NOMAN BASHIR

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RESEARCH FOCUS

Computer Systems, Cloud Computing, Energy Systems, Sustainable Computing, Uncertainty-Aware Decision-Making

ACADEMIC EXPERIENCE

Massachusetts Institute of Technology 2023 – present

Postdoctoral Associate, Computer Science & Artificial Lab. (CSAIL)
Advisor: *Christina Delimitrou*

- Working on power management for modern computing workloads, including LLMs and microservices.
- Working on enabling uncertainty-aware discernable decision-making in sustainable computing.

Computing & Climate Impact Fellow, MIT Climate & Sustainability Consortium (MCSC)
Advisor: *Elsa Olivetti*

- Designed a framework for sustainable development in generative AI in the face of unfettered growth.

University of Massachusetts Amherst 2016 – 2023

Postdoctoral Associate, College of Information and Computer Sciences (CICS)
Advisor: *Prashant Shenoy*

- Conducted research on using carbon efficiency as a first-class metric for designing sustainable computer systems.
- Mentored 10+ Ph.D. students, several M.S., and undergraduate students.

Graduate Research Assistant, Dept. of Electrical and Computer Engineering (ECE)
Advisor: *David Irwin*

- Improved the programmability of networked energy systems to enhance their reliability, scalability, and efficiency.

EDUCATION

University of Massachusetts Amherst 2016 – 2022
Ph.D. in Computer Engineering

National University of Science and Technology, Islamabad 2013 – 2016
MS in Energy Systems Engineering

University of Engineering and Technology, Lahore 2009 – 2013
BS in Electrical Engineering

HONORS & AWARDS

- **ACM SIGMETRICS'24 Best Student Paper Award** for the paper "CarbonScaler: Leveraging Cloud Workload Elasticity for Optimizing Carbon-Efficiency". Jun 2024
- **IGSC'23 Best Student Paper Award** for the paper "No Free Lunch: Analyzing the Cost of Deep Decarbonizing Residential Heating Systems". (1 out of 14 papers). Nov 2023
- **ACM e-Energy'23 Best Reviewer Award**, one of the top three reviewers out of 84 PC members. Jun 2023
- **Best Paper Runner Up & Finalist Awards** at **ACM e-Energy 2024**, **ACM/SPEC ICPE 2023**, **Supercomputing 2020**, and **ACM BuildSys 2017**. 2017–24

PUBLICATIONS

My work has been published at the top computer systems and energy systems venues, including ASPLOS (x2), EuroSys (x2), SIGMETRICS/Performance (x4), SoCC (x4), SC (x1), ICML (x1), e-Energy (x8), BuildSys (x4), and HotCarbon (x4). Ph.D. and master's students I have mentored are highlighted using ▼, while undergrad students are indicated with ★.

Representative Publications

[1] Walid Hanafy▼, Qianlin Liang▼, **Noman Bashir**, Abel Souza, David Irwin, and Prashant Shenoy. *Going Green for Less Green: Optimizing the Cost of Reducing Cloud Carbon Emissions*. In: *ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*. 2024. **Artifact Available/Functional, Results Produced**.

[2] Abel Souza, **Noman Bashir**, Jorge Murillo▼, Walid Hanafy▼, Qianlin Liang▼, David Irwin, and Prashant Shenoy. *Ecovisor: A Virtual Energy System for Carbon-Efficient Applications*. In: *ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*. 2023.

[3] **Noman Bashir**, Nan Deng, Krzysztof Rzadca, David Irwin, Sree Kodak, and Rohit Jnagal. *Take it to the Limit: Peak Prediction-driven Resource Overcommitment in Datacenters*. In: *European Conference on Computer Systems (EuroSys)*. 2021. **This work has been deployed on all Google datacenters as their default overcommit strategy.**

CONFERENCE PUBLICATIONS

[1] **Noman Bashir**, Priya Donti, James Cuff, Sydney Sroka, Marija Ilic, Vivienne Sze, Christina Delimitrou, and Elsa Olivetti. *The Climate and Sustainability Implications of Generative AI*. In: *An MIT Exploration of Generative AI: Nature-Inspired Design and Sustainability (MIT Press)*, (2024).

