Noman Bashir

Massachusetts Institute of Technology
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Research Interest

Improving the energy efficiency and sustainability of large-scale computing systems, e.g., edge, cloud, datacenters, and cyber-physical systems, e.g., electric grid.

Academic Experience

Massachusetts Institute of Technology
Computing & Climate Impact Fellow, MIT Climate & Sustainability Consortium (MCSC), MIT Computer Science & Artificial Intelligence Laboratory (CSAIL) — 10/2023–present

University of Massachusetts Amherst
Postdoctoral Research Associate, College of Information and Computer Sciences, — 02/2022–09/2023
Graduate Research Associate, Department of Electrical and Computer Engineering, — 08/2016–02/2022

Lahore University of Management Sciences, Pakistan
Research Associate, Department of Electrical Engineering, — 06/2015–06/2016

National University of Computer & Emerging Sciences, Pakistan
Research Engineer, Department of Computer Science, — 09/2013–05/2015

Industry Experience

VMware Research Group
Sustainability Research Intern, Advisors: Victor Firoiu, Ben Pfaff — 05/2021–08/2021

Google Research
Research Intern, Advisors: Nan Deng, Krzysztof Rzadca — 05/2020–11/2020
Salient Achievement: Our work on resource overcommitment in datacenters, published in EuroSys'21, is the default overcommit strategy across all Google datacenters.

Education

University of Massachusetts Amherst, PhD in Computer Engineering — 08/2016–02/2022
Advisor: David E. Irwin
Committee: Prashant Shenoy, Jay Taneja, and Fatima M. Anwar
Dissertation: *Improving the Programmability of Networked Energy Systems*

National University of Science and Technology (NUST), Pakistan — 09/2013–03/2016
MS in Energy Systems Engineering
Dissertation: *Using Stressed Grids as a Storage Medium for Renewable Energy*

University of Engineering and Technology Lahore, Pakistan — 09/2009–05/2013
BS in Electrical Engineering

Honors & Awards

EuroSys'24 paper awarded Artifact Available, Artifacts Functional, and Results Reproduced Badge
ASPLOS'24 paper awarded Artifact Available, Artifacts Functional, and Results Reproduced Badge
e-Energy'23, selected as one of the top three reviewers (top 3 out of 84 PC members)
New Energy Summer Summit 2023, selected as a part of cohort at Dartmouth College (1 of 19 members).
ACM SIGEnergy Doctoral Dissertation Award 2023 nomination.
ICPE'23 paper selected as Best Paper Award finalist (3 out of 46 submissions)
EuroSys'21 paper awarded Artifact Available, Artifacts Functional, and Results Reproduced Badge
Supercomputing'20 paper selected as Best Paper Award finalist (7 out of 380 submissions)
Supercomputing'20 paper selected as Best Student Paper Award finalist (7 out of 380 submissions)
BuildSys'17 Grid fairness paper nominated for Best Paper Award (top 5 out of 96 submissions)

Publications

All papers are available at https://noman-bashir.github.io/publications/. The names of the students I have advised or co-advised are underlined.

Position papers

[1] **[MIT Press 2024]** The Climate and Sustainability Implications of Generative AI
Noman Bashir, P. Donti, J. Cuff, S. Sroka, M. Ilic, V. Sze, C. Delimitrou, E. Olivetti

[2] **[HotCarbon 2023]** The War of the Efficiencies: Understanding the Tension between Carbon and Energy Optimization
W. Hanafy, R. Bostandoost, Noman Bashir, D. Irwin, M. Hajiesmaili, P. Shenoy

[3] **[HotCarbon 2023]** On the Promise and Pitfalls of Optimizing Embodied Carbon
Noman Bashir, D. Irwin, P. Shenoy

[4] **[HotCarbon 2022]** Sustainable Computing - Without the Hot Air
Noman Bashir, D. Irwin, P. Shenoy, A. Souza

[5] **[SoCC 2021]** Enabling Sustainable Clouds: The Case for Virtualizing the Energy System
Noman Bashir, T. Guo, M. Hajiesmaili, D. Irwin, P. Shenoy, R. Sitaraman, A. Souza, A. Wierman

Conference papers

[6] **[EuroSys 2024]** Quantifying the Benefits of Carbon-Aware Temporal and Spatial Workload Shifting in the Cloud
T. Sukprasert, A. Souza, Noman Bashir, and D. Irwin, P. Shenoy.

