

NING QI

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RESEARCH INTERESTS

Optimization under uncertainty, trustworthy AI, and energy economics for power systems, with a particular focus on generalized energy storage — advancing a reliable and sustainable energy transition.

POSITIONS

Columbia University, New York, NY, USA *Mar. 2024 – Present*
Postdoctoral Research Scientist, Department of Earth and Environmental Engineering
Advisor: Prof. Bolun Xu
Tsinghua University, Beijing, China *Jul. 2023 – Feb. 2024*
Postdoctoral Associate, Department of Electrical Engineering
Advisor: Prof. Feng Liu
Technical University of Denmark (DTU), Kongens Lyngby, Denmark *Nov. 2021 – Nov. 2022*
Visiting Scholar, Department of Technology, Management and Economics
Advisors: Prof. Pierre Pinson and Prof. Mads R. Almassalkhi

EDUCATION

Ph.D., Electrical Engineering, Tsinghua University, Beijing, China *Sep. 2018 – Jun. 2023*
Thesis: Risk Management and Optimal Resource Allocation of Power Distribution System under Decision-Dependent Uncertainties
Advisor: Prof. Lin Cheng
B.E., Electrical Engineering, Tianjin University, Tianjin, China *Sep. 2014 – Jul. 2018*
Thesis: Active Distribution System Planning Considering Optimal Operation of Flexible Resources
Advisors: Prof. Yanxia Zhang and Prof. Yunfei Mu

RESEARCH GRANTS

1. **PI**, “Data-Driven Thermostat Dynamic Behavior Modeling,” Ecobee “Donate Your Data” Program (industry data collaboration), 2025–2027.
2. **Lead Researcher**, “Carrizo Pumped Storage Hydropower: Seasonal Storage for Fully Decarbonized Grids,” U.S. Department of Energy, \$14.2M, 2024–2027.
3. **Lead Researcher**, “Grid-free Renewable Energy Enabling New Ways to Economical Liquids and Long-term Storage,” U.S. ARPA-E, \$3M, 2024–2027.
4. **Lead Researcher**, “Smart Energy Storage Integration and Management Platform for Buildings,” U.S. Department of Energy, \$1.5M, 2024–2026.
5. **Lead Researcher**, “Advanced ISO Models for Storage and Hybrid Resources Operation,” U.S. Department of Energy (LBNL lead), \$300K, 2023–2026.
6. **PI**, “Trustworthy Response of Virtual Power Plant with Scalable Flexible Resources,” China Postdoctoral Science Foundation Special Funded Project (2023TQ0169), ¥180K, 2023–2025.
7. **Lead Researcher**, “Operational Reliability Evaluation and Improvement Technology of Large-scale Battery Energy Storage Systems,” National Natural Science Foundation of China, Key Program (52037006), ¥3M, 2021–2026.
8. **Co-PI**, “Key Technologies of Large-Scale Second-Life Battery Energy Storage Systems,” Science and Technology Major Project of Inner Mongolia Autonomous Region (2020ZD0018), ¥3M (own budget: ¥300K), 2020–2025.

9. **Lead Researcher**, “Research and Demonstration of Multi-Agent and Multi-Energy Virtual Power Plant under the Energy Internet Environment,” Science and Technology Project of State Grid Corporation of China, ¥3M, 2019–2021.
10. **Lead Researcher**, “Active Distribution System Planning Based on Data Mining, Risk Hedging and Economic Incentives,” National Natural Science Foundation of China (51777105), ¥602K, 2018–2022.
11. **Lead Researcher**, “Coordinated Development Mode of Generation-Network-Load-Storage and Reliability Assessment of Power Systems Considering Inherent Safety Requirements,” Science and Technology Project of State Grid Corporation of China, ¥1M, 2018–2019.
12. **PI**, “Energy Dispatching System of Smart Buildings Considering Architectural Thermal Inertia,” National College Students’ Innovation and Entrepreneurship Program, ¥10K, 2016–2017.
13. **PI**, “Development of an Independent Real-Time Digital Energy Simulator based on FPGA,” National College Students’ Innovation and Entrepreneurship Program, ¥10K, 2016–2017.
14. **PI**, “Intelligent Cleaning Robot for Photovoltaic Cells,” National College Students’ Innovation and Entrepreneurship Program, ¥10K, 2015–2016.