[2] **Noman Bashir**, Varun Gohil, Mohammad Shahrad, David Irwin, Anagha B. Subramanya, Elsa Olivetti, and Christina Delimitrou. *The Sunk Carbon Fallacy: Rethinking Carbon Footprint Metrics for Effective Carbon-Aware Scheduling*. In: *ACM Symposium on Cloud Computing (SoCC)*. 2024.

[3] Yasra Chandio, **Noman Bashir**, Tian Guo, Elsa Olivetti, and Fatima M. Anwar. *Scoping Sustainable Collaborative Mixed Reality*. In: *IEEE International Symposium on Emerging Metaverse (ISEMV)*. 2024.

[4] Adam Lechowicz▼, Nicolas Christianson, Bo Sun, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Prashant Shenoy. *Chasing Convex Functions with Long-term Constraints*. In: *The International Conference on Machine Learning (ICML)*. 2024.

[5] Thanathorn Sukprasert▼, Abel Souza, **Noman Bashir**, David Irwin, and Prashant Shenoy. *On the Limitations of Carbon-Aware Temporal and Spatial Workload Shifting in the Cloud*. In: *European Conference on Computer Systems (EuroSys)*. 2024. **Artifact Available, Artifact Functional, Results Produced**.

[6] Walid Hanafy▼, Qianlin Liang▼, **Noman Bashir**, David Irwin, and Prashant Shenoy. *CarbonScaler: Leveraging Cloud Workload Elasticity for Optimizing Carbon-Efficiency*. In: *ACM SIGMETRICS/IFIP PERFORMANCE Joint International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*. 2024. **Best Student Paper Award**.

[7] Adam Lechowicz▼, Nicolas Christianson, Bo Sun, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Prashant Shenoy. *Online Conversion with Switching Costs: Robust and Learning-Augmented Algorithms*. In: *ACM SIGMETRICS/IFIP PERFORMANCE Joint International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*. 2024.

[8] Adam Lechowicz▼, Nicolas Christianson, Jinhang Zuo, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Prashant Shenoy. *The Online Pause and Resume Problem: Optimal Algorithms and An Application to Carbon-Aware Load Shifting*. In: *ACM SIGMETRICS/IFIP PERFORMANCE Joint International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS)*. 2024.

[9] Diptyaroop Maji▼, **Noman Bashir**, David Irwin, Prashant Shenoy, and Ramesh K Sitaraman. The Green Mirage: Impact of Location- and Market-based Carbon Intensity Estimation on Carbon Optimization Efficacy. In: *ACM International Conference on Future and Sustainable Energy Systems (e-Energy)*. 2024. **Best Paper Award Finalist**.

[10] Roozbeh Bostandoost▼, Adam Lechowicz▼, Walid Hanafy▼, **Noman Bashir**, Prashant Shenoy, and Mohammad Hajiesmaili. *LACS: Learning-Augmented Algorithms for Carbon-Aware Resource Scaling with Uncertain Demand*. In: *ACM International Conference on Future and Sustainable Energy Systems (e-Energy)*. 2024.

[11] Thanathorn Sukprasert▼, **Noman Bashir**, Abel Souza, David Irwin, and Prashant Shenoy. *On the Implications of Choosing Average versus Marginal Carbon Intensity Signals on Carbon-aware Optimizations*. In: *ACM International Conference on Future and Sustainable Energy Systems (e-Energy)*. 2024. **Best Notes Paper Award Finalist**.

[12] Mahsa Sahebdel▼, Ali Zeynali▼, **Noman Bashir**, Prashant Shenoy, and Mohammad Hajiesmaili. *A Holistic Approach for Equity-aware Carbon Reduction of the Ridesharing Platforms*. In: *ACM International Conference on Future and Sustainable Energy Systems (e-Energy)*. 2024.

[13] Julia Köhlke, Adam Lechowicz▼, Oluwole Fabikun★, **Noman Bashir**, Abel Souza, Prashant Shenoy, and Sebastian Lehnhoff. *Examining the Adoption of Electromobility Concepts Across Social Contexts for Energy Transition*. In: *ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys)*. 2024.

[14] Abel Souza, **Noman Bashir**, Jorge▼ Murillo, Walid Hanafy▼, Qianlin Liang▼, David Irwin, and Prashant Shenoy. *Ecovisor: A Virtual Energy System for Carbon-Efficient Applications*. In: *ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*. 2023.

