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Title

Models for Sustainable Energy System Design

Abstract

Avoiding the worst consequences of climate change hinges on the deployment of innovative, low-carbon technologies that could deeply decarbonize the global energy system over the course of the century. This talk will focus on the design and performance of two disruptive technologies that cater to two radically different visions of a low-carbon energy future. The first vision is of a highly decentralized system, where both generation and consumption are local: central to this future is residential energy storage (RES). A systems analysis of the design and deployment of RES will be discussed, revealing unintended effects of different design choices on cost and emissions. The second vision is of atmospheric remediation through direct capture of carbon dioxide. A novel systems analysis will be presented that compares the performance of different permutations of this direct air capture (DAC) technology when scaled up. The talk will conclude with a discussion of future research that integrates policy and behavioral constraints into energy system design. This enables engineers to develop truly sustainable technologies—ones that are both techno-economically feasible and socio-politically acceptable.

Ahmed Abdulla is Assistant Research Professor in the Department of Engineering and Public Policy at Carnegie Mellon University. His research employs models of the energy system to evaluate emerging, potentially disruptive technologies that currently sit at a low level of technical readiness, such as energy storage systems, negative emission technologies, and small modular nuclear reactors. Dr. Abdulla's work has been supported by the Alfred P. Sloan Foundation and the MacArthur Foundation, among others. Results from his research have been published in leading journals, including *Nature Climate Change* and the *Proceedings of the National Academy of Sciences*; they have also been featured in the *Wall Street Journal*, *Bloomberg News* and *The Los Angeles Times*. Prior to Carnegie Mellon, Dr. Abdulla was Assistant Research Scientist in the Center for Energy Research at the University of California, San Diego. He holds a PhD in Engineering and Public Policy from Carnegie Mellon University (2014) and a BS in Chemical Engineering from Princeton University (2009).