Sara Sultan

**ssultan.vols@gmail.com |** [LinkedIn](http://www.linkedin.com/in/sarasultanaqib) **|** [ORCID](http://orcid.org/0000-0002-6581-510X) **|** [Google Scholar](https://scholar.google.com/citations?user=ypvjwyAAAAAJ&hl=en&oi=ao) **|** [DOE OSTI](https://www.osti.gov/search/author:%22Sultan,%20Sara%22)

Interested in exploring ideas on the nexus of energy technologies, nature and social responsibilities, and mentor young scientists to empower next generation of innovators and future leaders.

**RESEARCH EXPERTISE**

**Integrated Energy Systems, Energy Storage, Phase Change Materials, Nano Materials, Building Envelope, Air Quality, Solar Thermal, Water Desalination, Grid Flexibility.**

**RESEARCH SKILLS**

Energy Modeling, Data Analysis, Material **Synthesis and Characterization, Policy and Market Analysis**

**RESEARCH OUTPUT METRICS**

h-index 5 Scientific Publications 15

Citations (Google) 91 Peer Reviews 10

# **EDUCATION**

**Ph.D. Energy Science and Engineering 2018 - 2023**

*Bredesen Center for Interdisciplinary Education, University of Tennessee (UTK) – Knoxville, TN*

Thesis: Heat Pump integrated with Thermal Storage for Demand Response and Decarbonization

Advisors: Dr. Kyle Gluesenkamp (Oak Ridge National Laboratory), Dr. William A. Miller

**Master of Science in Energy Systems Engineering 2014 - 2017**

*U.S.- Pakistan Center for Energy, National University of Science and Technology (NUST) – Pakistan*

*Oregon State University (OSU), Corvallis, OR*

Thesis:Solar energy driven water desalination system with improved dehumidification

Advisors: Dr. Adeel Waqas, Dr. Kendra Sharp (OSU)

# **PROFESSIONAL AND RESEARCH EXPERIENCE**

**Senior Advisor, California Energy Commission | 2024 – Present** | Code Development, Policy Analysis

* Spearheading 2028 California Energy Code updates for building envelopes and storage.
* Developed strategic partnerships with industry stakeholders to ensure proposals are feasible, cost effective and adaptable
* Reviewed $50M+ EPIC grant proposals (energy storage innovation, bird-friendly windows)
* Translated complex research into actionable insights and delivered to Commissioners.

**Senior Analyst, NV5 | 2023 – 2024 |** Energy Performance, AI Solutions, Data Analysis

* Led research for electrification, decarbonization and income-eligible programs for state energy efficiency councils in Rhode Island and Connecticut.
* Developed AI solutions to streamline and automate administrative and research tasks, reducing processing times by ~5 hours.
* Analyzed large datasets and simplified to present via technical briefs, memos, quarterly snapshot and newsletter for the state councils.

**Research Assistant, Oak Ridge National Laboratory | 2018 – 2023** | R&D, Product Development

* Led DOE-funded projects on grid-interactive thermal energy storage and phase change materials delivering up to 20% energy savings.
* Designed control strategies based on utility and grid emissions data and modeled smart thermostat for load shifting.
* Synthesized salt hydrate based PCM and performed parametric optimization to find the material with best temperature and storage capacity for integrated storage system.
* Experimentally validated integrated heat pump-thermal storage, achieving 50% carbon reduction and 20% utility cost savings across various climates.
* Brainstormed innovative research ideas and formulated research questions to draft proposals and develop business models.

**Lead Market Analyst, Shift Thermal | 2020 – 2021** | Market Analysis, Stakeholder Engagement

* Advised startup on market transformation for thermal energy storage and provided recommendations to improve the business model.

**Program Coordinator & Lecturer, University of Haripur | 2017 – 2018 |** Teaching, Management

* Managed cohort of 300 students; designed curriculum and taught Introductory Physics and Thermodynamics courses.

**Visiting Research Scholar, Oregon State University | 2016 – 2017** | R&D, Technical Writing

* Enhanced electric efficiency of a hydropower system and determined feasibility of a crossflow turbine.

**Research Assistant, U.S.-Pakistan Center for Energy | 2014 – 2017** | R&D, Experimental Design

* Designed a solar water desalination system and improved the yield by 20%.
* Developed solar thermal power plant and synthesized solar photovoltaic cell.