[15] John Thiede▼, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Carbon Containers: A System-level Facility for Managing Application-level Carbon Emissions*. In: *ACM Symposium on Cloud Computing (SoCC)*. 2023.

[16] **Noman Bashir**, Yasra Chandio, David Irwin, Fatima M. Anwar, Jeremy Gummeson, and Prashant Shenoy. *Jointly Managing Electrical and Thermal Energy in Solar- and Battery-powered Computer Systems*. In: *ACM International Conference on Future Energy Systems (e-Energy)*. 2023. This work led to **NSF CNS Core: Small** award with funding of **$325,965**, Award ID: **2230143**.

[17] Adam Lechowicz▼, **Noman Bashir**, John Wamburu▼, Mohammad Hajiesmaili, and Prashant Shenoy. *Equitable Network-Aware Decarbonization of Residential Heating at City Scale*. In: *ACM International Conference on Future Energy Systems (e-Energy)*. 2023.

[18] Priyanka Mary Mammen▼, **Noman Bashir**, Ramachandra Rao Kolluri, Eun Kung Lee, and Prashant Shenoy. *CUFF: A Configurable Uncertainty-driven Forecasting Framework for Green AI Clusters*. In: *ACM International Conference on Future Energy Systems (e-Energy)*. 2023.

[19] Qianlin Liang▼, Walid Hanafy▼, **Noman Bashir**, Ahmed Ali-Eldin, David Irwin, and Prashant Shenoy. *Dělen: Enabling Flexible and Adaptive Model-serving for Multi-tenant Edge AI*. In: *ACM/IEEE Conference on Internet of Things Design and Implementation (IoTDI)*. 2023.

[20] Qianlin Liang▼, Walid Hanafy▼, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Energy Time Fairness: Balancing Fair Allocation of Energy and Time for GPU Workloads*. In: *IEEE/ACM Symposium on Edge Computing (SEC)*. 2023.

[21] Xiaoding Guan▼, **Noman Bashir**, David Irwin, and Prashant Shenoy. *WattScope: Non-intrusive Application-level Power Disaggregation in Datacenters*. In: *Performance Evaluation (PEVA) and The International Symposium on Computer Performance, Modeling, Measurements and Evaluation (Performance)* (2023).

[22] Anupama Sitaraman★, **Noman Bashir**, David Irwin, and Prashant Shenoy. *No Free Lunch: Analyzing the Cost of Deep Decarbonizing Residential Heating Systems*. In: *International Green & Sustainable Computing Conference (IGSC)*. 2023. **Best Student Paper Award**.

[23] Talha Mehboob▼, **Noman Bashir**, Michael Zink, and David Irwin. *Is Sharing Caring? Analyzing the Incentives for Shared Cloud Clusters*. In: *ACM/SPEC International Conference on Performance Engineering (ICPE)*. 2023. **Best Paper Award Finalist**.

[24] John Wamburu▼, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Data-driven Decarbonization of Residential Heating Systems*. In: *ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys)*. 2022.

[25] **Noman Bashir**, Nan Deng, Krzysztof Rzadca, David Irwin, Sree Kodak, and Rohit Jnagal. *Take it to the Limit: Peak Prediction-driven Resource Overcommitment in Datacenters*. In: *European Conference on Computer Systems (EuroSys)*. 2021. **Artifact Available, Artifact Functional, Results Produced**.

[26] **Noman Bashir**, Tian Guo, Mohammad Hajiesmaili, David Irwin, Prashant Shenoy, Ramesh Sitaraman, Abel Souza, and Adam Wierman. *Enabling Sustainable Clouds: The Case for Virtualizing the Energy System*. In: *ACM Symposium on Cloud Computing (SoCC)*. 2021.

[27] Pradeep Ambati, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Good Things Come to Those Who Wait: Optimizing Job Waiting in the Cloud*. In: *ACM Symposium on Cloud Computing (SoCC)*. 2021.

[28] Pradeep Ambati, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Waiting Game: Optimally Provisioning Fixed Resources for Cloud-Enabled Schedulers*. In: *International Conference for High Performance Computing, Networking, Storage and Analysis (SC)*. 2020. **Best Paper Award Finalist** and **Best Student Paper Award Finalist**.

[29] **Noman Bashir**, David Irwin, and Prashant Shenoy. *DeepSnow: Modeling the Impact of Snow on Solar Generation*. In: *ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys)*. 2020.