[7] **[ASPLOS 2024]** Going Green for Less Green: Optimizing the Cost of Reducing Cloud Carbon Emissions
W. Hanafy, Q. Liang, Noman Bashir, A. Souza, D. Irwin, P. Shenoy.

[8] **[e-Energy 2024]** A Holistic Approach for Equity-aware Carbon Reduction of the Ridesharing Platforms
M. Sahebdel, A. Zeynali, Noman Bashir, P. Shenoy, M. Hajiesmaili.

[9] **[e-Energy 2024]** The Green Mirage: Impact of Location- and Market-based Carbon Intensity Estimation on Carbon Optimization Efficacy
D. Maji, Noman Bashir, D. Irwin, P. Shenoy, R.K. Sitaraman.

[10] **[e-Energy 2024]** LACS: Learning-Augmented Carbon-Aware Resource Scaling for Uncertain Demand
R. Bostandoost, A. Lechowicz, W. Hanafy, Noman Bashir, P. Shenoy, M. Hajiesmaili.

[11] **[e-Energy 2024]** On the Implications of Choosing Average versus Marginal Carbon Intensity Signals on Carbon-aware Optimizations
T. Sukprasert, Noman Bashir, A. Souza, S. Berehe, P. Jain, D. Irwin, P. Shenoy.

[12] **[SIGMETRICS 2024]** Online Conversion with Switching Costs: Robust and Learning-Augmented Algorithms
A. Lechowicz, N. Christianson, B. Sun, Noman Bashir, M. Hajiesmaili, A. Wierman, P. Shenoy.

[13] **[ICML 2024]** Chasing Convex Functions with Long-Term Constraints
A. Lechowicz, N. Christianson, B. Sun, Noman Bashir, M. Hajiesmaili, A. Wierman, P. Shenoy.

[14] **[SIGMETRICS 2024]** CarbonScaler: Leveraging Cloud Workload Elasticity for Optimizing Carbon-Efficiency
W. Hanafy, Q. Liang, Noman Bashir, D. Irwin, P. Shenoy

[15] **[SIGMETRICS 2024]** The Online Pause and Resume Problem: Optimal Algorithms and An Application to Carbon-Aware Load Shifting
A. Lechowicz, N. Christianson, J. Zuo, Noman Bashir, M. Hajiesmaili, A. Wierman, P. Shenoy

[16] **[SoCC 2023]** Carbon Containers: A System-level Facility for Managing Application-level Carbon Emissions
J. Thiede, Noman Bashir, D. Irwin, P. Shenoy

[17] **[SEC 2023]** Energy Time Fairness: Balancing Fair Allocation of Energy and Time for GPU Workloads
W. Hanafy, Q. Liang, Noman Bashir, D. Irwin, P. Shenoy

[18] **[ASPLOS 2023]** Ecovisor: A Virtual Energy System for Carbon-Efficient Applications
A. Souza, Noman Bashir, J. Murillo, W. Hanafy, Q. Liang, D. Irwin, P. Shenoy

[19] **[Performance 2023]** WattScope: Non-intrusive Application-level Power Disaggregation in Datacenters
X. Guan, Noman Bashir, D. Irwin, P. Shenoy

[20] **[e-Energy 2023]** Jointly Managing Electrical and Thermal Energy in Solar- and Battery-powered Computer Systems
Noman Bashir, Y. Chandio, D. Irwin, F.M. Anwar, J. Gummeson, P. Shenoy

[21] **[e-Energy 2023]** Equitable Network-Aware Decarbonization of Residential Heating at City Scale
A. Lechowicz, Noman Bashir, M. Hajiesmaili, P. Shenoy

[22] **[e-Energy 2023]** CUFF: A Configurable Uncertainty-driven Forecasting Framework for Green AI Clusters
P.M. Mammen, Noman Bashir, R. Kolluri, E.K. Lee, P. Shenoy

[23] **[IoTDI 2023]** Dělen: Enabling Flexible and Adaptive Model-serving for Multi-tenant Edge AI
Q. Liang, Noman Bashir, W.A. Hanafy, A. Ali-Eldin, D. Irwin, and P. Shenoy

[24] **[ICPE 2023]** Is Sharing Caring? Analyzing the Incentives for Shared Cloud Clusters
T. Mehboob, Noman Bashir, M. Zink, and D. Irwin
Nominated for the Best Paper.

