Honglin Li, Ph.D.

Honglin Li | hlli@ksu.edu | Website

Summary

Energy systems researcher with a Ph.D. in Mechanical Engineering who develops optimization and techno-economic models for the design, operation, and long-term planning of low-carbon energy systems. Methods include linear, mixed-integer, nonlinear, stochastic, and multi-objective optimization, combined with life cycle cost and carbon footprint analysis, simulation, and reliability modeling. Applications span wind, solar, and hydrogen systems, regional hydrogen networks, nuclear–hydrogen integration, small modular reactors (SMRs) for data centers, grid integration of data centers, and energy storage. First-author publications include *Nature Communications*, *Cell Reports Sustainability*, and the *International Journal of Hydrogen Energy*. Current research at Kansas State University focuses on techno-economic analysis and optimization of firm, low-carbon power for large and fast-growing electricity loads such as AI data centers, including small modular reactors.

Education

2021 - 2025 Ph.D. (Mechanical Engineering)
The University of Texas at Dallas
Dissertation: *Techno-Economic Analysis of Hydrogen-Integrated Sustainable Energy Systems*

2019 - 2021 M.S. in Engineering (Industrial Engineering)
Texas State University
Thesis: *Planning Virtual Power Plants for Smart Factories and Industry 4.0 with Renewable and Thermal Cogeneration*

2016 - 2018 M.E. in Computer Engineering - *Focus: Machine Learning*
Dalian Maritime University

Academic Experience

Kansas State University Apr. 2026 – present
Postdoctoral Fellow — Department of Electrical and Computer Engineering
Instructor — ECE 685 Power Systems Design Fall 2026

- Leading techno-economic and optimization research on small modular reactor (SMR)-powered data centers, quantifying colocation economics, delayed grid energization, and alternative grid-coupling architectures under load and market uncertainty.
- Developing system-level evaluation metrics and a multi-account cost framework spanning private, ratepayer, and social perspectives, extending prior nuclear–hydrogen–battery and carbon-aware scheduling work to AI-driven electricity demand growth.

University of Texas at Dallas Sep 2025 – Apr. 2026
Research Associate

- Led a techno-economic study of a BWRX-300 small modular reactor whose turbine-extracted steam drives absorption chillers, supplying a data center with both power and cooling; steam, cooling, and power were co-optimized hourly with ERCOT prices (first author; accepted in *Energy Conversion and Management*).
- Mapped where SMR supply becomes competitive with grid supply, and how an output-based production credit shifts steam from cooling to generation.

Internships

Idaho National Laboratory (INL) Feb 2025 – Aug 2025

- **Optimization of Hydrogen Integration in Nuclear Grid Services:** Developed an **optimization framework** using mathematical programming techniques to identify the most profitable deployment strategies for nuclear-powered hydrogen production. Integrated techno-economic analysis, historical market data (ISO prices), and policy incentives (45V tax credits) to maximize revenue from hydrogen sales and grid ancillary services; results published in *Nature Communications* (2026, first author).
- **Techno-Economic Analysis of Non-Powered Dam Retrofits:** Contributed a pro-forma techno-economic module to an INL toolset for retrofitting U.S. non-powered dams with hydropower and battery storage; integration with floating PV was scoped in planning.

FM Aug 2024 – Jan 2025

- **Solar PV Microgrid Design Optimization:** Developed and implemented a techno-economic model incorporating **optimization techniques** to determine the optimal sizing of solar PV, battery storage, and backup generation for an industrial research campus microgrid. Minimized levelized cost of energy subject to meeting demand in modeled grid-outage scenarios, using a DOE reference load profile scaled to the campus's annual consumption and site solar resource data.
- **Lithium Battery Production Line Simulation and Bottleneck Optimization:** Built a discrete-event simulation model (Arena) of a lithium battery production line to quantify the economic impact of equipment failures and maintenance schedules. Identified production bottlenecks and analyzed potential improvements through simulation, implicitly informing optimization of maintenance and buffer strategies.
- **Wind Farm Maintenance Strategy Optimization:** Proposed a research framework featuring an **optimization model** to determine the optimal predictive and corrective maintenance scheduling for wind farms. Aimed at balancing O&M costs, maximizing energy production (reducing downtime), and ensuring long-term asset reliability.

