




NOMAN BASHIR

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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.	
EDUCATION	University of Massachusetts Amherst , PhD in Computer Engineering Advisor: David E. Irwin Committee: Prashant Shenoy, Jay Taneja, and Fatima M. Anwar Dissertation: <i>Improving the Programmability of Networked Energy Systems</i>	08/2016–02/2022
	National University of Science and Technology (NUST) , Pakistan MS in Energy Systems Engineering Dissertation: <i>Using Stressed Grids as a Storage Medium for Renewable Energy</i>	09/2013–03/2016
	University of Engineering and Technology Lahore , Pakistan BS in Electrical Engineering	09/2009–05/2013
ACADEMIC EXPERIENCE	Massachusetts Institute of Technology <i>Computing & Climate Impact Fellow</i> , MIT Climate & Sustainability Consortium (MCSC),	10/2023–present
	University of Massachusetts Amherst <i>Postdoctoral Research Associate</i> , College of Information and Computer Sciences, <i>Graduate Research Associate</i> , Department of Electrical and Computer Engineering,	02/2022–09/2023 08/2016–02/2022
	Lahore University of Management Sciences , Pakistan <i>Research Associate</i> , Department of Electrical Engineering,	06/2015–06/2016
	National University of Computer & Emerging Sciences , Pakistan <i>Research Engineer</i> , Department of Computer Science,	09/2013–05/2015
	VMware Research Group <i>Sustainability Research Intern</i> , Advisors: Victor Firoiu, Ben Pfaff	05/2021–08/2021
INDUSTRY EXPERIENCE	Google Research <i>Research Intern</i> , Advisors: Nan Deng, Krzysztof Rzadca Salient Achievement: Our work on resource overcommitment in datacenters, published in EuroSys'21, is the default overcommit strategy across all Google datacenters.	05/2020–11/2020
HONORS & AWARDS	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. UMass ECE 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/>.

Position papers

- [1] [On the Promise and Pitfalls of Optimizing Embodied Carbon](#)
Noman Bashir, D. Irwin, P. Shenoy
The 2nd Workshop on Sustainable Computer Systems (**HotCarbon**), 2023.
- [2] [Sustainable Computing - Without the Hot Air](#)
Noman Bashir, D. Irwin, P. Shenoy, A. Souza
The Inaugural Workshop on Sustainable Computer Systems Design and Implementation (**HotCarbon**), 2022.
- [3] [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
ACM Symposium on Cloud Computing (**SoCC**), 2021.

Conference papers

- [4] [CarbonScaler: Leveraging Cloud Workload Elasticity for Optimizing Carbon-Efficiency](#)
W. Hanafy, Q. Liang, **Noman Bashir**, D. Irwin, P. Shenoy
ACM Special Interest Group on Measurement and Evaluation (**SIGMETRICS**), 2024.
- [5] [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
ACM Special Interest Group on Measurement and Evaluation (**SIGMETRICS**), 2024.
- [6] [Carbon Containers: A System-level Facility for Managing Application-level Carbon Emissions](#)
J. Thiede, **Noman Bashir**, D. Irwin, P. Shenoy
ACM Symposium on Cloud Computing (**SoCC**), 2023.
- [7] [Energy Time Fairness: Balancing Fair Allocation of Energy and Time for GPU Workloads](#)
W. Hanafy, Q. Liang, **Noman Bashir**, D. Irwin, P. Shenoy
ACM/IEEE Symposium on Edge Computing (**SEC**), 2023.
- [8] [Ecovisor: A Virtual Energy System for Carbon-Efficient Applications](#)
A. Souza, **Noman Bashir**, J. Murillo, W. Hanafy, Q. Liang, D. Irwin, P. Shenoy
The International Conference on Architectural Support for Programming Languages and Operating Systems (**ASPLOS**), 2023.
- [9] [WattScope: Non-intrusive Application-level Power Disaggregation in Datacenters](#)
X. Guan, **Noman Bashir**, D. Irwin, P. Shenoy
The International Symposium on Computer Performance, Modeling, Measurements and Evaluation (**Performance**), 2023.
- [10] [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
ACM International Conference on Future Energy Systems (**e-Energy**), 2023.
- [11] [Equitable Network-Aware Decarbonization of Residential Heating at City Scale](#)
A. Lechowicz, **Noman Bashir**, M. Hajiesmaili, P. Shenoy
ACM International Conference on Future Energy Systems (**e-Energy**), 2023.
- [12] [CUFF: A Configurable Uncertainty-driven Forecasting Framework for Green AI Clusters](#)
P.M. Mammen, **Noman Bashir**, R. Kolluri, E.K. Lee, P. Shenoy
ACM International Conference on Future Energy Systems (**e-Energy**), 2023.
- [13] [Dēlen: 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
IEEE/ACM Eighth International Conference on Internet-of-Things Design and Implementation (**IoTDI**), 2023.
- [14] [Is Sharing Caring? Analyzing the Incentives for Shared Cloud Clusters](#)
T. Mehboob, **Noman Bashir**, M. Zink, and D. Irwin
IEEE/SPEC International Conference on Performance Engineering (**ICPE**), 2023
Nominated for the Best Paper.
- [15] [Leveraging Solar PV and Storage for Deep Decarbonization of Residential Heating Systems](#)
A. Sitaraman, **Noman Bashir**, D. Irwin, P. Shenoy
The International Green and Sustainable Computing (**IGSC**), 2023.
- [16] [Data-driven Decarbonization of Residential Heating Systems](#)
J. Wamburu, **Noman Bashir**, D. Irwin, P. Shenoy
ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (**BuildSys**), 2022.
- [17] [Good Things Come to Those Who Wait: Optimizing Job Waiting in the Cloud](#)
P. Ambati, **Noman Bashir**, D. Irwin, P. Shenoy
ACM Symposium on Cloud Computing (**SoCC**), 2021.
- [18] [Take it to the Limit: Prediction-Driven Resource Overcommitment in Datacenters](#)
Noman Bashir, N. Deng, K. Rzađca, D. Irwin, S. Kodak, R. Jnagal
ACM European Conference on Computer Systems (**EuroSys**), 2021
Artifact Badges: Available, Functional, and Results Reproduced.

