

ABSTRACT:

Creating better energy systems is a crucial step in moving toward a more sustainable future. We must develop more efficient means to convert and utilize energy, and also explore the integration of renewable sources to minimize the environmental impact of power generation. In order to address these issues, the research approach of Dr. Schaefer's Energy Systems Lab (ESL) has been to examine energy systems from a fundamentals viewpoint and in a societal/environmental context. This presentation will highlight the recent work of the ESL on a number of energy systems, which are unified through the application of rigorous thermofluid modeling techniques, both on the small scale and at the systems level. First, an overview will be presented of the lattice Boltzmann method, including its ability to capture molecular interactions without high computational complexity. The mesoscopic particle distribution functions of the lattice Boltzmann method allow for simulation of the multiphase, multicomponent thermal flows that are common in a range of energy conversion and utilization systems. Improvements to the lattice Boltzmann method will also be discussed, along with the challenges in extending the method to capture higher-order behavior. Finally, examples will be presented on how the application of the lattice Boltzmann method, along with more conventional CFD and heat transfer approaches, can be useful in designing and implementing advanced energy systems.



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BIOGRAPHY:

Dr. Laura Schaefer is Chair of the Department of Mechanical Engineering at Rice University, as well as a Burton J. and Ann M. McMurtry Chaired Professor. Dr. Schaefer received a B.S. in Mechanical Engineering (1995) and a B.A. in English (1995) from Rice University, and her M.S. (1997) and Ph.D. (2000) degrees in Mechanical Engineering from the Georgia Institute of Technology. She was a faculty member in Mechanical Engineering at the University of Pittsburgh from 2000-2015, where she was also a Bicentennial Board of Visitors Faculty Fellow, Deputy Director of the Mascaro Center for Sustainable Innovation, and Associate Director of the Center for Energy. Dr. Schaefer was also a Visiting Researcher in the Energy Futures Laboratory at Imperial College in London in 2011-2012. Dr. Schaefer received a Career Award from NSF and a New Investigator Award from ASHRAE. Her research has received over \$11 million in funding by organizations such as NSF, AFOSR, ASHRAE, PITA, and NCIIA. She is a Fellow of the American Society of Mechanical Engineers, the Editor-in-Chief of the Elsevier journal Sustainable Energy Technologies and Assessments, an Associate Editor of the ASME Journal of Heat Transfer, and a past Chair of the Advanced Energy Systems Division of ASME.