Work Experience

The University of Texas at Dallas

– Research Assistant (Focus: Energy System Optimization Modeling) Aug 2021 – Aug 2024
– Teaching Assistant (Courses: Engineering Optimization, Numerical Methods) Aug 2022 – Dec 2022

- Conducted comprehensive techno-economic analyses of hydrogen-integrated sustainable energy systems.
- Developed optimization-based techno-economic strategies for nuclear–renewable integrated systems.
- Studied green hydrogen production and its integration with renewable and nuclear supply.

Texas State University

– Research Assistant (Focus: Operations Research in Energy/Manufacturing) Aug 2019 – Jul 2021
– Teaching Assistant (Courses: Probability & Statistics, Operations Research) Aug 2019 – Jul 2021

Shanghai Electric Power Construction Co., Ltd. (SEPC)

– Ipaye Power Plant Project, Ajebandele, Nigeria Sep 2016 – Apr 2019
– Eritrea HIRGIGO Power Plant 2×23MW Extension Project, Shanghai, China Nov 2015 – Sep 2016
– Phase I in 3×142MW Coal Fired Power Plant Project, Bali, Indonesia Sep 2014 – Oct 2015

Mentoring Experience

- Undergraduate student **Mirabella Herrera**(UT-Dallas) Summer 2022
  Mentored undergraduate researcher Mirabella through the Research Experience for Undergraduates (REU) program, focusing on techno-economic analysis of co-located wind and green hydrogen systems.
- High school student Summer 2022
  Co-advised a high school student in the TAST STEM Summer Research Program, focusing on techno-economic analysis modeling.
- Undergraduate student **Jonathon Matutes**(University of Indianapolis) Summer 2023
  Mentored undergraduate researcher Jonathon Matutes through the REU program, focusing on techno-economic analysis of potential offshore wind energy development along the northeastern US coast.
- Undergraduate student **Zaina Anarwala**(UIUC) Summer 2024
  Mentored undergraduate researcher Zaina through the REU program, focusing on techno-economic analysis of potential offshore wind energy development in the US Gulf of Mexico.
- Undergraduate student **Kevin Sun**(UT-Dallas) Spring 2025
  Mentored Kevin on a research project focused on techno-economic analysis of nuclear and hydrogen systems.

Grant Writing Experience

- **K-State Secure Energy Initiative (SEI) Seed Grant Proposal: Secure Power for Kansas Data Centers: Socio-Techno-Economic Pathways for SMR Deployment and Grid Integration** *(2026)*
  Co-PI; under review.
- **NSF INTERN supplement (funded)** *(2024)*
  Helped prepare a funded NSF INTERN supplement (**$55,000**; PI Prof. Jie Zhang) that supported my nuclear–hydrogen research at Idaho National Laboratory.

Skills

- **Optimization Techniques:** Linear Programming (LP), Mixed-Integer Linear Programming (MILP), Non-Linear Programming (NLP), Stochastic Programming, Dynamic Programming, Constraint Programming Basics.
- **Optimization Software:** Solvers: **Gurobi**, **CPLEX**, **SCIP**; Modeling Languages: **AMPL**, **Pyomo** (Python), **JuMP** (Julia), **GAMS**.
- **Programming & Data Analysis: Python** (Pandas, NumPy, SciPy, Matplotlib, Scikit-learn, Pyomo), **SQL**, **MATLAB**, **R**, **Julia**.
- **Simulation:** Discrete-Event Simulation (**Arena**), Monte Carlo Methods, System Dynamics Modeling.
- **Techno-Economic Analysis (TEA):** LCOE/LCOH, NPV, IRR, Cash Flow Analysis, Sensitivity Analysis (applied for optimization model inputs & validation).
- **Life-Cycle Assessment (LCA):** Carbon Footprint Accounting, Integration with TEA.
- **Machine Learning for OR:** Surrogate Modeling (Gaussian Processes), Uncertainty Quantification, Time Series Forecasting (LSTM).

