

Subir Majumder, Ph.D.

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RESEARCH PROFILE

- Works at the intersection of power-system engineering and energy economics: measures how electricity users respond to prices, policy, and grid conditions, and builds those responses into power-system models for planning and market design.
- Currently studies emerging large loads, showing that Bitcoin miners curtail less when mining revenue is high and that mixing batch and inference workloads smooths AI data center power while short-horizon ramping can remain elevated.
- Brings a foundation in power-system planning, electricity markets, and cost allocation; has contributed to policy and industry work through Harvard's Belfer Center and the ESIG Large Loads Task Force; and has published in *Joule*, *Nature Climate Change*, and IEEE Transactions journals.

EDUCATION

Indian Institute of Technology Bombay, Mumbai, India, and **University of Wollongong**, 2020
Wollongong, Australia

Ph.D. in Electrical Power Engineering (Cotutelle joint doctoral program)

Dissertation: *Techno-economic analysis of electricity networks with renewable energy sources and storage devices*

Advisors: Prof. S. A. Khaparde and Prof. A. P. Agalgaonkar

Indian Institute of Technology Bombay, Mumbai, India 2014

M.Tech. in Energy Systems Engineering (M.Tech.–Ph.D. dual-degree program)

Kalyani Government Engineering College, Kalyani, West Bengal, India 2012

B.Tech. in Electrical Engineering (West Bengal University of Technology)

RESEARCH APPOINTMENTS

One representative contribution is highlighted for each appointment. Bracketed labels link to the corresponding publication below.

Independent Researcher

Aug. 2025–Present

Power Systems and Energy Economics | Collaborators: Prof. Le Xie; Dr. Ignacio Aravena

[W2] Developed a quasi-experimental econometric framework to estimate how Bitcoin-mining facilities respond to wholesale electricity prices and coincident-peak transmission charges. Showed that the response weakens when hashprice is high, so the flexibility available to the power grid depends on revenue conditions in the crypto-financial sector.

Harvard University, Cambridge, MA, USA

Nov. 2024–Aug. 2025

Visiting Postdoctoral Fellow | Mentors: Prof. Le Xie; Prof. Minlan Yu

[W1] Developed a bottom-up, trace-calibrated model linking AI workloads to GPU power at short timescales. Showed that mixing batch and inference workloads at intermediate shares smooths aggregate GPU power but not short-horizon ramping, so hybrid AI data centers behave as dynamic grid loads.

Texas A&M University, College Station, TX, USA*Apr. 2023–Aug. 2025*

TEES Senior Research Engineer I | Mentors: Prof. Le Xie; Dr. Ignacio Aravena

[C2] Estimated the electricity price response of large flexible cryptocurrency-mining loads in the Texas market. Showed that the response varies over time and built it into an SARIMA-based model of their consumption, the pattern that motivated the hashprice mechanism identified in [W2].

West Virginia University, Morgantown, WV, USA*Sep. 2021–Mar. 2023*

Engineering Scientist | Mentor: Prof. Anurag K. Srivastava

[J4] Developed a hybrid controller for power-grid operation during wildfires: reinforcement learning gives anticipatory guidance on line de-energization, generator setpoints, and load shedding, and a single-step, power-flow-constrained optimization layer keeps every action feasible. This autonomous controller reduces load shedding relative to a myopic dispatch benchmark, with real-time-compatible runtimes.

Washington State University, Pullman, WA, USA*Jan. 2020–Aug. 2021*

Postdoctoral Research Associate | Mentor: Prof. Anurag K. Srivastava

[J3] Developed a chance-constrained framework to jointly schedule energy and reserves from distributed energy resources (DER) in a virtual power plant. The framework accounts for the fast-acting reserve requirements that arise from DER switching during temporary faults in low-inertia power grids.

Indian Institute of Technology Bombay, Mumbai, India*Jul. 2019–Dec. 2019*

Research Associate | Mentor: Prof. S. A. Khaparde

[J2] Developed a game-theoretic framework for fairly sharing voltage-sag mitigation among industrial customers who are not collocated because of distribution network, modeling the shared protection as a partially excludable common-pool resource. The allocation discourages unilateral free riding.