HONORS AND AWARDS

- ESI Highly Cited Paper & Hot Paper, 2026
- Outstanding Reviewer & Youth Editorial Board Member, *Energy Conversion and Economics*, 2025
- Outstanding Youth Editorial Board Member, *Power System Protection and Control*, 2025
- Outstanding Reviewer (Top 5), *IEEE Transactions on Smart Grid*, 2025
- Highly Cited Scholar (Top 5%), China National Knowledge Infrastructure (CNKI), 2025
- Best Paper Award, IEEE PES General Meeting, 2024
- High PCSI Paper, Highly Cited Paper, and Highly Downloaded Paper (2 papers), CNKI, 2024
- Outstanding Individual Science & Technology Contributor Award, Inner Mongolia Autonomous Region, 2023
- Outstanding Paper (Third Prize), *Automation of Electric Power Systems*, 2021
- Sifang Scholarship, Tsinghua University, 2021
- Outstanding Reviewer, *Renewable Energy*, 2020 & 2023 & 2024
- Xiaomi Scholarship, Tsinghua University, 2020
- Outstanding Undergraduate (Top 2%), Tianjin University, 2018
- Outstanding Paper Award, Chinese Society for Electrical Engineering (CSEE), 2018
- 16th Student Science Award (Top 10), Tianjin University, 2017
- Outstanding Student Scholarship, Baosteel Education Foundation, 2017
- Special Prize, China Instrument & Control Society Scholarship, 2016
- National Scholarship, Ministry of Education of China, 2016 & 2017

PUBLICATIONS

*Google Scholar (Jul. 2026): 900+ citations, h-index 17, * denotes corresponding author.*

Journal Articles

1. **N. Qi**, Y. Baker, and B. Xu, “Online Dispatch of Multi-duration Energy Storage in Low-carbon Microgrid with Explainable Reference Learning,” *Applied Energy*, vol. 412, 127725, 2026.
2. K. Huang, L. Cheng, **N. Qi***, D. W. Gao, A. Mujeeb, and Q. Guo, “Grid-Aware Real-Time Dispatch of Microgrid with Generalized Energy Storage: A Prediction-Free Online Optimization Approach,” *IEEE Transactions on Smart Grid*, vol. 17, no. 2, pp. 892–909, 2026.
3. **N. Qi**, X. Jin*, K. Hou, Z. Liu, H. Jia, W. Wei, and M.-Y. Chow, “Privacy-Preserving Opportunity Cost Bounds for Efficient Energy Storage Market Coordination,” *IEEE Transactions on Industrial Informatics*, 2026.
4. K. Huang, L. Cheng, Y. Zhou, F. Shi, Y. Xi, Y. Zhuang, and **N. Qi***, “Real-time Peer-to-peer Energy Trading for Multi-microgrids: Improved Double Auction Mechanism and Prediction-free Online Trading Approach,” *Applied Energy*, vol. 413, 127769, 2026.