**PUBLICATIONS**

**Sultan, S**.; Hirschey, J.; Kumar, N.; Cui, B.; Liu, X.; LaClair, T.J.; Gluesenkamp, K.R. Techno-Economic Assessment of Residential Heat Pump Integrated with Thermal Energy Storage. *Energies* 2023, *16*, 4087. <https://doi.org/10.3390/en16104087>

Monojoy Goswami, Navin Kumar, Yuzhan Li, Jason Hirschey, Tim J. LaClair, Damilola O. Akamo, **Sultan**, **S** Orlando Rios, Kyle R. Gluesenkamp, Samuel Graham; Understanding supercooling mechanism in sodium sulfate decahydrate phase-change material. J. Appl. Phys. 28 June 2021; 129 (24): 245109. <https://doi.org/10.1063/5.0049512>

Safdar, I., **Sultan, S**., Raza, H. A., Umer, M., & Ali, M. (2020). Empirical analysis of turbine and generator efficiency of a pico hydro system. Sustainable Energy Technologies and Assessments, 37, 100605. <https://doi.org/10.1016/j.seta.2019.100605>

**PRESS ARTICLES**

**Sultan, S.,** & Gluesenkamp, K. R. (2021). The State of Art of Heat-Pump integrated Thermal Energy Storage for Demand Response. *Heat Pumping Technologies Magazine*, *40*(2). <https://heatpumpingtechnologies.org/publications/the-state-of-art-of-heat-pump-integrated-thermal-energy-storage-for-demand-response/>

**Sultan, S.** Climate Change and Residential Buildings. *Scientia Magazine, 2022*

<https://scientiamag.org/climate-change-and-residential-buildings-the-way-forward/>

**PEER REVIEWED CONFERENCE PAPERS**

**Sultan, S.** Equity, Electrification, and Time of Use (TOU) Rates: Coupling Thermal Energy Storage with Heat Pumps for Improved Operational Efficiency. Proceedings of the 2024 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, CA, USA, 2024.

**Sultan, S.;** Hirschey, J.; Li, Z.; Shen, B.; Graham, S.; Gluesenkamp, K.R.Carbon Mitigation Potential of Heat Pump Integrated with Thermal Storage for Grid-Interactive Residential Buildings. Proceedings of the 14th IEA Heat Pump Conference, Chicago, IL, USA, 15–18 May 2023.

**Sultan, S**; Turnaoglu, Tugba; Akamo, Damilola; Hirschey, Jason; Laclair, Tim; Liu, Xiaobing; and Gluesenkamp, Kyle R., "PCM Material Selection For Heat Pump Integrated With Thermal Energy Storage For Demand Response in Residential Buildings" (2022). International High Performance Buildings Conference. Paper 427.

**Sultan, S**; Hirschey, Jason; Gluesenkamp, Kyle R.; and Graham, Samuel, "Analysis of Residential Time-of-Use Utility Rate Structures and Economic Implications for Thermal Energy Storage" (2021). International High Performance Buildings Conference. Paper 370.

**Sultan**, **S.** M. Ali, A. Waqas, H. A. Raza, S. Aziz and S. -u. -. Haq, "Modelling of a solar energy driven water desalination system using TRNSYS," *2016 19th International Multi-Topic Conference (INMIC)*, Islamabad, Pakistan, 2016, pp. 1-6, doi: 10.1109/INMIC.2016.7840151.

H. A. Raza, **Sultan S.,** A. Hussain, A. K. Janjua and A. Bashir, "Modeling of 1 MW solar thermal tower power plant using TRNSYS," 2018 1st International Conference on Power, Energy and Smart Grid (ICPESG), Mirpur Azad Kashmir, Pakistan, 2018, pp. 1-6, doi: 10.1109/ICPESG.2018.8384499.

H. A. Raza, M. Asad, **Sultan S.,** Shomaz-Ul-Haq, N. Shehzad and M. Ali, "Effect of heliostats reflectivity on the cost of solar thermal tower power plant," 2017 International Conference on Energy Conservation and Efficiency (ICECE), Lahore, Pakistan, 2017, pp. 11-15, doi: 10.1109/ECE.2017.8248821.

S. U. Haq, H. A. Raza, I. Safdar, S. **Sultan, S**. Naeem and M. Ali, "Comparative numerical investigation on effect of characteristic parameters on thermal energy enhancement by alumina-water and cupric-oxide-water nanofluids," 2017 International Conference on Energy Conservation and Efficiency (ICECE), Lahore, Pakistan, 2017, pp. 55-63, doi: 10.1109/ECE.2017.8248829.

H. A. Raza, **Sultan**, **S.,** Shomaz-Ul-Haq and M. Ali, "Modelling of efficient solar water desalination system using TRNSYS," 2018 International Conference on Engineering and Emerging Technologies (ICEET), Lahore, Pakistan, 2018, pp. 1-4, doi: 10.1109/ICEET1.2018.8338622.

**PRESENTATIONS AND WEBINARS**

**Sultan, S. “**Equity, Electrification, and Time of Use (TOU) Rates: Coupling Thermal Energy Storage with Heat Pumps for Improved Operational Efficiency.” Presented at the 2024 ACEEE Summer Study on Energy Efficiency in Buildings, Pacific Grove, CA, USA, August 6, 2024.

