

## Towards Decarbonized Energy Systems: The Key Role of Energy Storage

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1:45 – 2:45 p.m.

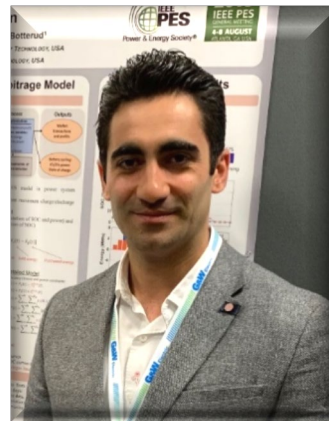
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### ABSTRACT

According to the Intergovernmental Panel for Climate Change (IPCC), human-caused net emissions should be reduced to zero by 2050. To meet this target, a transition to clean energy across different energy sectors is required, especially within the main greenhouse gas (GHG) emitting sectors i.e., electricity and transportation with more than 40% of the global emissions. In the electricity sector, a key challenge is the spatiotemporal variability and uncertainty of main renewable energy resources, namely solar and wind, which require adoption of energy storage systems. In the transportation sector, the main challenge is to provide reliable high energy density sources for propulsion systems, and two important solutions are clean fuels (hydrogen-based) and electrified transportation (batteries). Electricity and transportation systems are becoming increasingly connected through energy storage and, hence, in the pathway to decarbonize these sectors, energy storage will play a key role. Yet, technology requirements and economic potentials of the energy storage in these two sectors need to be profoundly investigated. Incidence of the climate change consequences such as seasonal hurricanes and wildfires all over the world emphasizes on the urgency of time-sensitive research on short-term and long-term sustainable solutions. In this talk, I discuss the critical role of energy storage in achieving low-carbon energy systems. I focus on developing enhanced representations of energy storage technologies that account for nonlinear performance and degradation behavior. I explain the current status and future trends of decarbonization efforts in electricity and transportation systems to illustrate where we are standing now and what we should achieve. I show that with the declining costs of renewable energy and energy storage technologies, high decarbonization rates can be achieved in the electricity system, even with moderate carbon restriction policies and government subsidies. I also show that incorporating more accurate representations of the storage technologies into the optimization and simulation models can change the overall economic evaluations.

### BIOGRAPHY



Mehdi Jafari is a Postdoctoral Associate in the Laboratory for Information and Decision Systems (LIDS) at the Massachusetts Institute of Technology (MIT). His research focuses on device- and system-level analyses of advanced energy storage solutions for electricity and transportation applications and renewable energy

integration. His research aims at improved mathematical modelling and economic analysis of renewable energy and energy storage technologies using experimental techniques and computational — linear optimization, machine learning, Bayesian networks — algorithms. Mehdi was formerly a visiting scholar at Norwegian University of Science and Technology (NTNU) where he worked with Prof. Magnus Korpås on renewable energy integration into European power systems. He received his Ph.D. from the Department of Electrical and Computer Engineering at Michigan Technological University, where he was advised by Prof. Lucia Gauchia. He has authored more than 40 journal papers and conference presentations in the power and energy field. His research has been featured in MIT News (2020) and he has received the outstanding research fellowship (2016) and outstanding teaching award (2017) from Michigan Tech. He is a member of the committee for diversity, equity, and inclusion (CDEI) at MIT Department of Electrical Engineering and Computer Science (EECS).