5. Z. Li, H. Liang, **N. Qi**, Y. Chen, H. Lai, Z. Wei, and Q. Wang, “Exact Analytical Solution for Self-Scheduling of Energy Storage with Piecewise Objective and Energy Loss Functions,” *IEEE Transactions on Smart Grid*, 2026.
6. X. Lan, H. Jiang, X. Jiang, M. Andersson, G. Strbac, **N. Qi**, E. Du, and N. Zhang, “Risk-aware Resistance Enhancement of Combined Heat and Power Supply under Cold Extremes,” *Applied Energy*, 2026.
7. Y. Zhuang, L. Cheng, **N. Qi***, M. R. Almassalkhi, and F. Liu, “An Iterative Problem-Driven Scenario Reduction Framework for Stochastic Optimization with Conditional Value-at-Risk,” *Electric Power Systems Research (PSCC 2026)*, 2026.
8. Y. Zhuang, L. Cheng, Y. Cao, T. Li, **N. Qi**, Y. Xu, and Y. Chen*, “Quantum Learning and Estimation for Distribution Networks and Energy Communities Coordination,” *CSEE Journal of Power and Energy Systems*, 2026.
9. **N. Qi**, P. Pinson, M. R. Almassalkhi, Y. Zhuang, Y. Su, and F. Liu*, “Capacity Credit Evaluation of Generalized Energy Storage Considering Strategic Capacity Withholding and Decision-Dependent Uncertainty,” *Applied Energy*, vol. 397, 126310, 2025.
10. **N. Qi**, K. Huang, Z. Fan, and B. Xu, “Long-term Energy Management for Microgrid with Hybrid Hydrogen–Battery Energy Storage: A Prediction-free Coordinated Optimization Framework,” *Applied Energy*, vol. 377, 124485, 2025. (ESI Highly Cited Paper & Hot Paper)
11. **N. Qi** and B. Xu, “Locational Energy Storage Bid Bounds for Facilitating Social Welfare Convergence,” *IEEE Transactions on Energy Markets, Policy and Regulation*, vol. 3, no. 4, pp. 486–497, 2025.
12. Y. Zhuang, L. Cheng, **N. Qi***, M. R. Almassalkhi, and F. Liu, “Problem-Driven Scenario Reduction Framework for Power System Stochastic Operation,” *IEEE Transactions on Power Systems*, vol. 40, no. 4, pp. 3232–3246, 2025.
13. Y. Zhuang, L. Cheng, **N. Qi**, X. Wang, and Y. Chen, “Real-time Hosting Capacity Assessment for Electric Vehicles: A Sequential Forecast-then-Optimize Method,” *Applied Energy*, vol. 380, 125034, 2025.
14. Y. Zhuang, L. Cheng, C. Wan, R. Xie, **N. Qi**, and Y. Chen*, “A Weighted Predict-and-Optimize Framework for Power System Operation Considering Varying Impacts of Uncertainty,” *IEEE Transactions on Power Systems*, 2025.
15. Y. Su, P. Yang, K. Kang, Z. Wang, **N. Qi**, T. Liu, and F. Liu*, “Sharing Energy in Wider Area: A Two-layer Energy Sharing Scheme for Massive Prosumers,” *Applied Energy*, vol. 392, 125968, 2025.
16. D. Paizulamu, L. Cheng, H. Xu, Y. Zhuang, **N. Qi**, and S. Ci, “LiFePO₄ Battery SOC Estimation under OCV–SOC Curve Error Based on Adaptive Multimodel Kalman Filter,” *IEEE Transactions on Transportation Electrification*, vol. 11, no. 4, pp. 8833–8846, 2025.
17. K. Kang, Y. Su, P. Yang, Z. Wang, Y. Zhang, **N. Qi**, and F. Liu*, “Understanding Cross-market Strategic Behaviors of Prosumers: An Equilibrium-driven Evolutionary Game Approach,” *Journal of Cleaner Production*, 145345, 2025.
18. **N. Qi**, A. Hussain, A. Mujeeb, Z. Javid, S. Zeb, and S. Wu, “Mitigation of Overvoltage in LVDC Distribution System with Constant Power Load Using Generic Energy Storage System,” *Journal of Energy Storage*, vol. 95, 112554, 2024.
19. **N. Qi**, P. Pinson, M. R. Almassalkhi, L. Cheng, and Y. Zhuang, “Chance-Constrained Generic Energy Storage Operations under Decision-Dependent Uncertainty,” *IEEE Transactions on Sustainable Energy*, vol. 14, no. 4, pp. 2234–2248, 2023.
20. **N. Qi**, L. Cheng, H. Li, Y. Zhao, and H. Tian, “Portfolio Optimization of Generic Energy Storage-based Virtual Power Plant under Decision-dependent Uncertainties,” *Journal of Energy Storage*, vol. 63, 107000, 2023.
21. **N. Qi**, L. Cheng, and F. Liu, “Capacity Credit Evaluation of Generic Energy Storage under Decision-Dependent Uncertainty,” *Power Grid Technology*, vol. 47, no. 12, pp. 4916–4925, 2023. (in Chinese)
22. Y. Zhuang, L. Cheng, **N. Qi***, W. Chen, X. Wu, and Z. Yao, “Typical Scenario Generation Algorithm for Microgrid Based on Deep Temporal Clustering,” *Automation of Electric Power Systems*, vol. 47,

- no. 20, pp. 95–103, 2023. (in Chinese)
23. **N. Qi**, L. Cheng, Y. Zhuang, Y. Zhou, Y. Zhang, and C. Zhu, “Reliability Assessment and Improvement of Distribution System with Virtual Energy Storage under Exogenous and Endogenous Uncertainty,” *Journal of Energy Storage*, vol. 56, 105993, 2022.
 24. L. Cheng, Y. Wan*, **N. Qi**, and Y. Zhou, “Coordinated Operation Strategy of Distribution Network with the Multi-station Integrated System Considering the Risk of Controllable Resources,” *International Journal of Electrical Power & Energy Systems*, vol. 137, 107793, 2022.
 25. S. Ma, T. Xiang, K. Hou, Z. Liu*, P. Tang, and **N. Qi**, “Spatial-temporal Optimal Dispatch of Mobile Energy Storage for Emergency Power Supply,” *Energy Reports*, vol. 8, pp. 322–329, 2022.
 26. Q. Yun, L. Tian, **N. Qi**, F. Zhang*, and L. Cheng, “Optimization Method of Resource Combination for Virtual Power Plant Based on Modern Portfolio Theory,” *Automation of Electric Power Systems*, vol. 46, no. 1, pp. 146–154, 2022. (in Chinese)
 27. L. Cheng, Y. Wan*, **N. Qi**, and L. Tian, “Review and Prospect of Research on Operation Reliability of Power Distribution and Consumption System Considering Various Distributed Energy Resources,” *Automation of Electric Power Systems*, vol. 45, no. 22, pp. 191–207, 2021. (in Chinese)
 28. **N. Qi**, L. Cheng, H. Xu, K. Wu, X. Li, Y. Wang, and R. Liu, “Smart Meter Data-driven Evaluation of Operational Demand Response Potential of Residential Air Conditioning Loads,” *Applied Energy*, vol. 279, 115708, 2020.
 29. **N. Qi**, L. Cheng, H. Xu, Z. Wang, and X. Zhou, “Practical Demand Response Potential Evaluation of Air-conditioning Loads for Aggregated Customers,” *Energy Reports*, vol. 6, pp. 71–81, 2020.
 30. H. Xu, L. Cheng, **N. Qi**, and X. Zhou, “Peak Shaving Potential Analysis of Distributed Load Virtual Power Plants,” *Energy Reports*, vol. 6, pp. 515–525, 2020.
 31. **N. Qi**, L. Cheng, L. Tian, J. Guo, R. Huang, and C. Wang, “Review and Prospect of Distribution Network Planning Research Considering Access of Flexible Load,” *Automation of Electric Power Systems*, vol. 44, no. 10, pp. 193–207, 2020. (Best Paper; in Chinese)
 32. L. Cheng, **N. Qi***, and L. Tian, “Joint Planning of Generalized Energy Storage Resource and Distributed Generator Considering Operation Control Strategy,” *Automation of Electric Power Systems*, no. 10, pp. 27–40, 2019. (Best Paper; in Chinese)
 33. B. Yuan, L. Cheng, L. Chen, **N. Qi***, L. Qin, and Y. Wang, “Evaluation Method for Power Grid Vulnerability Considering Operation Reliability of Components,” *Proceedings of the CSU-EPSCA*, 2019. (in Chinese)
 34. **N. Qi**, Z. Xu, and Q. Zhang*, “The Application of Integral Transform Method to Solve the Boundary Value Problem of Electrostatic Field,” *Journal of Electrical & Electronic Education*, vol. 39, no. 2, pp. 79–82, 2017. (in Chinese)