[25] **[IGSC 2023]** Leveraging Solar PV and Storage for Deep Decarbonization of Residential Heating Systems
A. Sitaraman, Noman Bashir, D. Irwin, P. Shenoy

[26] **[BuildSys 2022]** Data-driven Decarbonization of Residential Heating Systems
J. Wamburu, Noman Bashir, D. Irwin, P. Shenoy

[27] **[SoCC 2021]** Good Things Come to Those Who Wait: Optimizing Job Waiting in the Cloud
P. Ambati, Noman Bashir, D. Irwin, P. Shenoy

[28] **[EuroSys 2021]** Take it to the Limit: Prediction-Driven Resource Overcommitment in Datacenters
Noman Bashir, N. Deng, K. Rzadca, D. Irwin, S. Kodak, R. Jnagal
Artifact Badges: Available, *Functional*, and *Results Reproduced.*

[29] **[SC 2020]** Waiting Game: Optimally Provisioning Fixed Resources for Cloud-enabled Schedulers
P. Ambati, Noman Bashir, D. Irwin, P. Shenoy
Best Paper Award Finalist and Best Student Paper Award Finalist.

[30] **[BuildSys 2020]** DeepSnow: Modeling the Impact of Snow on Solar Generation
Noman Bashir, D. Irwin, P. Shenoy

[31] **[IGSC 2020]** A Probabilistic Approach to Committing Solar Energy in Day-ahead Electricity Markets
Noman Bashir, D. Irwin, P. Shenoy

[32] **[COMPASS 2020]** Extend: A Framework for Increasing Energy Access by Interconnecting Solar Home Systems
S. Correa, Noman Bashir, A. Tran, D. Irwin, J. Taneja

[33] **[COMPASS 2020]** SunDown: Model-driven Per-Panel Solar Anomaly Detection for Residential Arrays
M. Feng, Noman Bashir, P. Shenoy, D. Irwin, D. Kosanovic

[34] **[IC2E 2020]** Hedge Your Bets: Optimizing Long-term Cloud Costs by Mixing VM Purchasing Options
P. Ambati, Noman Bashir, M. Hajiesmaili, D. Irwin, P. Shenoy

[35] **[MASS 2019]** Solar-TK: A Data-driven Toolkit for Solar PV Performance Modeling and Forecasting
Noman Bashir, D. Chen, D. Irwin, P. Shenoy

[36] **[e-Energy 2019]** Like a Good Neighbor, Solar is There
S. Correa, Noman Bashir, J.O. Iglesias, C. Saffery, J. Taneja

[37] **[BuildSys 2018]** Helios: A Programmable Software-defined Solar Module
Noman Bashir, D. Irwin, P. Shenoy

[38] **[BuildSys 2017]** Enforcing Fair Grid Energy Access for Controllable Distributed Solar Capacity
Noman Bashir, D. Irwin, P. Shenoy, J. Taneja
Nominated for the Best Paper.

[39] **[PowerTech 2017]** Lifetime Maximization of Lead-acid Batteries in Small Scale UPS and Distributed Generation Systems
Noman Bashir, H.S. Sardar, M. Nasir, N.U. Hassan, H.A. Khan

[40] **[TenCon 2016]** Impact of Home Appliances on the Performance of Narrow-band Power Line Communications for Smart Grid Applications
A.U. Rehman, Noman Bashir, N.U. Hassan, C. Yuen

[41] **[SmartGridComm 2015]** Delivering Smart Load-shedding for Highly-stressed Grids
Noman Bashir, Z. Sharani, K. Qayyum, and A.A. Syed

Journal articles

[42] **[EIR 2023]** Equity-aware Decarbonization of Residential Heating Systems
J. Wamburu, Noman Bashir, E. Grazier, D. Irwin, C. Crago, P. Shenoy