[30] Santiago Correa, **Noman Bashir**, Andrew Tran★, David Irwin, and Jay Taneja. *Extend: A Framework for Increasing Energy Access by Interconnecting Solar Home Systems*. In: *ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS)*. 2020.

[31] Menghong Feng▼, **Noman Bashir**, Prashant Shenoy, David Irwin, and Dragoljub Kosanovic. *SunDown: Model-driven Per-Panel Solar Anomaly Detection for Residential Arrays*. In: *ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS)*. 2020.

[32] Pradeep Ambati, **Noman Bashir**, David Irwin, Mohammad Hajiesmaili, and Prashant Shenoy. *Hedge Your Bets: Optimizing Long-term Cloud Costs by Mixing VM Purchasing Options*. In: *IEEE International Conference on Cloud Engineering (IC2E)*. 2020. **Invited Paper**.

[33] **Noman Bashir**, Dong Chen, David Irwin, and Prashant Shenoy. *Solar-TK: A Data-Driven Toolkit for Solar PV Performance Modeling and Forecasting*. In: *IEEE International Conference on Mobile Ad Hoc and Sensor Systems (MASS)*. 2019. **Invited Paper**.

[34] Santiago Correa, **Noman Bashir**, Jesus Omana Iglesias, Candace Saffery, and Jay Taneja. *Like a Good Neighbor, Solar is There*. In: *ACM International Conference on Future Energy Systems (e-Energy)*. 2019.

[35] **Noman Bashir**, David Irwin, and Prashant Shenoy. *Helios: A Programmable Software-defined Solar Module*. In: *ACM International Conference on Systems for Built Environments (BuildSys)*. 2018.

[36] **Noman Bashir**, David Irwin, Prashant Shenoy, and Jay Taneja. *Enforcing Fair Grid Energy Access for Controllable Distributed Solar Capacity*. In: *ACM International Conference on Systems for Energy-Efficient Built Environments (BuildSys)*. 2017. **Best Paper Award Finalist**.

[37] **Noman Bashir**, Hira Shahzad Sardar★, Mashood Nasir, Naveed Ul Hassan, and Hassan A. Khan. *Lifetime Maximization of Lead-Acid Batteries in Small Scale UPS and Distributed Generation Systems*. In: *IEEE PowerTech*. 2017.

[38] **Noman Bashir**, Zohaib Sharani, Khushboo Qayyum, and Affan A. Syed. *Delivering Smart Load-shedding for Highly-stressed Grids*. In: *IEEE International Conference on Smart Grid Communications (SmartGridComm)*. 2015.

[39] Aneeq ur Rehman★, **Noman Bashir**, Naveed Ul Hassan, and Chau Yuen. *Impact of Home Appliances on the Performance of Narrow-band Power Line Communications for Smart Grid Applications*. In: *IEEE Region 10 Conference (TENCON)*. 2016.

JOURNAL PUBLICATIONS

[40] John Wamburu▼, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Analyzing the Impact of Decarbonizing Residential Heating on the Electric Distribution Grid*. In: *SIGENERGY Energy Informatics Review (EIR)* (2023).

[41] John Wamburu▼, **Noman Bashir**, Emma Grazier, David Irwin, Christine Crago, and Prashant Shenoy. *Equity-Aware Decarbonization of Residential Heating Systems*. In: *SIGENERGY Energy Informatics Review (EIR)* (2023).

[42] **Noman Bashir**, David Irwin, and Prashant Shenoy. *A Probabilistic Approach to Committing Solar Energy in Day-ahead Electricity Markets*. In: *Sustainable Computing: Informatics and Systems (SUSCOM)* (2021).

[43] Menghong Feng★, **Noman Bashir**, Prashant Shenoy, David Irwin, and Beka Kosanovic. *Model-driven Per-panel Solar Anomaly Detection for Residential Arrays*. In: *ACM Transaction Cyber-Physical Systems (TCPS)* (2021).

[44] Pradeep Ambati, **Noman Bashir**, David Irwin, and Prashant Shenoy. *Modeling and Analyzing Waiting Policies for Cloud-Enabled Schedulers*. In: *IEEE Transactions on Parallel and Distributed Systems (TPDS)* (2021).