RESEARCH SUPPORT

Contributed as a researcher to the following sponsored projects:

- U.S. DOE, *OPEN COG Grid*, Texas A&M University *2023–2025*
- Additional support from the Texas A&M Energy Institute and the Blockchain and Energy Research Consortium at Texas A&M University *2023–2025*
- U.S. DOE, *Dynamic Watermarking* for cyber-physical security of power distribution systems, Texas A&M University *2023–2025*
- U.S. DOE, *UI-ASSIST* (U.S.–India Collaborative for Smart Distribution System with Storage), Washington State University and West Virginia University *2020–2023*
- NSF CPS/DFG Joint, *Data-driven secure holonic control and optimization for the networked CPS (aDaption)*, Washington State University and West Virginia University *2020–2023*

Proposal development

- Contributed to various proposals to PSERC, NSF, and U.S. DOE as a researcher or co-investigator *2020–2025*

WORKING PAPERS

- [W2] **S. Majumder.**
“Hashprice moderates the electricity demand response of Bitcoin miners.”
arXiv preprint arXiv:2606.00587v2, 2026. Replication code: [doi:10.5281/zenodo.20272757](https://doi.org/10.5281/zenodo.20272757).
- [W1] **S. Majumder**, M. Yu, and L. Xie.
“Workload composition smooths aggregate power demand while sustaining short-horizon ramps in AI data centers.”
arXiv preprint arXiv:2604.10769, 2026. Replication code: [doi:10.5281/zenodo.19463785](https://doi.org/10.5281/zenodo.19463785).

SELECTED PUBLICATIONS

Selected to reflect the research themes above. The remaining publications are listed under Additional Publications at the end of this CV.

Policy brief

- [P1] R. Mural, D. Pherwani, C. Gupta, Y. Yu, A. Takahashi, D. Kim, **S. Majumder**, H. Lee, M. Yu, and L. Xie.
“AI, data centers, and the U.S. electric grid: A watershed moment.”
Belfer Center for Science and International Affairs, Harvard Kennedy School, and Power and AI Initiative, Harvard SEAS, 2026. Foundational brief of the Harvard Project on Grid Integration.

Refereed journal articles

- [J7] I. Aravena, C.-C. Sun, R. Shi, **S. Majumder**, W. Yan, J.-Y. Joo, L. Xie, and J. Wang.
“Open power system datasets and open simulation engines: A survey toward machine learning applications.”
IEEE Open Access Journal of Power and Energy, vol. 12, pp. 353–365, 2025.
- [J6] L. Xie, **S. Majumder**, T. Huang, Q. Zhang, P. Chang, D. J. Hill, and M. Shahidehpour.
“The role of electric grid research in addressing climate change.”
Nature Climate Change, vol. 14, no. 9, pp. 909–915, 2024.
- [J5] **S. Majumder***, L. Dong*, F. Doudi*, Y. Cai*, C. Tian, D. Kalathil, K. Ding, A. A. Thatte, N. Li, and L. Xie.
“Exploring the capabilities and limitations of large language models in the electric energy sector.”
Joule, vol. 8, no. 6, pp. 1544–1549, 2024. (*Equal contribution.)
- [J4] S. U. Kadir, **S. Majumder**, A. K. Srivastava, A. Chhokra, H. Neema, A. Dubey, and A. Laszka.
“Reinforcement learning based proactive control for enabling power grid resilience to wildfire.”
IEEE Transactions on Industrial Informatics, vol. 20, no. 1, pp. 795–805, 2024.
- [J3] **S. Majumder**, S. A. Khaparde, A. P. Agalgaonkar, S. V. Kulkarni, A. K. Srivastava, and S. Perera.
“Chance-constrained pre-contingency joint self-scheduling of energy and reserve in a VPP.”
IEEE Transactions on Power Systems, vol. 39, no. 1, pp. 245–260, 2024. (Also presented at IEEE PES GM, 2024.)
- [J2] **S. Majumder**, S. A. Khaparde, A. P. Agalgaonkar, S. V. Kulkarni, and S. Perera.
“Graph theory based voltage sag mitigation cluster formation utilizing dynamic voltage restorers in radial distribution networks.”
IEEE Transactions on Power Delivery, vol. 37, no. 1, pp. 18–28, 2022.