- [19] [Waiting Game: Optimally Provisioning Fixed Resources for Cloud-enabled Schedulers](#)
P. Ambati, **Noman Bashir**, D. Irwin, P. Shenoy
Supercomputing (SC) 2020
Best Paper Award Finalist and Best Student Paper Award Finalist.
- [20] [DeepSnow: Modeling the Impact of Snow on Solar Generation](#)
Noman Bashir, D. Irwin, P. Shenoy
ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (**BuildSys**), 2020.
- [21] [A Probabilistic Approach to Committing Solar Energy in Day-ahead Electricity Markets](#)
Noman Bashir, D. Irwin, P. Shenoy
International Green and Sustainable Computing Conference (**IGSC**), 2020.
- [22] [Extend: A Framework for Increasing Energy Access by Interconnecting Solar Home Systems](#)
S. Correa, **Noman Bashir**, A. Tran, D. Irwin, J. Taneja
ACM SIGCAS Conference on Computing and Sustainable Societies (**COMPASS**), 2020.
- [23] [SunDown: Model-driven Per-Panel Solar Anomaly Detection for Residential Arrays](#)
M. Feng, **Noman Bashir**, P. Shenoy, D. Irwin, D. Kosanovic
ACM SIGCAS Conference on Computing and Sustainable Societies (**COMPASS**), 2020.
- [24] [Hedge Your Bets: Optimizing Long-term Cloud Costs by Mixing VM Purchasing Options](#)
P. Ambati, **Noman Bashir**, M. Hajiesmaili, D. Irwin, P. Shenoy
IEEE International Conference on Cloud Engineering (**IC2E**), 2020.
- [25] [Solar-TK: A Data-driven Toolkit for Solar PV Performance Modeling and Forecasting](#)
Noman Bashir, Dong Chen, D. Irwin, P. Shenoy
IEEE International Conference on Mobile Ad-Hoc and Smart Systems (**MASS**), 2019.
- [26] [Like a Good Neighbor, Solar is There](#)
S. Correa, **Noman Bashir**, J.O. Iglesias, C. Saffery, J. Taneja
The International Conference on Future Energy Systems (**e-Energy**), 2019.
- [27] [Helios: A Programmable Software-defined Solar Module](#)
Noman Bashir, D. Irwin, P. Shenoy
ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (**BuildSys**), 2018.
- [28] [Enforcing Fair Grid Energy Access for Controllable Distributed Solar Capacity](#)
Noman Bashir, D. Irwin, P. Shenoy, J. Taneja
ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (**BuildSys**), 2017
Nominated for the Best Paper.
- [29] [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
IEEE **PowerTech**, 2017.
- [30] [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
IEEE Region Ten International Conference (**TenCon**), 2016.
- [31] [Delivering Smart Load-shedding for Highly-stressed Grids](#)
Noman Bashir, Z. Sharani, K. Qayyum, and A.A. Syed
IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (**SmartGridComm**), 2015.

Journal articles

- [32] [Investigating the Correlation Between Presence and Reaction Time in Mixed Reality](#)
Y. Chandio, **Noman Bashir**, F. Anwar, V. Interrante
IEEE Transactions on Visualization and Computer Graphics (**TVCG**), 2023.
- [33] [Equity-aware Decarbonization of Residential Heating Systems](#)
J. Wamburu, **Noman Bashir**, E. Grazier, D. Irwin, C. Crago, P. Shenoy
SIGEnergy Energy Informatics Review (**EIR**), 2023.

[34] [Modeling and Analyzing Waiting Policies for Cloud-Enabled Schedulers](#)
P. Ambati, **Noman Bashir**, D. Irwin, P. Shenoy
IEEE Transactions on Parallel and Distributed Systems (TPDS), 2021.