[45] **Noman Bashir**, David Irwin, Prashant Shenoy, and Jay Taneja. *Mechanisms and Policies for Controlling Distributed Solar Capacity*. In: *ACM Transactions on Sensor Networks (TOSN)* (2018).

WORKSHOP PUBLICATIONS

[46] Roozbeh Bostandoost▼, Walid Hanafy▼, Adam Lechowicz▼, **Noman Bashir**, Mohammad Hajiesmaili, and Prashant Shenoy. *Data-driven Algorithm Selection for Carbon-Aware Scheduling*. In: *SIGENERGY Energy Informatics Review (EIR) and Workshop on Sustainable Computer Systems (HotCarbon)* (2024).

[47] Diptyaroop Maji▼, **Noman Bashir**, David Irwin, Prashant Shenoy, and Ramesh K Sitaraman. *Untangling Carbon-free Energy Attribution and Carbon Intensity Estimation for Carbon-aware Computing*. In: *ACM e-Energy International Workshop on Energy Data and Analytics (EDA)*. 2024.

[48] **Noman Bashir**, David Irwin, Prashant Shenoy, and Abel Souza. *Sustainable Computing – Without the Hot Air*. In: *SIGENERGY Energy Informatics Review (EIR) and Workshop on Sustainable Computer Systems (HotCarbon)* (2023).

[49] Walid Hanafy▼, Roozbeh Bostandoost▼, **Noman Bashir**, David Irwin, Mohammad Hajiesmaili, and Prashant Shenoy. *The War of the Efficiencies: Understanding the Tension between Carbon and Energy Optimization*. In: *SIGENERGY Energy Informatics Review (EIR) and Workshop on Sustainable Computer Systems (HotCarbon)* (2023).

[50] Phuthipong Bovornkeeratiroj▼, **Noman Bashir**, Vivek Deulkar, Bharathan Balaji, Prashant Shenoy, David Irwin, and Mohammad Hajiesmaili. *Quantifying the Decarbonization Potential of Flexible Load*. In: *ACM BuildSys International Workshop on Cyber-Physical-Social Infrastructure Systems (CPSIS)*. 2023.

[51] **Noman Bashir**, David Irwin, Prashant Shenoy, and Abel Souza. *Sustainable Computing – Without the Hot Air*. In: *SIGENERGY Energy Informatics Review (EIR) and Workshop on Sustainable Computer Systems (HotCarbon)* (2022).

BOOK CHAPTER

[1] **Noman Bashir**, Naveed Ul Hassan, Chau Yuen, and Wayes Tushar. *Smart Grid Communications and Standard*. In: *Communication, Control and Security Challenges for the Smart Grid*. Ed. by SM Muyeen and Saifur Rahman. Institution of Engineering and Technology, 2017.

THESIS

[1] **Noman Bashir**. *Improving the Programmability of Networked Energy Systems*. PhD Thesis. University of Massachusetts Amherst, 2022.

[2] **Noman Bashir**. *Using Stressed Grids as a Storage Medium for Renewable Energy*. MS Thesis. National University of Science and Technology, 2016.

UNDER-REVIEW/IN-PREPARATION

[1] **Noman Bashir**, Anagha B. Subramanya▼, Julia Xia▼, Melissa Zgola, Ajay Gupta, Greg Norris, Elsa Olivetti, and Christina Delimitrou. *Discernible Decision Making under Uncertainty in Sustainable Computing*. In: submission. 2024.

[2] Varun Gohil▼, **Noman Bashir**, and Christina Delimitrou. *URJA: Request-Level Power Capping for Microservice*. In: preparation. 2024.

[3] Adam Lechowicz▼, Rohan Shenoy★, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Christina Delimitrou. *Learning Carbon-Aware Scheduling Algorithms for Data Processing Clusters*. In: preparation. 2024.

[4] Yichen Gao★, **Noman Bashir**, Christopher Hill, and Jeremy Gregory. *Enabling Proactive Sustainability Interventions in Datacenters*. In: submission. 2024.

[5] Xiaoding Guan▼, **Noman Bashir**, Prashant Shenoy, and David Irwin. *Ahead of the Curve: Leveraging Periodicity to Improve Job Scheduling in Data Centers*. In: submission. 2024.

[6] Talha Mehboob▼, **Noman Bashir**, Jesus Omana Iglesias, Michael Zink, and David Irwin. *EcoLearn: Optimizing the Carbon Footprint of Federated Learning*. In: submission. 2024.