- **Domain Knowledge:** Renewable Energy Systems (Wind, Solar PV), Data Centers, Energy Storage (Battery, Hydrogen), Power Grid Operations & Ancillary Services, Electricity Markets (ERCOT, MISO basics), Carbon Neutrality Strategies, Manufacturing Systems.

Research Projects

- **Integrated Supply Chain & Microgrid Optimization under Uncertainty** *(Approx. 2019 – 2020)*
  Contributed to the optimization models (mixed-integer linear programs over a 52-week horizon) and the case-study analyses for supply chain design integrating manufacturing, microgrids (renewables/storage), and climate factors (*Journal of the Operational Research Society*, 2022; second author); optimized logistics and transactive energy operations for cost, carbon, and reliability goals.
- **Joint Facility & Energy System Location-Allocation (FMLA)** *(Approx. 2020 – 2021)*
  Formulated novel optimization models for joint location-allocation of industrial facilities (plants, warehouses) and prosumer microgrids, incorporating energy generation, market participation, and grid interactions as key economic drivers in strategic siting.
- **System Reliability Modeling & Maintenance Optimization** *(Approx. 2020 – 2021)*
  Co-authored a study (IISE 2021) of system availability considering component redundancy, maintenance strategies (including dual repair processes), and spare parts logistics to inform optimal maintenance planning.
- **Techno-Economic Analysis & Optimal Planning of Co-located Renewable/Hydrogen Systems** *(Approx. 2021 – 2024)*
  Conducted TEA and developed optimization frameworks for co-located wind/solar and hydrogen production systems (onshore/offshore); analyzed economic feasibility, optimal sizing/operation, and the role of hydrogen in renewable expansion, incorporating intelligent O&M.
- **Wind Power Uncertainty Quantification via Machine Learning** *(Approx. 2022 – 2023)*
  Applied multi-fidelity Gaussian process regression, combining a theoretical turbine power curve (low fidelity) with noisy SCADA data (high fidelity), to estimate probabilistic wind-farm power curves.
- **Real-Time GHG-Informed Demand-Side Management** *(Approx. 2023 – 2024)*
  Developed demand-side load regulation strategies using real-time grid greenhouse gas emission factors to optimize energy consumption patterns for power grid decarbonization.
- **FM Research Campus Solar PV Project** *(Approx. 2024 – 2025)*
  Developed and applied a techno-economic model with optimization to determine the optimal sizing of solar PV, battery storage, and backup generation for an industrial research campus microgrid. Minimized levelized cost of energy subject to meeting demand in modeled grid-outage scenarios, using a DOE reference load profile scaled to the campus's annual consumption and site solar resource data.
- **TEA of Nuclear-Hydrogen Systems for Grid Ancillary Services** *(Feb. 2025 – Aug. 2025)*
  Developed **optimization frameworks** to determine the most profitable strategies for integrating nuclear power with hydrogen production to participate in electricity market ancillary services, considering market rules and incentives.
- **Techno-Economic Analysis of Non-Powered Dam Retrofits with Battery Storage** *(Feb. 2025 – Aug. 2025)*
  Contributed a pro-forma techno-economic module for retrofitting U.S. non-powered dams with hydropower and battery storage; floating PV was scoped in planning notes.
- **TEA of Co-located SMR-Powered Data Center Integrated System** *(Sep. 2025 – present)*
  Developing integrated thermo-economic and **optimization-based planning models** for co-located SMR powered data centers, evaluating electricity–cooling coupling through absorption cooling driven by turbine-extracted steam, operational flexibility, reliability premiums, and lifecycle economic per-

formance under AI-driven high-density computing demands.

- **National-Scale Integrated Planning of Data Centers and Power Systems**
  (Jan. 2026 – present)
  Developing large-scale **optimization and techno-economic planning frameworks** to jointly evaluate data center deployment and power system expansion across the United States, incorporating regional electricity markets, transmission constraints, climate impacts, cooling resource availability, and long-term decarbonization pathways.