Conference Papers

1. E. Logan, **N. Qi***, and B. Xu, “Nonparametric Kernel Regression for Coordinated Energy Storage Peak Shaving with Stacked Services,” *IEEE PES General Meeting*, 2026.
2. Y. Baker, **N. Qi***, M. Yi, and B. Xu, “Bellman-Consistent Reduced-Dimension Representation of Energy Storage Value Functions for Accelerated Computation,” *Proc. 17th ACM International Conference on Future and Sustainable Energy Systems (e-Energy)*, 2026.
3. N. Ma, N. Zheng, **N. Qi***, and B. Xu, “Comparative Withholding Behavior Analysis of Historical Energy Storage Bids in California,” *IEEE PES General Meeting*, 2025.
4. E. Cohn, **N. Qi***, U. Lall, and B. Xu, “A Lagrangian-Informed Long-Term Dispatch Policy for Coupled Hydropower and Photovoltaic Systems,” *IEEE PES General Meeting*, 2025.
5. **N. Qi**, L. Cheng, K. Huang, A. Mujeeb, F. Liu*, and P. Pinson, “Reliability-Aware Probabilistic Reserve Procurement under Decision-Dependent Uncertainty,” *IEEE PES General Meeting*, 2024. (Best Paper Award)
6. K. Huang, L. Cheng, **N. Qi***, Q. Ji, and D. W. Gao, “Security-Aware Coordinated Dispatch of Microgrid: An Adaptive Online Optimization Approach,” *IEEE PES General Meeting*, 2024.
7. K. Kang, Y. Su, **N. Qi**, T. Liu, and F. Liu*, “Enforcing Nonanticipativity via Controlled Evolution: A Two-Layer Framework for Chance-Constrained Dispatch of Power Systems with High-Share

Renewable Generation,” *IEEE PES General Meeting*, 2024.