[7] Adam Lechowicz▼, Nicolas Christianson, Bo Sun, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Prashant Shenoy. CarbonClipper*: Optimal Algorithms for Carbon-aware Spatiotemporal Workload Management*. In: submission. 2024.

[8] Ali Zeynali▼, Mahsa Sahebdel▼, **Noman Bashir**, Ramesh Sitaraman, and Mohammad Hajiesmaili. *Near-Optimal Emission-Aware Online Ride Assignment Algorithm for Peak Demand Hours*. In: submission. 2024.

[9] Cooper Sigrist▼, Adam Lechowicz▼, Jovan Champ★, **Noman Bashir**, and Mohammad Hajiesmaili. *Lost in Siting: The Hidden Carbon Cost of Inequitable Residential Solar Installations*. In: submission. 2024.

[10] Adam Lechowicz▼, Nicolas Christianson, Bo Sun, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Prashant Shenoy. *Online Conversion with Switching Costs: Robust and Learning-augmented Algorithms*. In: submission. 2024.

[11] Mahsa Sahebdel▼, Ali Zeynali▼, **Noman Bashir**, Prashant Shenoy, and Mohammad Hajiesmaili. *LEAD: Towards Learning-Based Equity-Aware Decarbonization in Ridesharing Platforms*. In: submission. 2024.

[12] Anupama Sitaraman★, Adam Lechowicz▼, **Noman Bashir**, Xutong Liu, Prashant Shenoy, and Mohammad Hajiesmaili. *Online Learning of Dynamic Incentive Allocation for City-scale Deep Decarbonization*. In: submission. 2024.

INVITED TALKS/PANELS

The Climate and Sustainability Implications of Generative AI
- MIT ILP Sustainability Conference — 11/2024
- Conference on the Political Economy of Artificial Intelligence, Harvard Kennedy School — 04/2024
- MIT Sloan AI + ML Conference — 03/2024

Systems for Sustainable Computing
- Nokia Bell Labs — 02/2024
- Rigorous Systems Research Group (RSRG), Caltech — 09/2023
- Climate Change AI — 07/2023
- IBM Research — 03/2023

A Holistic View of Societal Decarbonization
- MIT Climate & Sustainability Consortium — 01/2024
- Low Carbon and Sustainable Computing (LOCOS) seminar, University of Glasgow. — 11/2022

Benefits and Limitations of Carbon Accounting Paradigms
- NetZero Carbon Computing (NetZero), co-located with HPCA — 02/2023

Peak Prediction-driven Resource Overcommitment in Google Datacenters
- Tracing Summit at Google, UK — 11/2022

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

Panel: Balancing Acts: Climate Mitigation and Adaptation
- Pakistan Student Association, Columbia University. — 02/2024

Panel: Data Centers and Computing
- MIT MCSC and MIT Energy Initiative. — 01/2024

MENTORING EXPERIENCE

Massachusetts Institute of Technology

- Ph.D. student Anagha Belavadi Subramanya and M.Eng. student Julia Xia. Since 10/2023
  Anagha and Julia (with Elsa Olivetti) are developing a model to quantify the uncertainty in embodied carbon estimates for computing hardware.
- Ph.D. student Varun Gohil. Since 10/2023
  Varun (with Christina Delimitrou) is working on request-level power management for microservices.
- Undergraduate student Yichen Gao. Since 10/2023
  Yichen (co-advised with Jeremy Gregory, Chris Hill, and James Cuff) is developing a framework to enable proactive sustainability interventions in datacenters. Her work [4] is under-review.
- Undergraduate student Gerson Asifiwe. Since 06/2024
  Gerson is analyzing the potential for power oversubscription in LLM inference clusters. He plans to work on devising fine-grained power management strategies.
- Undergraduate student Wacuka M. Ngata. Since 06/2024
  Wacuka is devising a framework to compare the environmental footprint of large-scale datacenters against small distributed datacenters, potentially powered by renewable energy.
- Undergraduate student Pragnya Govinda. Since 02/2024
  Pragnya is analyzing the fine-grained locational marginal emissions (LMEs) data from PJM. She is exploring the implications of the spatiotemporal variations in LMEs on carbon-aware decision-making.