[43] **[TPDS 2021]** Modeling and Analyzing Waiting Policies for Cloud-Enabled Schedulers
P. Ambati, Noman Bashir, D. Irwin, P. Shenoy

[44] **[TCPS 2021]** Model-driven Per-Panel Solar Anomaly Detection for Residential Arrays
M. Feng, Noman Bashir, P. Shenoy, D. Irwin, D. Kosanovic

[45] **[TOSN 2018]** Mechanisms and Policies for Controlling Distributed Solar Capacity
Noman Bashir, D. Irwin, P. Shenoy, J. Taneja

Under-review

[46] EcoLearn: Optimizing the Carbon Emissions of Federated Learning
T. Mehboob, Noman Bashir, J. Iglesias, M. Zink, D. Irwin.

[47] Carbon-aware Spatial Load Balancing for Content Delivery Networks
J. Murillo, Noman Bashir, D. Irwin, R.K. Sitaraman, P. Shenoy.

[48] Shining a Light on Solar Equity: Photovoltaic Potential Across Spatial and Demographic Diversity
L. Davoren, A. Lechowicz, Noman Bashir, M. Hajiesmaili, P. Shenoy.

[49] Online Learning of Dynamic Incentive Allocation for City-scale Deep Decarbonization
A. Sitaraman, A. Lechowicz, Noman Bashir, X. Liu, M. Hajiesmaili, P. Shenoy.

Workshop papers

[50] **[CPSIS 2023]** Quantifying the Decarbonization Potential of Flexible Residential Loads
P. Bovornkeeratiroj, Noman Bashir, V. Deulkar, B. Balaji, D. Irwin, P. Shenoy, M. Hajiesmaili

Book chapters

[51] Smart-grid Communications and Standard
Noman Bashir, N.U. Hassan, C. Yuen, W. Tushar
IET Communication, Control and Security Challenges for the Smart Grid, 2017.

Thesis

[52] Improving the Programmability of Networked Energy Systems
Noman Bashir, PhD thesis, University of Massachusetts Amherst, 2022.

[53] Using Stressed Grids as a Storage Medium for Renewable Energy
Noman Bashir, MSc thesis, National University of Science and Technology, Islamabad, 2016.

Academic honors

2023	Nominated for SIGEnergy Doctoral Dissertation Award.
2023	Best paper finalist at ACM/SPEC ICPE.
2020	Best student paper and best paper finalist at ACM/IEEE Supercomputing (SC).
2017	Best paper nomination at ACM BuildSys.

Invited talks

Talk title	**The Climate and Sustainability Implications of Generative AI**
04/2024	Conference on the Political Economy of Artificial Intelligence, Harvard Kennedy School.
03/2024	MIT Sloan AI+ML Conference.

Talk title	**Systems for Sustainable Computing**
02/2024	Nokia Bell Labs.
11/2023	SAIL Lab, MIT CSAIL.
09/2023	Rigorous Systems Research Group (RSRG), Caltech.
07/2023	Climate Change AI
03/2023	IBM Research.

Talk title	**A Holistic View of Societal Decarbonization**
01/2024	MIT Climate & Sustainability Consortium.
10/2023	University of Toronto.
11/2022	Low Carbon and Sustainable Computing (LOCOS) seminar at the University of Glasgow.
04/2021	Information Technology University (ITU), Pakistan, (virtual).

Talk title	**Benefits and Limitations of Carbon Accounting Paradigms**
02/2023	Workshop on NetZero Carbon Computing (NetZero), co-located with HPCA.

Talk title	**Peak Prediction-driven Resource Overcommitment in Google Datacenters.**
11/2022	Tracing Summit at Google UK.

Talk title	**Solar-TK: A Data-driven Toolkit for Solar PV Performance Modeling and Forecasting**
11/2020	Energy Data Analytics Symposium, Duke University.

Invited panelist

02/2024	*Balancing Acts: Climate Mitigation and Adaptation*, PSA, Columbia University.
01/2024	*Data Centers and Computing*, MIT MCSC and MIT Energy Initiative.

