No. 11,831,505. Washington, DC: U.S. Patent and Trademark Office, 2023.

Research Projects

Computation-efficient Algorithms for Grid-scale Energy Storage Control, Bidding, and Integration Analysis
National Science Foundation, Jan 2023 - present, Columbia University

- Develop equitable electricity tariff under distributed energy resource integration considering sociodemographic information;
- Study prudent behavior of convex demand (battery) when facing price uncertainty considering the matter of time;
- Analyze coincident peak shaving methods and algorithms from the perspective of customers' strategic behavior and equilibrium efficiency.

Western-based Analysis of Distributed Battery Storage System Emission Benefits and Tradeoffs
Department of Energy, Jun 2024 - present, Columbia University

- Develop a state-of-the-art battery storage system degradation model based on real-world battery degradation data;
- Embed the degradation model to the REopt platform from NREL to better account for the future production of the batteries based on actual historical performance;
- Calibrate battery dispatch and carbon emission formulation to model emission benefits, combined with findings from the historical emission analysis.

Optimal Bidding Strategy for Price-taker Virtual Power Plants
Internal Project, May 2023 - Sep 2023, National Renewable Energy Laboratory

- Find the research gap that virtual power plant (VPP) bidding should consider uncertain electricity price evolution;
- Develop a multistage stochastic programming model to optimize VPP's bidding strategy under exponential price scenarios;
- Propose a two-level algorithm combining the zeroth order method and stochastic dual dynamic programming algorithm to solve the problem and verify the algorithm's convergence.

Solar Hero *Department of Energy, May 2023 - Dec 2023, National Renewable Energy Laboratory*

- Design a questionnaire for electricity customers to obtain individual energy consumption behavior;
- Develop a machine learning-based framework to quantify electricity customers' flexibility envelop based on historical demand consumption data, survey results, and meteorology data;
- Analyze the demand flexibility for different social demography customers.

Inherent equity issues of energy infrastructure and equitable electrification solutions in NYC
Internal project, May 2023 - present, Columbia University

- Analyze energy infrastructure data, including transformer and substations, combined with sociodemographics from New York and examine distribution equity;
- Quantify the importance of sociodemographics on energy infrastructure distributions combined with locational effect;
- Design metrics to evaluate the priority of energy infrastructure investment considering techno-social complexity.

Research and Demonstration on the Key Technologies of 100% Clean and High Reliable Power Supply in the Beijing 2022 Winter Olympic *National Key R&D Program of China, Oct 2020 - May 2022, North China Electric Power University*

- Develop a reliability assessment platform that considers cyber, physical, and social factors to increase the reliability of the Beijing 2022 Winter Olympics;
- Formulate a two-stage planning model for power emergency resources scheduling considering load importance and demand uncertainty;
- Propose an emergency resources scheduling model to optimize the emergency response strategy for crews, mobile distributed generators, and emergency materials;

- Construct an outage management model based on distribution network reconfiguration and emergency resources dispatch to minimize the power outage time and dispatch cost.

Interactive Energy Management Methods for multi-PV Users from the Perspective of Game Theory
National Natural Science Foundation of China, Jan 2019 - May 2022, North China Electric Power University

- Propose a Stackelberg-game-based model to optimize the P2P energy sharing among prosumers inside a predefined sharing regions;
- Develop a peer-tp-peer (P2P) energy sharing model with dynamic network structures to optimize energy scheduling and network operation conditions;
- Formulate cyber-attacks model and corresponding detection mechanism using machine learning tools in interactive energy optimization;

Optimal Stochastic Control for Distributed Energy Clusters from the Perspective of Cyber-physical-social Systems
State Key Laboratory Project of China, Jan 2021 - May 2022, North China Electric Power University

- Analyze the social preference of entities and their impact on the power system operations, especially demand response program;
- Model consumers' decision behavior through model-driven methods and data-driven methods;
- Built energy scheduling model for consumers and distribution system operators considering socio-technical complexities;

Professional Services

- **Journal Reviewer**: IEEE Transactions on Smart Grid; IEEE Transactions on Power System; IEEE Transactions on Industrial Informatics; IEEE Transactions on Sustainable Energy; IEEE Transactions on Energy Markets, Policy and Regulation; Journal of Modern Power Systems and Clean Energy; Sustainable Energy, Grids and Networks
- **Conference Reviewer**: 2023 North American Power Symposium (NAPS); 2020 15th IEEE Conference on Industrial Electronics and Applications (ICIEA); 2019 IEEE Sustainable Power and Energy Conference (iSPEC)
- **Selected Talks & Posters**: ACM SIGEnergy Graduate Student Seminar; 2024 IEEE ISGT North America; 2023 6th and 2024 7th NREL Autonomous Energy System Workshop; 2023 and 2024 IEEE PES General Meeting; 2021 5th IEEE Conference on Energy Internet and Energy System Integration (EI2); 2021 IEEE IAS Industrial and Commercial Power System Asia Conference
- **Conference Volunteer**: 2023 IEEE PES General Meeting; 2018 2nd IEEE Conference on Energy Internet and Energy System Integration (EI2); IEEE Women in Engineering (WIE) Beijing 2019 and 2020

Work Experience

National Renewable Energy Laboratory Golen, CO
Graduate II – Electrical Engineering, Mentor: Bai Cui, Xiangqi Zhu, Ahmed Zamzam *May 2023 - Sep 2023*

- Study bidding strategy for virtual power plant, build mathematical models based on multistage stochastic optimization;
- Quantify electricity customer's flexibility envelop by designing questionnaires and formulating a machine learning-based framework.

Selected Honors and Awards

- IEEE Power & Energy Society (PES) Outstanding Student Scholarship, awarded by IEEE PES, 2022
- 2025 Los Alamos National Lab (LANL) Grid Science Winter School and Conference Travel Grant, awarded by LANL, 2024
- 7th NREL Autonomous Energy System Workshop Travel Grant, awarded by NREL, 2024
- China National Scholarship, awarded by the Ministry of Education of the People's Republic of China, 2018, 2020, 2021
- Ultra-high Voltage (UHV) Scholarship, awarded by State Grid Corporation of China, 2018
- Principal Scholarship, awarded by North China Electric Power University, 2020
- Outstanding Undergrad (Graduate) Graduates Awards of Beijing, China, 2019 (2022)
- China National Graduate Student Mathematical Contest in Modeling, First Prize, 2019
- Mathematical Contest In Modeling & Interdisciplinary Contest In Modeling (MCM&ICM), Meritorious Winner, 2018