University of Massachusetts Amherst

- Ph.D. student Adam Lechowicz. Since 02/2022
  Adam (with Prashant Shenoy and Mohammad Hajiesmaili) has worked on developing learning-augmented carbon-aware workload scheduling algorithms. Our work has resulted in multiple prestigious conference publications [4, 7, 8, 17] and some of our recent work is under-review [4, 7].
- Ph.D. students Walid A. Hanafy and Qianlin Liang. 02/2022 – 10/2023
  Walid and Qianlin (with Prashant Shenoy and David Irwin) worked on developing systems for sustainable cloud computing [1, 49, 6, 14] and energy-efficient multi-tenant edge computing systems [19, 20]. Qianlin has since joined Amazon as a Research Scientist.
- Ph.D. student John Wamburu. 02/2022 – 10/2023
  John (with Prashant Shenoy) worked on enabling equity-aware decarbonization of residential homes by transitioning from gas-based heating to electric air-source heat pumps. Our work resulted in multiple publications [40, 41, 24]. John has since joined IBM Research as a Research Scientist.
- Ph.D. student Thanathorn Sukprasert. 02/2022 – 10/2023
  Tammy (with Prashant Shenoy and David Irwin) worked on understanding the potential and limitations of carbon-aware workload migrations. She also explored how the choice of carbon intensity signals impacts the outcomes of carbon-aware scheduling. Our work was published at EuroSys'24 [5] and e-Energy'24 [11].
- Ph.D. student Talha Mehboob. 02/2022 – 10/2023
  Talha (with David Irwin and Michael Zink) worked on understanding the potential and incentives for a shared cloud cluster across the users of an organization [23]. In his recent project, he has worked on carbon-aware client selection in federated learning, which is currently under review [6].
- Ph.D. student Xiaoding Guan. 02/2022 – 10/2023
  Rebecca (with David Irwin and Prashant Shenoy) worked on non-intrusive power monitoring in datacenters [21]. She is currently leveraging workloads' periodicity to overcommit CPU resources in datacenters [5].
- Ph.D. student Roozbeh Bostandoost. 02/2022 – 10/2023
  Roozbeh (with Mohammad Hajiesmaili and Prashant Shenoy) worked on data-driven algorithms for carbon-aware execution of computing workloads with uncertain demand [10]. His recent work developed algorithms for selecting among carbon-aware workload execution approaches [46].
- Ph.D. student Mahsa Sahebdel. 02/2022 – 08/2024
  Mahsa (with Mohammad Hajiesmaili and Prashant Shenoy) has worked on reducing the carbon footprint of ridesharing platforms while optimizing the rider's wait time [12]. In her recent work, she has explored the fairness issues from a driver's perspective in carbon-aware ride assignments [11].

- Ph.D. student Diptayroop Maji. 02/2022 – 08/2024

  Dip (with Ramesh Sitaraman and Prashant Shenoy) analyzed various carbon intensity estimation approaches and how they impact the efficacy of carbon-aware workload optimizations [9, 47].

- Ph.D. student John Thiede. 02/2022 – 10/2023

  John (with David Irwin and Prashant Shenoy) developed a system-level facility for managing application-level carbon footprint, called CarbonContainers, which migrates VMs based on carbon intensity and workload variations [15].

- MS student Menghong (Aslan) Feng. 02/2022 – 08/2024

  Aslan (with Prashant Shenoy, David Irwin, and Beka Kosanovic) worked on anomaly detection in solar PV systems [31, 43]. He has since joined Apple as an Advanced Inspection Engineer.

- Undergraduate student Anupama Sitaraman. 02/2022 – 08/2024

  Anu (**co-advised** with Prashant Shenoy and Mohammad Hajiesmaili) explored deep decarbonization of residential heating systems by transitioning to electric heating from gas-based heating [22]. Her recent work leveraged online learning for dynamic incentive allocation for deep decarbonization [12]. She has joined CMU as a Ph.D. student.

Lahore University of Management Sciences

- Undergraduate student Hira Shahzad Sardar. 06/2015 – 03/2017

  Worked on improving the lifetime of battery backups [37]. Hira joined Dartmouth College for her MS. She later joined MathWorks as a Technical Project Manager.

- Undergraduate student Aneeq ur Rehman. 06/2015 – 05/2016

  Worked on using powerline communication technology for smart grid applications [39]. Aneeq joined the University of Sheffield for his MS. He has since joined AstraZeneca as Sr. Data Scientist.