Service to the profession

Program Committee Member

NSDI (2025), e-Energy (2023, 2024), IPSN (2024), SIGKDD (2024), BuildSys (2023, 2024), SoCC (2022, 2023), DATA (2023), ENSYS (2022), Workshop on Tackling Climate Change with Machine Learning (ICLR 2023, NeurIPS 2022).

Chair, Co-Chair, Organizer

2024	NSF Workshop on Water Sustainability and Ecological Diversity, Purdue University, 2024.
2022–2024	ACM SIGEnergy Workshop on Societal Decarbonization (SoDec)
2023	Ph.D. Symposium Chair at ACM BuildSys'23.
2023	Ph.D. Symposium Chair at IEEE IC2E'23.
2022–2023	Co-Chair SIGEnergy Graduate Student Talk Series.
2022	Organizer ACM e-Energy Hybrid Hub at UMass Amherst 2022.
2022–2023	Co-organizer of UMass Summer Turing Program (2022, 2023).

Reviewer

Climate Change AI Innovation Grants Program (2023), Journal of Systems Research – Serverless Systems Track (2023), IEEE TPDS, Elsevier SUSCOM, and Elsevier Applied Energy.

Mentoring experience

I have advised, co-advised, or mentored the following Ph.D., MS, and Undergraduate students at various universities.

Massachusetts Institute of Technology

2023 –	Varun Gohil	Ph.D. Student	Primary Advisor – Christina Delimitrou.
2023 –	Anagha Belavadi Subramanya	Ph.D. Student	Primary Advisor – Elsa Olivetti.
2023 –	Yichen Gao	Undergrad	Co-advised with James Cuff, Chris Hill, and Jeremy Gregory.
2024 –	Pragnya Govinda	Undergrad	Individually supervised.
2024 –	Anika Puri	Undergrad	Individually supervised.
2024 –	Shreya Reshamwala	Undergrad	Individually supervised.
2024 –	Jingling Zhu	Undergrad	Individually supervised.
2024 –	Wacuka M. Ngata	Undergrad	Individually supervised.
2024 –	Gerson H. Asifiwe	Undergrad	Individually supervised.

University of Massachusetts Amherst

2022 –	Walid Hanafy	Ph.D. Student	Primary Advisor – Prashant Shenoy.
22 – 24	Qianlin Liang	Ph.D. Student	//
22 – 24	Jorge Murillo	Ph.D. Student	//
22 – 24	Phuthipong Bovornkeeratiroj	Ph.D. Student	//
2023	Priyanka Mary Memmon	Ph.D. Student	//
22 – 23	John Wamburu	Ph.D. Student	Now **Research Scientist** at **IBM Research**.
2021	Menghong Fang	MS Student	Now **Advanced Inspection Engineer** at **Apple**.
22 – 24	Anupama Sitaraman	Undergrad	Joining **CMU** as a **PhD Student** with **Yuvraj Agarwal**
2022 –	John Thiede	PhD Student	Primary Advisor – David Irwin.
2022 –	Xiaoding Guan	PhD Student	//
2022 –	Talha Mehboob	PhD Student	//
2022	Taisuke Miamoto	Undergrad	//
2022 –	Mahsa Sahebdel	PhD Student	Primary Advisor – Mohammad Hajiesmaili.
2022 –	Roozbeh Bostandoost	PhD Student	//
2022 –	Adam Lechowicz	PhD Student	Primary Advisors – Prashant Shenoy, Mohammad Hajiesmaili.
2022 –	Diptayroop Maji	PhD Student	Primary Advisors – Prashant Shenoy, Ramesh Sitaraman.
2022 –	Thanathorn Sukprasert	Ph.D. Student	Primary Advisors – Prashant Shenoy, David Irwin.

Lahore University of Management Sciences

15 – 17	Hira Shahzad Sardar	Undergrad	**MS Dartmouth College**, **TPM @ MathWorks**.
15 – 16	Aneeq ur Rehman	Undergrad	**MS U of Sheffield**, **Senior Data Scientist @ AstraZeneca**

National University of Computer and Emerging Sciences

13 – 14	Fuqaan Mehmood	Undergrad	**MS TU Dresden**, **Senior Engineer @ NVM Devices**.
13 – 14	Faizan Hassan	Undergrad	