Conference Presentations

- 03/10/2021: 2021 International Research Conference. *Power Demand Prediction using LSTM Neural Network with Multiple Features.*
- 05/24/2021: Annual IISE Conference and Expo 2021. *Allocating microgrid for transactive energy operations in a multi-echelon manufacturing supply chain.*
- 06/02/2022: TORQUE 2022, Delft, Netherlands. *Optimal Planning of Co-Located Wind Energy and Hydrogen Plants: A Techno-Economic Analysis.*
- 10/17/2022: Annual INFORMS Conference 2022. *Redesign Supply Chain for Transactive Energy Operations in Manufacturing-Microgrid-Climate Nexus.*
- 08/20/2023: ASME 2023 IDETC/CIE, Boston, Massachusetts, USA. *A Multi-fidelity Gaussian Process Regression Method for Probabilistic Wind Farm Power Curve Estimation.*
- 10/31/2023: NAWEA/WindTech 2023 Conference, Denver, Colorado, USA. *Economic Feasibility and Decarbonization Potential of Hybrid Wind and Hydrogen Systems in Texas.*
- 11/01/2024: NAWEA/WindTech 2024 Conference, Rutgers University, New Brunswick, New Jersey, USA. *Economic Feasibility and Decarbonization Potential of Hybrid Renewables and Hydrogen Systems in Texas.*
- 10/12/2026: 2026 North American Power Symposium (NAPS), Michigan Technological University, Houghton, Michigan, USA. *Quantifying the Cost of Delayed Grid Energization (CoDE) for AI Data Centers.*

Publications

[1] Jin, Tongdan, **Li, Honglin**, and Siva Prashanth Kumar Prabha (2022). "Supply chain design for transactive energy operations in the nexus of manufacturing, microgrid and climate". In: ***Journal of the Operational Research Society*** 73.11, pp. 2395–2411. DOI: 10.1080/01605682.2022.2035273.

[2] Jin, Tongdan, **Li, Honglin**, and Fei Sun (2021). "System availability considering redundancy, maintenance and spare parts with dual repair processes". In: *IIE Annual Conference. Proceedings*. Institute of Industrial and Systems Engineers (IISE), pp. 590–595.

[3] **Li, Honglin** (2021). "Planning Virtual Power Plants for Smart Factories and Industry 4.0 with Renewable and Thermal Cogeneration". M.S. thesis. Texas State University. URL: https://hdl.handle.net/10877/17829.

[4] Badakhshan, Sobhan, Soroush Senemmar, **Li, Honglin**, and Jie Zhang (2022). "Integrating offshore wind farms with unmanned hydrogen and battery ships". In: *2022 IEEE Kansas Power and Energy Conference (KPEC)*. IEEE, pp. 1–6.

[5] **Li, Honglin**, Jubeyer Rahman, and Jie Zhang (2022). "Optimal planning of co-located wind energy and hydrogen plants: a techno-economic analysis". In: *Journal of Physics: Conference Series*. Vol. 2265. 4. IOP Publishing, p. 042063.

[6] **Li, Honglin**, Cong Feng, and Jie Zhang (2023). "A Multi-Fidelity Gaussian Process Regression Method for Probabilistic Wind Farm Power Curve Estimation". In: *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. Vol. 87301. American Society of Mechanical Engineers, V03AT03A034.

[7] **Li, Honglin**, Tongdan Jin, and Clara Novoa (2023). "Facility and microgrid location-allocation for integrated supply chain and transactive energy operations". In: ***Applied Mathematical Modelling*** 119, pp. 119–136. DOI: 10.1016/j.apm.2023.02.014.

[8] **Li, Honglin**, Tongdan Jin, and Emily Zhu Fainman (2023). "Locating and Allocating Warehouse Facilities and Prosumer Microgrid in Transactive Energy Paradigm". In: *2023 International Conference on Smart Electrical Grid and Renewable Energy (SEGRE)*. IEEE, pp. 410–415.