TEACHING EXPERIENCE

On-Demand Lecture for AASHE Conference & Expo 2024

"Sustainable AI - How Higher Education Can Advance Addressing the Environmental Impacts of Gen-AI"
in collaboration with IBM's Corporate Social Responsibility Office for Academia.

Guest Lecturer Spring 2022, 2023, 2024

Lecture on *"Sustainable Computing Systems and Computing for Sustainability"*
in COMPSCI677: Distributed and Operating Systems at UMass Amherst.

Guest Lecturer Summer 2022, 2023, 2024

Lecture on *"Unique Source of Energy"*
in UMass Amherst Turing Summer Program at UMass Amherst.

Teaching Assistant, University of Massachusetts Amherst

ECE322 – Systems Programming Fall 2020

ECE341 – Introduction to Algorithms Spring 2021

Teaching Assistant, National University of Computer and Emerging Science, Islamabad, Pakistan

EE522 – Advance Embedded Systems Fall 2013, 2014

INDUSTRY EXPERIENCE

VMware Research Group Summer 2021

Sustainability Research Intern, OCTO
Mentors: Ben Pfaff, Victor Firoiu

- Worked on developing benchmarks to evaluate the sustainability of VMware applications and products.

Google, Inc. May 2020 – Nov 2020

Research Intern, Borg
Mentors: Nan Deng, Krzysztof Rzadca

- Worked on improving resource overcommitment in Google datacenters managed by Borg.
- Our data-driven dynamic approach is now the default overcommit strategy in Google datacenters.

GRANT WRITING EXPERIENCE

- **"Provisioning and Operating Sustainable Datacenters"** 11/2024 – 08/2025
  As a lead person with Prof. Elsa Olivetti. Funded by Nokia Research Awards 2024. The award amount is **$57k**.
- **"Managing Electrical and Thermal Energy in Sustainable Computing Systems"** 2022–2025
  Based on my research work on jointly managing electric and thermal energy in computing systems [16]. The project was funded as NSF CNS Core Small and awarded to my advisor and collaborators. Award amount was **$325K**.
- **"Linking Datacenter Architecture Design to Siting Decisions in an Evolving Energy System"** 2024
  As a lead person with Prof. Christina Delimitrou and Prof. Elsa Olivetti. Under review at the MIT Future Energy Systems Center. Expected funding amount of **$250K**.

COMMUNITY SERVICE

Conference Program Committees: ACM SenSys (2025), USENIX NSDI (2025), ACM SoCC (2022–2024), SIGKDD (2024), ACM/IEEE IPSN (2024), ACM e-Energy (2023–2025), ACM BuildSys (2023, 2024), IGSC (2023).

Workshop Program Committees: HotInfra (2024), DATA (2023), ENSYS (2022), Workshop on Tackling Climate with Machine Learning (ICLR 2023, NeurIPS 2022).

Journal Reviewer: Journal of Systems Research, Energy Informatics Review, IEEE Transactions on Parallel and Distributed Systems, Elsevier Sustainable Computing: Informatics and Systems, and Elsevier Applied Energy.

Grant Reviewer: Climate Change AI Innovation Grants Program (2023) and MIT Solve Challenge (2024).

Chair/Co-Chair: ACM SIGEnergy Workshop on Societal Decarbonization (SoDec) (2022 – present), Ph.D. Symposium Chair at ACM BuildSys (2023), Ph.D. Symposium Chair at IEEE IC2E (2023), and ACM SIGEnergy Graduate Student Talk Series (2022 – 2023).

Organizer: NSF Workshop on Water Sustainability and Ecological Diversity at Purdue University (2024), ACM e-Energy Hybrid Hub at UMass Amherst (2022), and UMass Summer Turing Program (2022, 2023).

REFERENCES

1. **Christina Delimitrou**, Massachusetts Institute of Technology delimitrou@csail.mit.edu
2. **David Irwin**, University of Massachusetts Amherst deirwin@umass.edu
3. **Elsa Olivetti**, Massachusetts Institute of Technology elsao@mit.edu
4. **Prashant Shenoy**, University of Massachusetts Amherst shenoy@umass.edu
5. **Adam Wierman**, California Institute of Technology adamw@caltech.edu