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Guest Editorial

Special Issue on the 17th Annual International Conference on Energy Sustainability (ES2023)

This Special Issue of the ASME *Journal of Solar Energy Engineering* highlights the breadth and depth of research presented at the 17th Annual International Conference on Energy Sustainability, held in Washington, DC in the summer of 2023. The conference was jointly organized by the Solar Energy Division and the Advanced Energy Systems Division of the ASME. The conference theme, "A Just Transition to a Sustainable Future," emphasized both the critical importance of transitioning from fossil-based to sustainable energy and the imperative to do so in a way that is fair, inclusive, and just. The conference brought together a community of scholars dedicated to developing solutions to the coupled climate and energy crises facing society. Scholars from around the world gave 158 presentations in 14 tracks, and contributed 59 technical conference papers, 13 of which are featured in this issue.

The 14 tracks represented a wide range of sustainable energy research areas. Many of the 13 papers in this special issue come from some of the largest tracks, including "Concentrating Solar Power," "Sustainable Buildings and Cities," Solar Chemistry," and "Energy Storage." Additional papers come from smaller, emerging tracks, including "Sociotechnical Research for a Clean Energy Transition," and "Alternative Energy Conversion Technologies."

One of the major challenges for sustainable energy across sectors is storage. Eight papers in this special issue contribute to solving that challenge in different ways and for different applications. Electricity storage is difficult and costly, and finding efficient and economical ways to store energy will be critical in achieving a net-zero grid. Several papers investigate grid-scale thermal storage. The papers by Parisi et al. and Mwesigye both investigate pumped thermal energy storage (PTES) for the grid. Parisi et al. provide a techno-economic analysis of using reversible turbomachinery in PTES while Mwesigye investigates the thermodynamic performance of using environmentally friendly working fluids in a geothermal integrated PTES system. Gifford et al. combine experimental testing and computational modeling to design and measure the performance of a containment vessel for storage of high-temperature particles for long duration, particle-based thermal energy storage.

High temperatures, like those achievable in concentrating solar energy systems, can be used to drive endothermic chemical reactions that enable storage as chemical energy. The paper by Mishra et al. demonstrates a heat and mass transfer model for an oxidation reactor and heat exchanger to improve the performance of particle-based thermochemical energy storage. The endothermic reactions can also be used to produce fuels, with the flexibility to use them for the grid, transportation, industry, or beyond. The papers by Bassett et al. and Vega Puga et al. investigate thermochemical cycles to store high-temperature thermal energy as hydrogen fuel using a cobalt oxide and ceria cycle, respectively. At much lower temperatures, the paper by Nicodemus et al. improves thermal storage for domestic hot water and heat applications, and the paper by Gladen et al. investigates thermal storage of waste heat in manufacturing.

High-temperature, grid-scale concentrating solar power (CSP) has an unrealized potential for cost-effective sustainable electricity production. Two papers include analyses of systems to increase the heat transfer performance in emerging CSP applications. The paper by Appaswamy et al. presents the modeling of a fluidized bed heat exchanger for particle CSP systems, while the paper by Ebadi et al. focuses on the thermodynamic analysis of a tubular receiver for air-heating CSP systems.

Additional papers cover diverse topics related to sustainable energy. The paper by Ouro-Koura et al. presents an optimized thermal energy harvester for underwater vehicles, and in the paper by Juette et al., genetic algorithms are applied to predict the performance of thermionic energy conversion. The impact of energy-efficient air conditioning systems is considered in the work by Alotaibi et al.

These papers provide a small, high-quality, snapshot of the extensive work presented at the ASME 17th Annual International Conference on Energy Sustainability, and the many developments made toward energy sustainability by the engineering community. We would like to conclude by thanking the editor-in-chief, Professor S. A. Sherif for the opportunity to have this special issue included in the ASME *Journal of Solar Energy Engineering*, and for his assistance throughout the process to our efforts. We also wish to thank the efforts of reviewers in evaluating and assisting in the improvement of the manuscripts. All of these efforts, and especially those of the authors, have made this special issue possible.

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