Kyle Gluesenkamp, Bo Shen, Zhenning Li, Xiaobing Liu, Jason Hirschey, **Sultan, S.**, Chad Malone (2024). “Can Thermal Storage with Heat Pumps Be the Lowest-Cost National-Scale Storage Solution?” presented at the ACEEE Hot Air Forum, Atlanta, GA, March 12, 2024, Session 2C: Systems: Thermal Energy Storage in Heating. [Proceedings](https://www.aceee.org/sites/default/files/pdfs/Program%20%2B%20Presentations_4.pdf)

**Sultan, S.;** Hirschey, J.; Li, Z.; Shen, B.; Graham, S.; Gluesenkamp, K.R. **“**Carbon Mitigation Potential of Heat Pump Integrated with Thermal Storage for Grid-Interactive Residential Buildings.” Presented at the 14th IEA Heat Pump Conference, Chicago, IL, USA, 15–18 May 2023.

Turnaoglu, T., Gluesenkamp, K., Liu, X., Wang, L., Bocherova, V., Goswami, M., Huff, S., Li, Z., Akamo, D., **Sultan, S.,** Rehbein, S., (2023). “Low-cost PCM Integration into Heat Pumps,” 10th Annual [BTO Peer Review](https://www.energy.gov/eere/buildings/building-technologies-office-peer-review), Doubletree Crystal City in Arlington, Virginia, April 24-28, 2023. [Direct link](https://www.energy.gov/eere/buildings/articles/low-cost-composite-phase-change-material)

**Sultan, S**; Turnaoglu, Tugba; Akamo, Damilola; Hirschey, Jason; Laclair, Tim; Liu, Xiaobing; and Gluesenkamp, Kyle R., "PCM Material Selection for Heat Pump Integrated with Thermal Energy Storage For Demand Response in Residential Buildings" Presented at the 7th International High Performance Buildings Conference at Purdue. West Lafayette, IN, USA, 16 July 2022.

**Sultan, S.;** Hirschey, J.; Gluesenkamp, K.R.; Graham, S. **“**Analysis of Residential Time-of-Use Utility Rate Structures and Economic Implications for Thermal Energy Storage.” Presented at the 6th International High Performance Buildings Conference at Purdue, West Lafayette, IN, USA, 24–28 May 2021

Gluesenkamp, Kyle R., Navin Kumar, **Sultan, S**., Jason Hirschey, Tim LaClair (2020). “Economic value of HVAC-mediated thermal storage under TOU tariffs,” IEA HPT Annex 55 Experts Meeting (web meeting), June 25, 2020.

**INVITED TALKS**

**‘Bridging Science and Storytelling to shape future of Sustainability and Innovation’ - Scientia magazine’s internship cohort.**

**“Post-Ph.D. careers in industry as Policy Maker” – Higher Ed Plus**

**Sultan, S.** “Grid-interactive Thermal Energy Storage integrated with Residential Heat Pumps” 2025 ACEEE Hot Water & Hot Air Forum. (Not attended due to state travel restrictions)

**HONORS & AWARDS**

2024 40 under 40alumnus by University of Tennessee Knoxville (UTK)

2023 Volunteer of Distinction award by UTK Provost

2022 Linda Latham Scholar by the American Council of Energy Efficient Economy (ACEEE)

**2022 IMPEL 2022 Innovator by Berkeley Lab for “Digitalization” of building technologies**

2020 3rd place award at Southeastern Energy Conference by Georgia Institute of Technology

2019 Runner up Duke Energy Conference for best paper presentation

**GRANTS**

**2018 - 2023 DOE funded projects through ORNL**

**2016 - 2017 USAID grant of $5000**

**PROFESSIONAL SERVICE**

**California Energy Commission’s EPIC Grant**

Reviewed proposals through EPIC grant for Research and Development Division at CEC.

**DOE Solar Decathlon**

Invited as a judge on panel to evaluate DOE’s Solar Decathlon semi-final competition at NREL

**Peer Review**

Peer reviewed papers for “Energies” journal and conferences including 2024 ACEEE summer study, and 2023 IEA Heat Pump Conference

**ADVISING AND MENTORING**

Co-advising Ph.D. student at UC Davis Energy Graduate Group: “Sustainable housing on-campus”

Co-advising two Ph.D. students at Oklahoma State University: “Integrated thermal storage”

**PROFESSIONAL AFFILIATION**

ASHRAE Committee Member: Thermal Storage, Occupant Behavior, 90.1 Standards

DOE Stor4Build Thermal Storage Consortium technical working groups

**LEADERSHIP AND VOLUNTEER WORK**

**2018 - 2023 Graduate Student Senator, University of Tennesse, Konoxville, TN**

**-Outreached and coordinated with guest speakers to arrange talks for weekly seminar**

**-Advocated for access to research tools, and sustainability on campus**

**2019 - 2021 Program Manager, NUSTIAN USA**

**-Created coaching program and employed 50+ team members to facilitate 300+ students.**

**-Developed policies and guidelines, and directed plans to execute 1-1 coaching initiatives, website and educational material.**

**STATISTICAL & METHODOLOGICAL SKILLS**

**Data analysis, Modeling and Visualization:** MS Excel, MATLAB, TRNSYS, EnergyPlus, EES

**Project Management:** Asana, Trello, and Notion