8. A. Mujeeb, Z. Hu*, R. Diao, **N. Qi**, and Z. Bao, “Ramp-reference Track Algorithm for the Provision of AGC Dispatch through VPP in Frequency Regulation Market,” *IEEE PES General Meeting*, 2024.
9. **N. Qi**, L. Cheng, H. Li, Y. Zhuang, L. Hao, and F. Liu, “Capacity Credit Evaluation of Generic Energy Storage under Decision-dependent Uncertainty,” *IEEE PES ISGT Europe*, 2023.
10. Y. Zhuang, L. Cheng, **N. Qi***, H. Li, Z. Li, and C. Wang, “Optimal Energy Management for Multi-Microgrid System Based on Stackelberg Game,” *IEEE PES ISGT Europe*, 2023.
11. K. Huang, L. Cheng, **N. Qi**, H. Xu, and E. Zhao, “An Online Convex Optimization Method for Optimal Dispatch of Microgrid,” *IEEE International Conference on Energy Technologies for Future Grids (ETFG)*, 2023.
12. **N. Qi**, L. Cheng, Y. Wan, Y. Zhuang, and Z. Liu, “Risk Assessment with Generic Energy Storage under Exogenous and Endogenous Uncertainty,” *IEEE PES General Meeting*, 2022.
13. Y. Wan, L. Cheng, H. Xu, **N. Qi**, and L. Tian, “Photovoltaic Generation Scenario Analysis Considering Irradiation Uncertainty and Output Derating Probability,” *IEEE Conference on Energy Internet and Energy System Integration (EI²)*, 2021.
14. **N. Qi**, L. Cheng, F. Liu, X. Zhou, and F. You, “Optimal Mechanism Design for Incentive-Based Demand Response Based on Stackelberg Game,” *IEEE Sustainable Power and Energy Conference (iSPEC)*, 2020.
15. X. Zhou, L. Cheng, Y. Wan, **N. Qi**, L. Tian, and F. You, “Research on Lithium-ion Battery Safety Risk Assessment Based on Measured Information,” *IEEE Sustainable Power and Energy Conference (iSPEC)*, 2020.
16. **N. Qi**, L. Cheng, Y. Jiang, J. Luo, K. Sun, D. Wang, L. Cheng, and Q. Wang, “Reliability Assessment of Generation and Transmission Systems Considering Multi-Form Access of Source-Network-Load-Storage,” *IEEE Sustainable Power and Energy Conference (iSPEC)*, 2019.
17. **N. Qi**, L. Cheng, Y. Jiang, J. Luo, K. Sun, D. Wang, W. Wang, and W. Sun, “Vulnerability Assessment Based on Operational Reliability Weighted and Preventive Planning,” *IEEE Sustainable Power and Energy Conference (iSPEC)*, 2019.
18. L. Cheng, **N. Qi***, Y. Guo, N. Liu, and W. Wei, “Potential Evaluation of Distributed Energy Resources with Affine Arithmetic,” *IEEE Innovative Smart Grid Technologies – Asia (ISGT Asia)*, 2019.
19. L. Cheng, X. Wang, **N. Qi***, L. Tian, and H. Liu, “Joint Planning of Distribution Networks with Demand Side Response and Distributed Generation Considering Operation-Control Strategy,” *International Conference on Power System Technology (POWERCON)*, 2018.
20. L. Cheng, **N. Qi***, L. Wei, S. Xu, and Q. Liu, “Power and Energy Balance of Active Distribution Network Considering Operation-Control Strategy,” *IEEE Conference on Energy Internet and Energy System Integration (EI²)*, 2018.
21. L. Cheng, **N. Qi***, L. Tian, R. Li, and S. Sun, “Exploration on the Value Innovation of Energy Internet Demonstration Park,” *IEEE Conference on Energy Internet and Energy System Integration (EI²)*, 2018.
22. W. Yang, L. Cheng, **N. Qi***, Y. Liu, and X. Wang, “Review on Distribution Network Planning Methods Considering Large-scale Access of Flexible Load,” *IEEE Conference on Energy Internet and Energy System Integration (EI²)*, 2018.
23. H. Kong, Y. Luo, X. Huang, L. Cheng, L. Tian*, and **N. Qi**, “Operation Strategy Selection of a District Multi-energy System Based on Environmental Impact,” *IEEE Conference on Energy Internet and Energy System Integration (EI²)*, 2018.
24. L. Cheng, **N. Qi***, F. Zhang, H. Kong, and X. Huang, “Energy Internet: Concept and Practice Exploration,” *IEEE Conference on Energy Internet and Energy System Integration (EI²)*, 2017.

Manuscripts Under Review

1. E. Cohn, **N. Qi***, U. Lall, and B. Xu, “Real-time Coordination of Cascaded Hydroelectric Generation under Decision-Dependent Uncertainties,” *IEEE Transactions on Sustainable Energy* (under review).
2. D. Paizulamu, L. Cheng, **N. Qi***, Z. Li, and N. D. Hatziargyriou, “Full Timescale Hierarchical MPC-

MTIP Framework for Hybrid Energy Storage Management in Low-Carbon Industrial Microgrid,” *IEEE Transactions on Sustainable Energy* (under review).

3. Q. Ji, L. Cheng, F. Shi*, J. Li, Y. Zhou, **N. Qi**, and Y. Xi, “Dynamic Socioeconomic Event-Aware Load Forecasting: An LLM-Empowered Architecture Integrating Temporal Decomposition and Cross-Modal Attention Mechanism,” *Protection and Control of Modern Power Systems* (under review).