- [J1] **S. Majumder**, R. M. Shereef, and S. A. Khaparde.
 “Two-stage algorithm for efficient transmission expansion planning with renewable energy resources.”
IET Renewable Power Generation, vol. 11, no. 3, pp. 320–329, 2017.

Refereed conference papers

- [C2] **S. Majumder**, I. Aravena, and L. Xie.
 “An econometric analysis of large flexible cryptocurrency-mining consumers in electricity markets.”
 In *Proceedings of the 58th Hawaii International Conference on System Sciences (HICSS)*, Waikoloa Village, HI, USA, 2025, pp. 3057–3066.
- [C1] P. S. Sarker, **S. Majumder**, M. F. Rafy, and A. K. Srivastava.
 “Impact analysis of cyber-events on distributed voltage control with active power curtailment.”
 In *Proceedings of the 2022 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES)*, Jaipur, India, 2022.

Task-force reports

- [B2] Energy Systems Integration Group (ESIG), Large Loads Task Force.
 “Wholesale market design and operations for systems with large loads: Current practices and recommendations.”
 ESIG Technical Report, Aug. 2026. (**S. Majumder**, Project Team Member.)
- [B1] Energy Systems Integration Group (ESIG), Large Loads Task Force.
 “Resource adequacy with large loads: Planning for flexibility to accelerate integration.”
 ESIG Technical Report, Apr. 2026. (**S. Majumder**, Project Team Member.)

FELLOWSHIPS AND AWARDS

Alexis de Tocqueville Fellowship, Mercatus Center at George Mason University Feb.–May 2026
 Theme: *The intersection of Bitcoin, political economy, and philosophy.*

POSOCO Power System Award, Doctoral category; POSOCO (now Grid Controller of India Limited, Grid-India) 2020
National award; administered with FITT, IIT Delhi.

Recommended for the Best Ph.D. Thesis Award, IIT Bombay (by an external examiner) 2020
Cited for innovative research, rigorous analysis, and diverse mathematical approaches.

Recommended for Special Commendation for an Outstanding Ph.D. Thesis, University of Wollongong (by an external examiner) 2020
Cited for high-quality publications and innovative research solutions.

University Postgraduate Award and Institute Postgraduate Tuition Award, University of Wollongong 2016–2019

INVITED TALKS, PANELS, AND PRESENTATIONS

Invited talk: “Modeling the power grid impact of AI data centers.” Jul. 2025
 Massachusetts Institute of Technology, Cambridge, MA, USA.

Invited talk: “Necessity of system-aware grid-edge operations in power grids.” Mar. 2025
 Pran Foundation, India.

Panelist: “The dual edge of technology: Equity and sustainability in AI usage.” *Mar. 2025*
Harvard University Information Technology, Boston, MA, USA.

Invited talk: “Behavior of large cryptocurrency-mining firms in electricity markets: A Texas econometric analysis.” *Sep. 2024*
Energy & Power Group Seminar, Texas A&M University, College Station, TX, USA.

Panelist: “Operational control of the power grid through AI in the advent of wildfire,” *Jul. 2024*
panel on resiliency of the power system for sustainability.
IEEE Power & Energy Society General Meeting, Seattle, WA, USA.

Posters and co-authored session presentations

- **S. Majumder**, “Queueing dynamics shape power demand in AI data centers,” poster, IEEE PES Energy and Policy Forum *Mar. 2026*
- L. Xie and **S. Majumder**, “The role of electric grid research in addressing climate change,” poster, PSERC Annual Meeting *Dec. 2024*
- J. Kim, H. Ibrahim, **S. Majumder**, P. Enjeti, and L. Xie, “Secure monitoring and control of solar power distribution system through dynamic watermarking,” poster, Co-op Cyber Tech, Arlington, VA *Jun. 2024*
- **S. Majumder**, P. Fu, and L. Xie, “A mechanism to account for locational carbon impact in electricity markets,” oral-session abstract, Texas A&M Conference on Energy, College Station, TX *2023*
- A. K. Srivastava and **S. Majumder**, “Proactive control to minimize impact of extreme events on the power grid,” super session, plus two co-authored panel presentations on distributed optimization and real-time resiliency monitoring, IEEE PES General Meeting *Jul. 2022*
- A. K. Srivastava, **S. Majumder**, et al., “Data-driven secure holonic control and optimization for the networked CPS (aDaption),” project posters, NSF Cyber-Physical Systems PI Meetings *2021, 2022*