[35] [Model-driven Per-Panel Solar Anomaly Detection for Residential Arrays](#)
M. Feng, **Noman Bashir**, P. Shenoy, D. Irwin, D. Kosanovic
ACM Transactions on Cyber-Physical Systems (TCPS), 2021.

[36] [Mechanisms and Policies for Controlling Distributed Solar Capacity](#)
Noman Bashir, D. Irwin, P. Shenoy, J. Taneja
The ACM Transactions on Sensor Networks (TOSN), 2018.

Under-review

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

[38] [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.

[39] [Carbon-aware Spatial Load Balancing for Content Delivery Networks](#)
J. Murillo, **Noman Bashir**, D. Irwin, R.K. Sitarama, P. Shenoy.

[40] [GAIA: A Cost- and Carbon-Aware Scheduler for Batch Processing in the Cloud](#)
W. Hanafy, Q. Liang, **Noman Bashir**, A. Souza, D. Irwin, P. Shenoy.

[41] [A Holistic Approach for Equity-aware Carbon Reduction of the Ridesharing Platforms](#)
M. Sahebdel, A. Zeynali, **Noman Bashir**, P. Shenoy, M. Hajiesmaili.

[42] [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.

[43] [Sustainability at a Crossroad: How the Choice of Carbon Intensity Signal Shapes Carbon-Aware Scheduling Outcomes](#)
T. Sukprasert, **Noman Bashir**, A. Souza, S. Berehe, P. Jain, D. Irwin, P. Shenoy.

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

[45] [Exploring Stealthy Multi-modal Attacks in Mixed Reality](#)
Y. Chandio, **Noman Bashir**, F. Anwar. .

Workshop papers

[46] [HoloSet - A Dataset for Visual Inertial Odometry in Extended Reality](#)
Y. Chandio, **Noman Bashir**, F. Anwar. The Data: Acquisition To Analysis (DATA), 2022.

[47] [Quantifying the Decarbonization Potential of Flexible Residential Loads](#)
P. Bovornkeeratiroj, **Noman Bashir**, V. Deulkar, B. Balaji, D. Irwin, P. Shenoy, M. Hajiesmaili
International Workshop on Cyber-Physical-Social Infrastructure Systems (CPSIS) at BuildSys, 2023.

Book chapters

[48] [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

[49] [Improving the Programmability of Networked Energy Systems](#)
Noman Bashir
PhD thesis, University of Massachusetts Amherst, 2022.

[50] [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

07/2023	Climate Change AI, <i>Decarbonizing AI: The Good, the Bad, and the Ugly</i> .
03/2023	IBM Research, <i>Ecovisor: A Virtual Energy System for Carbon-Efficient Applications</i> .
02/2023	Workshop on NetZero Carbon Computing (NetZero), co-located with HPCA, <i>Benefits and Limitations of Carbon Accounting Paradigms</i> .
11/2022	Low Carbon and Sustainable Computing (LOCOS) seminar at University of Glasgow <i>Enabling Sustainable Clouds: The Case for Virtualizing the Energy System</i> .
11/2022	Tracing Summit at Google UK, <i>Take it to the Limit: Peak Prediction-driven Resource Overcommitment in datacenters</i> .
04/2021	Information Technology University (ITU), Pakistan, (virtual), <i>Leveraging Machine Learning to Design Energy Efficient and Sustainable Systems</i> .
11/2020	Energy Data Analytics Symposium, Duke University, <i>Solar-TK: A Data-driven Toolkit for Solar PV Performance Modeling and Forecasting</i> .

Service to the profession

PC member at ACM e-Energy'24 and ACM/IEEE IPSN'24.
Publicity chair at ACM/IEEE IPSN'24.
Publicity chair at ACM e-Energy'24.
Co-chair ACM SIGEnergy Workshop on Societal Decarbonization (SoDec'23), formerly WeCan'22.
Ph.D. Symposium Chair at ACM BuildSys'23, IEEE IC2E'23.
PC member at ACM e-Energy'23, ACM BuildSys'23, ACM SoCC'23, and DATA'23.
PC member at ACM SoCC'22, ACM ENSYS'22.
Reviewer for Climate Change AI Innovation Grants Program (2023)
Reviewer for Journal of Systems Research, Serverless Systems Track (2023)
PC member at Workshop on Tackling Climate Change with Machine Learning at ICLR23, NeurIPS'22.
Co-organizer SIGEnergy Graduate Student Talk Series (starting 2022).
Organizer ACM e-Energy Hybrid Hub at UMass Amherst 2022.
Co-organizer of UMass Summer Turing Program (2022, 2023).
Shadow PC member at ACM EuroSys 2022 and ACM SenSys 2022.
Reviewer for IEEE Transactions on Parallel and Distributed Systems (TPDS), Elsevier Sustainable Computing (SUSCOM), and Elsevier Applied Energy journals.