Patents

1. F. Liu, K. Kang, Y. Su, Y. Zhang, and **N. Qi**, “Unit Commitment Method for Power Systems and Associated Components,” U.S. Patent App. US20250070568A1, 2024.
2. F. Liu, K. Kang, **N. Qi**, and Y. Su, “Day-ahead Scheduling Method and Apparatus for Power System, Electronic Device and Storage Medium,” U.S. Patent App. US20250105632A1, 2024.
3. F. Liu, K. Kang, Y. Su, and **N. Qi**, “Multi-time-scale Scheduling Method of Power System and Related Components,” Chinese Patent CN118316085A, 2024.
4. F. Liu, K. Kang, Y. Su, Y. Zhang, and **N. Qi**, “Scheduling Method and Device of Power System and Electronic Equipment,” Chinese Patent CN117154839A, 2024.
5. F. Liu, K. Kang, Y. Su, Y. Zhang, and **N. Qi**, “A Unit Combination Method and Related Components of a Power System,” Chinese Patent CN117154841A, 2023.
6. F. Liu, K. Kang, Y. Zhang, Y. Su, and **N. Qi**, “Double-layer Robust Unit Combination Method and Assembly of Power System,” Chinese Patent CN117154840A, 2023.
7. K. Kang, F. Liu, **N. Qi**, and Y. Su, “Multi-type Energy Storage Cooperative Scheduling Method and Device for Power System and Electronic Equipment,” Chinese Patent CN117973735A, 2023.
8. K. Kang, F. Liu, Y. Su, and **N. Qi**, “Power System Dispatching Method and Device Considering Decision-Dependent Uncertainty,” Chinese Patent CN117878941A, 2023.
9. F. Liu, K. Kang, Y. Zhang, Y. Su, and **N. Qi**, “Power System Day-ahead Dispatching Methods, Devices, Electronic Equipment and Storage Media,” Chinese Patent CN117353283A, 2023.
10. Z. Han, Q. Jia, G. Na, M. Su, C. Tu, Y. Kang, **N. Qi**, F. Liu, W. Yi, Y. Jun, S. Lu, K. Liu, H. Zhu, Q. Zhang, and X. Li, “Multi-stage Unit Backup Setting Method and Device Based on Batch Scenario Screening,” Chinese Patent CN117394447A, 2023.
11. Z. Han, Q. Jia, G. Na, M. Su, C. Tu, Y. Kang, **N. Qi**, F. Liu, W. Yi, Y. Jun, S. Lu, K. Liu, H. Zhu, Q. Zhang, and X. Li, “Multi-stage Robust Unit Combination Method and Device Based on Sequential Evolution of Batch Scenarios,” Chinese Patent CN117394446A, 2023.
12. Y. Zhang, L. Cheng, C. Zhu, K. Suo, K. Zhang, **N. Qi**, and Y. Liu, “Method and System for Evaluating and Improving the Value of SOH in the Whole Life Cycle of Energy Storage by Stages,” Chinese Patent CN115663936A, 2023.
13. Y. Zhang, L. Cheng, C. Zhu, K. Suo, K. Zhang, **N. Qi**, and Y. Liu, “Hybrid Energy Storage Scheduling Method, System and Equipment for Wind Power Plant with Retired Battery,” Chinese Patent CN115879596A, 2023.
14. X. Song, L. Han, L. Cheng, Y. Cai, Z. Xiao, J. Zhang, S. Gu, D. Yang, M. Liu, Y. Jiang, J. Li, T. Xia, C. Wu, W. Liu, T. Feng, P. Yan, X. Zhang, and **N. Qi**, “An Integrated Isolation Circuit Breaker and Its Reliability Optimization Method,” Chinese Patent CN109521309B, 2023.
15. L. Cheng, X. Tian, **N. Qi**, F. Peng, Y. Jiang, X. Gao, Z. Wang, J. Zhang, and Y. Zhang, “Reliability Assessment Method and System for Power Transmission System with Wind and Solar Storage,” Chinese Patent CN110661250B, 2022.
16. L. Cheng, L. Tian, **N. Qi**, K. Wu, X. Li, Y. Wang, and R. Liu, “Multi-level Optimization Method for Comprehensive Energy System Considering Carbon Emission,” Chinese Patent CN112116131B, 2022.
17. E. Lin, L. Cheng, Y. Li, K. Suo, Y. Zhou, and **N. Qi**, “A Kind of Battery Energy Storage System Price Adjustment Method and Device,” Chinese Patent CN115063185A, 2022.
18. Y. Liu, L. Cheng, H. Li, H. Tian, Z. Zhou, **N. Qi**, T. Zhang, M. Qi, L. Tian, Y. Li, L. Chen, S. Bai, and Y. Li, “Power Distribution Network Risk Sensing Method and System, Electronic Equipment and Storage Medium,” Chinese Patent CN114282762A, 2022.