MEDIA COVERAGE

CryptoSlate: “Bitcoin miners saved Texas power grid from collapse, but their lucrative pivot to AI is stripping away the emergency brake.” Analysis discussing findings of [W2]. *Aug. 2026*

Harvard SEAS News: “Bringing GPT to the grid: The promise and limitations of large-language models in the energy sector.” Also syndicated by TechXplore. *Jun. 2024*

Texas A&M Engineering News: “Large language models may revolutionize the electric energy sector.” *Jun. 2024*

TEACHING AND MENTORING

Guest Lecturer, IIT Bombay *2018*

- *Smart Grids*: three lectures on battery storage sizing (class size: 20)

Teaching Assistant, IIT Bombay *2013–2018*

- *Smart Grids* (class size: ~ 20) *2018*
- *Energy Management* (class size: ~ 80) *2016*
- Assisted with a four-day continuing education course, *Energy Management* *2015 (twice)*
- **Head TA**, *Fundamentals of Electrical Engineering* (class size: ~ 70) *2014, 2015*

- *Power Systems* (class size: ~ 60) 2014, 2015
- *Fundamentals of Energy Engineering* (class size: ~ 30) 2013

Laboratory Demonstrator, University of Wollongong 2017

- *Power Electronics and Drives* (class size: ~ 20)
- *Electrical Energy Utilization* (class size: ~ 20)

Selected Research Mentoring

- A. Alonso, undergraduate, Harvard University; with Prof. L. Xie 2025
- M. Zeid, Ph.D. student, Texas A&M University; with Prof. P. Enjeti 2024
- P. Fu, then at Future 500, now at Harvard Kennedy School; with Prof. L. Xie 2023
- Md. F. Rafy, Ph.D. student, West Virginia University; with Prof. A. K. Srivastava 2022–2023
- J. Adan, Ph.D. student, West Virginia University; with Prof. A. K. Srivastava 2022–2023
- B. Ha and S. R. Bhavirisetty, WSU/WVU students; with Prof. A. K. Srivastava 2021
- T. E. Warner and A. B. King, undergraduates, WSU; with Prof. A. K. Srivastava 2020
- M. Ayad, undergraduate, University of Wollongong in Dubai 2017

PROFESSIONAL SERVICE

Editorial and program committees

- Editorial Review Board Member, *Energy Exploration & Exploitation* (SAGE) 2026–present
- Technical Program Committee Member, IEEE BRAINS Conference 2026
- Technical Program Committee Member, AIBThings Conference 2023

Journal reviewer

- *IEEE Transactions on Power Systems* 2022–present
- *IEEE Transactions on Smart Grid* 2024–present
- *IEEE Transactions on Power Delivery* 2022–2023
- *Energies* 2022–2023
- Also reviewed for *IEEE Transactions on Sustainable Energy*, *IEEE Transactions on Industrial Electronics*, *IEEE Transactions on Industrial Informatics*, *Cell Reports Physical Science*, *The Electricity Journal*, and *IEEE Access*.

Task forces, working groups, and committees

- Project Team Member, Energy Systems Integration Group (ESIG) Large Loads Task Force; contributed to *Resource Adequacy with Large Loads: Planning for Flexibility to Accelerate Integration* (Apr. 2026) and *Wholesale Market Design and Operations for Systems with Large Loads: Current Practices and Recommendations* (Aug. 2026). 2026
- Member, IEEE PES Working Group on Modern & Future Distribution System Planning 2022–2024
- Member, IEEE WG on Natural Disaster Mitigation Methods and Operation Technology 2023
- Volunteer, IEEE PES Young Professionals Technical Activities Coordination Subcommittee 2023–2024

