College of Engineering
Department of
Mechanical & Industrial Engineering

# The Robert W. Courter Seminar Series

3:00-4:00pm, Friday, October 29th, 2021

ZOOM: https://lsu.zoom.us/meeting/register/tJApd-mhqzssHNAtbx8xlujIXfCf28JLgcJB

## Thermal Energy Storage for Nuclear Power Plants


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The primary economic challenge for existing and next generation Nuclear power plants (NPPs) is due to their less flexibility to follow grid load demand. A convenient and effective method to facilitate load following by NPPs would be to integrate energy storage. Thermal energy storage (TES) methods are the most economical among all proposed grid-scale energy storage solutions, and are naturally compatible with NPPs. Storing thermal energy in technologically mature liquid or solid materials can be achievable if systems are designed with better understanding of thermal transport processes during integration. The well-established TES methods have limited integration potential with existing and forthcoming NPPs. To overcome this challenge an advanced packed bed TES system with solid rocks as storage media is designed by our team, which is compatible with liquid, vapor or gas type heat transfer fluids. These packed bed TES systems are uniquely suitable for directly recovering thermal energy from saturated steam. However, one of their critical design parameter, thermal dispersion in packed beds, is less understood. Our models show that thermal dispersion or stratification strongly governs the exergy efficiency of TES ystem, therefore accurate measurement of this parameter is essential. A fiber optics diagnostic tool, based on the the distributed Rayleigh back-scattering profiles is customized to measure and characterize thermal dispersion, stratification or mixing in packed beds. Experimental studies show that phase change during steam injection leads to much sharper thermal front or highly stratified zones in comparison to single phase heat transfer fluids. The accurate measurement of thermal stratification or dispersion parameter with different combination of heat transfer fluids and storage media can advance the design and control strategies of these TES systems. This seminar will provide a broad overview of integrating TES systems with NPPs, and a deeper understanding of thermal stratification in packed bed type TES systems which plays a critical role in exergy efficient integration.


* Dr. Hitesh Bindra is an Associate Professor in the Department of Mechanical and Nuclear Engineering at Kansas State University. He has recently established a laboratory 'Nuclear Energy Systems Transport' lab to investigate thermalhydraulics in advanced reactors, and development of thermal energy storage methods. Prior to joining KSU, Dr. Bindra worked as a research associate in the Energy Institute at City University of New York where he studied high temperature energy systems for gas cooled reactors and thermal storage applications. He has several inventions and publications in the field of thermalhydraulics and energy systems. He obtained his Ph.D. degree in Nuclear Engineering from University of Illinois.