

NOMAN BASHIR

✉ nbashir@csail.mit.edu

🌐 <https://noman-bashir.github.io/>

☎ +1-413-406-4610

📍 NE36-7311, Cambridge, MA

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, Super-computing 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**, 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**.

- [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 Rządca, 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] Adam Lechowicz[▼], Nicolas Christianson, Bo Sun, **Noman Bashir**, Mohammad Hajiesmaili, Adam Wierman, and Prashant Shenoy. *Learning-Augmented Competitive Algorithms for Spatiotemporal Online Allocation with Deadline Constraints*. In: ACM **SIGMETRICS**. 2025.
- [2] **Noman Bashir**, Varun Gohil, Mohammad Shahradd, 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] **Noman Bashir**, Priya Danti, 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).
- [4] 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.
- [5] 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, Artifact Functional, Results Produced**, Repo: <https://github.com/umassos/GAIA>.
- [6] 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.
- [7] 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**.
- [8] 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**.
- [9] 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.
- [10] 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.
- [11] Diptyarop 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**.
- [12] 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.
- [13] 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**.
- [14] 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.
- [15] 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.
- [16] 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.

- [17] 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.
- [18] **Noman Bashir**, Yasra Chandio, David Irwin, Fatima M. Anwar, Jeremy Gummesson, 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.*
- [19] 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.
- [20] 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.
- [21] Qianlin Liang[▼], Walid Hanafy[▼], **Noman Bashir**, Ahmed Ali-Eldin, David Irwin, and Prashant Shenoy. *Dēlen: Enabling Flexible and Adaptive Model-serving for Multi-tenant Edge AI*. In: ACM/IEEE Conference on Internet of Things Design and Implementation (IoTDI). 2023.
- [22] 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.
- [23] 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).
- [24] 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.*
- [25] 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.*
- [26] 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.
- [27] **Noman Bashir**, Nan Deng, Krzysztof Rządca, 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.*
- [28] **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.
- [29] 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.
- [30] 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.*
- [31] **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.
- [32] 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.
- [33] 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.
- [34] 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.*
- [35] **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.*
- [36] 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.

- [37] **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.
- [38] **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**.
- [39] **Noman Bashir**, Hira Shahzad Sardar[★], Mashood Nasir, Naveed UI Hassan, and Hassan A. Khan. *Lifetime Maximization of Lead-Acid Batteries in Small Scale UPS and Distributed Generation Systems*. In: IEEE **PowerTech**. 2017.
- [40] **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.
- [41] Aneeq ur Rehman[★], **Noman Bashir**, Naveed UI 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

- [42] 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).
- [43] 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).
- [44] **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).
- [45] 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).
- [46] 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).
- [47] **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

- [48] 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).
- [49] 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.
- [50] **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).
- [51] 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).
- [52] 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.
- [53] **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 UI Hassan, Chau Yuen, and Wayes Tushar. *Smart Grid Communications and Standard*. In: *Communication, Control and Security Challenges for the Smart Grid*. Ed. by SM Mueeen 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.

EXPECTED PUBLICATIONS

- [1] **Noman Bashir**, Anagha Subramanya[▼], Julia Xia[▼], Melissa Zgola, Ajay Gupta, Greg Norris, Elsa Olivetti, and Christina Delimitrou. *Discernible Decision Making under Uncertainty in Sustainable Computing*. In: 2024.
- [2] Varun Gohil[▼], **Noman Bashir**, and Christina Delimitrou. *URJA: Request-Level Power Capping for Microservice*. In: 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: 2024.
- [4] Yichen Gao[★], **Noman Bashir**, Christopher Hill, and Jeremy Gregory. *Enabling Proactive Sustainability Interventions in Datacenters*. In: 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: 2024.
- [6] Talha Mehboob[▼], **Noman Bashir**, Jesus Omana Iglesias, Michael Zink, and David Irwin. *EcoLearn: Optimizing the Carbon Footprint of Federated Learning*. In: 2024.
- [7] Ali Zeynali[▼], Mahsa Sahebdel[▼], **Noman Bashir**, Ramesh Sitaraman, and Mohammad Hajiesmaili. *Near-Optimal Emission-Aware Online Ride Assignment Algorithm for Peak Demand Hours*. In: 2024.
- [8] Cooper Sigrist[▼], Adam Lechowicz[▼], Jovan Champ[★], **Noman Bashir**, and Mohammad Hajiesmaili. *Lost in Siting: The Hidden Carbon Cost of Inequitable Residential Solar Installations*. In: 2024.
- [9] 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: 2024.
- [10] Mahsa Sahebdel[▼], Ali Zeynali[▼], **Noman Bashir**, Prashant Shenoy, and Mohammad Hajiesmaili. *LEAD: Towards Learning-Based Equity-Aware Decarbonization in Ridesharing Platforms*. In: 2024.
- [11] 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: 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


Enable Sustainable Datacenters by Virtualizing Energy Systems

- Harvard SEAS  12/2024
- 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 [6, 9, 10, 19] and some of our recent work is under-review [6, 1].
- 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 [5, 51, 8, 16] and energy-efficient multi-tenant edge computing systems [21, 22]. **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 [42, 43, 26]. **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 [7] and e-Energy'24 [13].
- 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 [25]. 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 [23]. 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 [12]. His recent work developed algorithms for selecting among carbon-aware workload execution approaches [48].
- 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 [14]. In her recent work, she has explored the fairness issues from a driver's perspective in carbon-aware ride assignments [10].

- 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 [11, 49].
- 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 [17].
- 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 [33, 45]. **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 [24]. Her recent work leveraged online learning for dynamic incentive allocation for deep decarbonization [11]. **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 [39]. **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 [41]. **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 [18]. 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

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|--|--------------------------|
| 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 |