Judging, mentoring, and event support

- Judge, IEEE PES General Meeting Student Poster Competition 2022, 2023
- Mentor, IEEE PES General Meeting 2023
- Judge, 14th Annual Summer Undergraduate Research Symposium and Spring Undergraduate Research Symposium, West Virginia University 2022
- Proctor, IEEEExtreme Programming Competition 2017
- Web Administrator, IEEE Student Branch, University of Wollongong 2016–2017
- Co-lead, technical sessions, National Power Electronics Conference, IIT Bombay 2015

Outreach

- Mentor for K–12 students, Independent Study and Mentorship program 2024
- Mentorship and awareness initiatives with the Pran Foundation, supporting marginalized students in India 2022–2025

Professional memberships

- Member, IEEE: Power & Energy Society, Control Systems Society, and IEEE Young Professionals
- Member, The Institution of Engineers (India); Chartered Engineer, CEng (India)
- Member, American Economic Association

ADDITIONAL PUBLICATIONS

Together with the working papers and selected publications above, these entries complete the publication record.

Refereed journal articles

- [J16] **S. Majumder**, A. Vosughi, H. M. Mustafa, T. E. Warner, and A. K. Srivastava, “On the cyber-physical needs of DER-based voltage control/optimization algorithms in active distribution network,” *IEEE Access*, vol. 11, pp. 64397–64429, 2023.
- [J15] **S. Majumder**, N. Patari, A. K. Srivastava, P. Srivastava, and A. M. Annaswamy, “Epistemology of voltage control in DER-rich power system,” *Electric Power Systems Research*, vol. 214, 2023.
- [J14] **S. Majumder**, “Premium power investment strategy utilizing the economy of scale of custom power devices,” *Electric Power Systems Research*, vol. 214, Part A, Art. no. 108743, 2023.
- [J13] **S. Majumder**, G. Kandaperumal, S. Pandey, A. K. Srivastava, and C. Koplin, “Pre-event two-stage proactive control for enhanced distribution system resiliency,” *IEEE Access*, vol. 10, pp. 83281–83296, 2022.
- [J12] A. Vosughi, A. Tamimi, A. B. King, **S. Majumder**, and A. K. Srivastava, “Cyber–physical vulnerability and resiliency analysis for DER integration: A review, challenges and research needs,” *Renewable and Sustainable Energy Reviews*, vol. 168, Art. no. 112794, 2022.
- [J11] **S. Majumder**, A. P. Agalgaonkar, S. A. Khaparde, S. Perera, S. V. Kulkarni, and P. P. Ciufo, “Allowable delay heuristic in provision of primary frequency reserve in future power systems,” *IEEE Transactions on Power Systems*, vol. 35, no. 2, pp. 1231–1241, 2020.
- [J10] **S. Majumder**, A. P. Agalgaonkar, S. A. Khaparde, P. P. Ciufo, S. Perera, and S. V. Kulkarni, “Allocation of common-pool resources in an unmonitored open system,” *IEEE Transactions on Power Systems*, vol. 34, no. 5, pp. 3912–3920, 2019.

- [J9] **S. Majumder**, S. A. Khaparde, A. P. Agalgaonkar, P. P. Ciufo, S. Perera, and S. V. Kulkarni, "DFT-based sizing of battery storage devices to determine day-ahead minimum variability injection dispatch with renewable energy resources," *IEEE Transactions on Smart Grid*, vol. 10, no. 1, pp. 626–638, 2019. (Also presented at IEEE PES GM, 2018.)
- [J8] **S. Majumder** and S. A. Khaparde, "Revenue and ancillary benefit maximisation of multiple non-collocated wind power producers considering uncertainties," *IET Generation, Transmission & Distribution*, vol. 10, no. 3, pp. 789–797, 2016.