19. L. Cheng, Y. Wan, Y. Shen, H. Xu, **N. Qi**, and L. Tian, “Photovoltaic Output Scene Generation Method and Scene Generation Device Based on CatBoost Algorithm,” Chinese Patent CN113283492B, 2021.
20. L. Cheng, L. Tian, Y. Jiang, Y. Wan, **N. Qi**, Q. Huang, X. Yuan, and C. Zhang, “Optimization Method of AC/DC Hybrid Power Distribution System,” Chinese Patent CN110086195B, 2021.
21. Y. Liu, L. Cheng, H. Li, H. Tian, Z. Zhou, **N. Qi**, T. Zhang, M. Qi, L. Tian, Y. Li, L. Chen, S. Bai, and Y. Li, “Method, System, Device and Storage Medium for Predicting Source-Load Characteristics of Optical Storage Micro-grid System,” Chinese Patent CN113837485B, 2021.
22. L. Cheng, X. Gao, Y. Wan, X. Tian, Y. Jiang, Z. Wang, **N. Qi**, F. Peng, and Y. Zhang, “An Air-conditioning Load Power Supply Reliability Evaluation Method and Evaluation Device,” Chinese Patent CN110223005B, 2021.
23. L. Cheng, L. Tian, Y. Jiang, Y. Wan, **N. Qi**, Q. Huang, X. Yuan, and C. Zhang, “Decoupling Power Flow Determination Method for AC/DC Hybrid Power Distribution Network,” Chinese Patent CN109861233B, 2020.
24. L. Cheng, L. Tian, X. Yuan, X. Ge, Q. Li, **N. Qi**, and Y. Wan, “Power Supply Partition Method, System, Device and Medium for AC and DC Equipment,” Chinese Patent CN109685379B, 2020.
25. K. Sun, L. Cheng, D. Wang, J. Luo, **N. Qi**, X. Zhang, Z. Liu, X. Han, and X. Zhang, “Large Power Grid Vulnerability Assessment Method Based on Tidal Current Betweenness,” Chinese Patent CN111160716A, 2020.
26. L. Cheng, J. Luo, M. Liu, K. Sun, D. Wang, **N. Qi**, S. Xin, X. Han, L. Cheng, W. Wang, Z. Xie, and W. Sun, “Grid Vulnerability Assessment Method Considering Operational Reliability,” Chinese Patent CN111160675A, 2020.
27. H. Zhan, M. Li, Z. Lai, Y. Cao, H. Jia, Z. Xu, C. Xu, Z. Wang, and **N. Qi**, “A Photovoltaic Array Cleaning Device and a Photovoltaic Array Automatic Positioning Cleaning Robot,” Chinese Patent CN209982425U, 2020.
28. L. Cheng, L. Tian, C. Shi, Y. Wan, **N. Qi**, S. Sun, Y. Cheng, and D. Wei, “Energy Efficiency Evaluation Method and Device for Integrated Energy System,” Chinese Patent CN110147568A8, 2019.
29. W. Yang, Z. Wu, L. Cheng, Y. Liu, X. Wang, Y. Wang, S. Jiang, L. Tian, **N. Qi**, Z. Leng, L. Zhang, and H. Huang, “Site Selection Method and System for Connecting Heat Accumulating Type Electric Boiler to Power Distribution Network,” Chinese Patent CN109255558A, 2019.
30. X. Song, L. Han, L. Cheng, Y. Cai, Z. Xiao, J. Zhang, S. Gu, D. Yang, M. Liu, Y. Jiang, J. Li, T. Xia, C. Wu, W. Liu, T. Feng, P. Yan, X. Zhang, and **N. Qi**, “Integrated Isolation Circuit Breaker,” Chinese Patent CN209169078U, 2019.
31. X. Song, L. Han, L. Cheng, Z. Xiao, Y. Cai, S. Gu, J. Zhan, M. Liu, D. Yang, J. Li, T. Xia, Y. Jiang, C. Wu, W. Liu, R. Zhang, H. Shen, and **N. Qi**, “Novel Method and System for Evaluating Reliability of Power Equipment Connected to Power Grid and Optimizing Power Equipment Connected to Power Grid,” Chinese Patent CN109711637A, 2019.
32. H. Zhan, M. Li, Z. Lai, Y. Cao, H. Jia, Z. Xu, C. Xu, Z. Wang, and **N. Qi**, “A Kind of Photovoltaic Array Cleaning Device and Automatic Positioning Clean Robot,” Chinese Patent CN109981043A, 2019.

INVITED TALKS AND GUEST LECTURES

- “Powering the Energy Transition with Intelligent Energy Storage: From Data to Decisions,” Onsite Seminar, San Diego State University, Apr. 2026.
- “Behavior-Informed Decision-Making under Uncertainty for Generalized Energy Storage,” Invited Talk, Tsinghua University, Dec. 2025.
- “Strategic Battery Behaviors and Enhanced Market Designs,” Invited Talk, IEEE PES General Meeting, Jul. 2025.
- “Enhanced Market Design and Long-Term Energy Management of Energy Storage,” Joint Columbia–HKU Seminar, Columbia University, Jul. 2025.

- “Generalized Energy Storage Technologies for Intelligent Distribution Grids,” Guest Lecture, China Agricultural University, Apr. 2025.
- “Towards Net Zero: The Role of Generalized Energy Storage Systems,” Invited Talk, Shanghai Jiao Tong University, Jan. 2025.
- “Towards Net Zero: The Role of Generalized Energy Storage Systems,” Invited Talk, Tsinghua University, Dec. 2024.
- “Measurement, Forecasting, and Control of Reliable Flexibility for Electric Vehicle Loads,” Invited Talk, ECE Annual Meeting, Dec. 2024.
- “Pricing Energy Storage for Social-Welfare Maximization,” Invited Talk, INFORMS Annual Meeting, Oct. 2024.
- “Chance-Constrained Generalized Energy Storage Operations under Decision-Dependent Uncertainty,” Invited Talk, California Institute of Technology, Sep. 2024.
- “Reliability-Aware Probabilistic Reserve Procurement under Decision-Dependent Uncertainty,” Invited Talk, IEEE PES General Meeting, Jul. 2024.
- “Unlocking Reliable Flexibility from Generalized Energy Storage Resources,” Guest Lecture, Aalto University, Apr. 2024.
- “Capacity Credit Evaluation of Generic Energy Storage under Decision-dependent Uncertainty,” Invited Talk, IEEE ISGT Europe, Oct. 2023.