[9] **Li, Honglin**, Juha Kiviluoma, and Jie Zhang (2023). "Techno-economic analysis for co-located solar and hydrogen plants". In: *2023 19th International Conference on the European Energy Market (EEM)*. IEEE, pp. 1–6.

[10] **Li, Honglin**, Mingxin Li, James Carroll, and Jie Zhang (2024). "Techno-economic analysis incorporating intelligent operation and maintenance management: a case study of an integrated offshore wind and hydrogen energy system". In: *Journal of Physics: Conference Series*. Vol. 2767. 6. IOP Publishing, p. 062016.

[11] **Li, Honglin** and Jie Zhang (2024). "Towards sustainable integration: techno-economic analysis and future perspectives of Co-located wind and hydrogen energy systems". In: ***Journal of Mechanical Design*** 146.2. **(Featured Article)**, p. 020903. DOI: 10.1115/1.4063971.

[12] Shen, Gulai, **Li, Honglin**, et al. (2024). "Demand-side Management Under Real-time Greenhouse Gas Emission Factor for Electricity". In: *2024 ACEEE Summer Study on Energy Efficiency in Buildings*. American Council for an Energy-Efficient Economy.

[13] **Li, Honglin**, Gulai Shen, et al. (2025). "Real-time greenhouse gas emission intensity informed demand-side load regulation for power grid decarbonization". In: ***Cell Reports Sustainability*** 2. **(UTD News)**, p. 100367. DOI: 10.1016/j.crsus.2025.100367.

[14] **Li, Honglin** and Jie Zhang (2025). "Hydrogen's role in expanding renewable energy and reducing carbon emissions in Texas". In: ***International Journal of Hydrogen Energy*** 113, pp. 77–89. DOI: 10.1016/j.ijhydene.2025.02.303.

[15] **Li, Honglin** (2025). "Techno-Economic Analysis of Hydrogen-Integrated Sustainable Energy Systems". Ph.D. dissertation. The University of Texas at Dallas.

[16] **Li, Honglin**, Jianqiao Huang, et al. (2026). "Rethinking the economics and flexibility of U.S. nuclear power through hydrogen integration and policy support". In: ***Nature Communications*** 17, p. 7090. ISSN: 2041-1723. DOI: 10.1038/s41467-026-73630-y.

[17] Jacob, Roshni Anna*, **Li, Honglin***, et al. (2026). "The role of small modular reactors in powering data centers for a sustainable digital economy". In: ***Cell Reports Sustainability*** 3. *Co-first authors, p. 100820. DOI: 10.1016/j.crsus.2026.100820.

[18] **Li, Honglin** and Buxin She (2026). "Quantifying the Cost of Delayed Grid Energization (CoDE) for AI Data Centers". In: *2026 North American Power Symposium (NAPS)*. Accepted.

[19] She, Buxin, **Li, Honglin**, Guangxu Feng, and Qiwei Zhang (2026). "Inertia-Aware Planning of Grid-Forming Energy Storage and Firm Capacity under Thermal Retirement". In: *2026 North American Power Symposium (NAPS)*. Accepted.

[20] **Li, Honglin**, Buxin She, and Jie Zhang (2026). "Techno-Economic Boundary Analysis of Small Modular Reactor Cogeneration for Hyperscale Data Center IT and Cooling Loads". In: *Energy Conversion and Management*. Accepted. arXiv: 2608.10999 [eess.SY].

Reviews of Manuscript

- **Journals:** Applied Energy, Journal of Cleaner Production, Energy, International Journal of Hydrogen Energy, Journal of Mechanical Design, Journal of Energy Storage, Scientific Reports, Journal of Energy Engineering, Energy Conversion and Management, Energy Conversion and Management: X, Energies, Sustainable Energy Technologies and Assessments, Journal of Electrical Engineering, Discover Sustainability, Discover Environment, Sustainable Energy, Grids and Networks, International Journal of Electrical Power & Energy Systems, Journal of Thermal Analysis and Calorimetry, Next Energy, Sustainable Futures, Cleaner Manufacturing.
- **Conferences:** ASME-IDETC-2024, ASME-IDETC-2025, ASME-IDETC-2026, NAPS 2026.