Refereed conference papers

- [C13] D. Kim, **S. Majumder**, and L. Xie, "A multi-source data repository and profit-robust framework for energy storage planning," in *Proceedings of the 57th North American Power Symposium (NAPS)*, Hartford, CT, USA, 2025.
- [C12] M. Zeid, **S. Majumder**, H. Ibrahim, P. Enjeti, L. Xie, and C. Tian, "Predicting DC-link capacitor current ripple in AC-DC rectifier circuits using fine-tuned large language models," in *Proceedings of the 50th Annual Conference of the IEEE Industrial Electronics Society (IECON)*, Chicago, IL, USA, 2024, pp. 2933–2938.
- [C11] A. Samanta, **S. Majumder**, H. Ibrahim, P. Enjeti, and L. Xie, "Electromagnetic transient model of cryptocurrency mining loads for low-voltage ride through assessment in transmission grids," in *Proceedings of the IEEE Power & Energy Society General Meeting (PES GM)*, Seattle, DC, USA, 2024.
- [C10] D. Kim, **S. Majumder**, and L. Xie, "Line-post insulator fault classification model using deep convolutional GAN-based synthetic images," in *Proceedings of the 55th North American Power Symposium (NAPS)*, Asheville, NC, USA, 2023.
- [C9] J. Adan, **S. Majumder**, and A. K. Srivastava, "Distributed optimization approaches with discrete variables in the power distribution systems," in *Proceedings of the 2022 North American Power Symposium (NAPS)*, Salt Lake City, UT, USA, 2022.
- [C8] P. S. Sarker, N. Patari, B. Ha, **S. Majumder**, and A. K. Srivastava, "Cyber-power testbed for analyzing distributed control performance during cyber-events," in *Proceedings of the 10th Workshop on Modelling and Simulation of Cyber-Physical Energy Systems (MSCPES)*, Milan, Italy, 2022.
- [C7] S. Knudsen, **S. Majumder**, and A. K. Srivastava, "Securely implementing and managing neighborhood solar with storage and peer-to-peer transactive energy," in *CIGRE Paris Session*, Paper no. D2-10414, Paris, France, 2022.
- [C6] **S. Majumder**, S. A. Khaparde, V. Pradhan, A. P. Agalgaonkar, and S. Perera, "Optimal voltage sag mitigation solution provision using customers' approximate marginal willingness-to-pay function," in *Proceedings of the 2021 IEEE Madrid PowerTech*, Madrid, Spain, 2021.
- [C5] **S. Majumder**, S. A. Khaparde, A. P. Agalgaonkar, S. V. Kulkarni, S. Perera, and P. P. Ciufo, "Hybrid storage system sizing for minimum daily variability injection," in *Proceedings of the 2019 IEEE Region 10 Symposium (TENSYP)*, Kolkata, India, 2019, pp. 33–38.
- [C4] **S. Majumder**, S. A. Khaparde, V. Pradhan, S. V. Kulkarni, A. P. Agalgaonkar, S. Perera, and P. P. Ciufo, "A critical review on the methods for calculating the risk of process failure because of voltage sags," in *Proceedings of the 2016 IEEE International Conference on Power System Technology (POWERCON)*, Wollongong, NSW, Australia, 2016.
- [C3] N. V. Vigil, **S. Majumder**, V. Pradhan, V. Padmini, and S. A. Khaparde, "Transmission expansion planning with variable wind source," in *Proceedings of the 18th National Power Systems Conference (NPSC)*, Guwahati, India, 2014.

Bulletin articles (non-refereed)

- [M2] **S. Majumder** and A. K. Srivastava, “Resilience-driven integration of distributed energy resource (DER): Coordinating DER services for value,” *IEEE Smart Grid eBulletin*, Nov. 2022.
- [M1] **S. Majumder** and A. K. Srivastava, “Resilience-driven integration of distributed energy resource (DER): Holistic value analysis,” *IEEE Smart Grid eBulletin*, Sep. 2022.

Technical report and book chapter

- [B4] D. L. Donaldson, M. Deakin, D. Montenegro, A. Poudyal, B. Hayes, B. Lee, H. Caswell, J. Azzolini, M.-C. Alvarez-Herault, P. P. Vergara, **S. Majumder**, and S. Choi, “A framework to identify and map uncertainties in distribution system planning,” *IEEE Power & Energy Society Technical Report PES-TR129*, prepared by the PES Working Group on Modern and Future Distribution System Planning, 2025.
- [B3] G. Kandaperumal, **S. Majumder**, and A. K. Srivastava, “Microgrids as a resilience resource in the electric distribution grid,” in *Electric Power Systems Resiliency: Modelling, Opportunity and Challenges*, Academic Press, 2022, ch. 7, pp. 181–212.

REFERENCES

Available on request.