TEACHING EXPERIENCE

- Teaching Assistant, Engineering Game Theory (Ph.D. course), Tsinghua University, 2023–2024.
- Teaching Assistant, Optimization Theory & Method (Ph.D. course), Tsinghua University, 2019–2022.
- Teaching Assistant, Power System Reliability Evaluation Theory (undergraduate course), Tsinghua University, 2019–2022.
- Teaching Assistant, State-of-the-art Technology in Electrical Engineering (Ph.D. course), Tsinghua University, 2019–2021.
- Teaching Assistant, China-German Advanced Manufacturing Class (Ph.D. course), Tsinghua University, 2019–2020.

STUDENT SUPERVISION

- Beini Lu (graduate, Columbia University): Online Feedback Optimization and Process Control for Cascade Electrolyzers, 2026–Present.
- Emily Logan (graduate, Columbia University): Kernel Regression for Energy Storage Peak Shaving with Stacked Services, 2025–Present.
- Eliza Cohn (graduate, Columbia University): Cascaded Hydropower Operation under Decision-Dependent Uncertainty, 2024–Present.
- Yousuf Baker (graduate, Columbia University): Non-Anticipatory Networked Energy Storage Energy Management, 2024–Present.
- Neal Ma (graduate, Columbia University): Comparative Energy Storage Withholding Behavior Analysis in California, 2024.
- Janie Zhang (undergraduate, Columbia University): Data-Driven EV Flexibility Learning, 2024.
- Kaidi Huang (graduate, Tsinghua University): Online Convex Optimization for Microgrid Economic Dispatch and P2P Trading, 2022–2023.
- Yingrui Zhuang (graduate, Tsinghua University): Decision-Focused Learning for Distribution System Operations with DERs, 2021–2022.
- Qiuchen Yun (graduate, Tsinghua University): Investment Portfolio Optimization for Multi-Service Provision of VPPs, 2020–2021.
- Jingxuan Huo (undergraduate, Tsinghua University): Planning of North China State Grid Based on Big Data, 2019–2020.

- Helin Xu (undergraduate, Tsinghua University): Data-driven Demand Response Regulation Potential of Air-conditioning Loads, 2019–2020.

PROFESSIONAL SERVICE

Editorial Roles

- Guest Editor, *Processes*, Special Issue “Advanced Technologies in Modeling and Control of Microgrid,” 2026–Present.
- Associate Editor, *IEEE Data Descriptions*, 2025–Present.
- Youth Editorial Board Member, *Protection and Control of Modern Power Systems*, 2025–Present.
- Young Expert Committee Member, *Energy Conversion and Economics*, 2025–Present.
- Youth Editorial Board Member, *Power System Protection and Control*, 2024–Present.
- Guest Editor, *Frontiers in Energy Research*, Special Issue “Advancing Demand Response in Renewable Smart Grid for a Sustainable Future,” 2024–2025.
- Guest Editor, *Processes*, Special Issue “Recent Technologies on CO₂ Capture and (Photo) Electrochemical Utilization,” 2024–2025.

Conference and Community Service

- Section Chair (Best Paper & Paper Forum), “Analytic Methods for Power Systems,” IEEE PES General Meeting, 2026.
- Panel Co-Chair, “Energy Storage Management for Efficient Market Integration and Operation,” IEEE PES General Meeting, 2025.
- Judge, Student Poster Session & Contest, IEEE PES General Meeting, 2024 & 2026.
- Working Group Member, IEEE P762 and IEEE P3434, 2017–Present.
- Member, IEEE, IEEE PES, IEEE Young Professionals, IEEE PES SBLC Technical Committee, IET, and CSEE, 2017–Present.
- Book Reviewer, *Theory and Applications of Engineering Research*, 2023–Present.
- Student Affairs Coordinator, Tsinghua University, 2019–2021.
- Founder and Vice President, Beiyang Mathematical Research Society, Tianjin University, 2016.
- Reviewer, *IEEE Transactions on Power Systems / Smart Grid / Sustainable Energy / Industry Applications / Transportation Electrification*, *IEEE Data Descriptions*, *Applied Energy*, *Journal of Energy Storage*, *International Journal of Electrical Power & Energy Systems*, *IET Renewable Power Generation*, *IET Generation, Transmission & Distribution*, *IEEE PES General Meeting*, *Journal of Modern Power Systems and Clean Energy*, and *Protection & Control of Modern Power Systems*, 2019–Present.