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Analytics on Sustainable Human Building Ecosystem – A New Approach to Understand Barriers to Energy Efficient Buildings

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ABSTRACT:

Reducing waste energy consumption by making buildings more energy efficient has been touted as one of the low-hanging-fruit solutions towards carbon-neutral energy societies. Yet, despite significant progress in research and technology development, adoptions of energy efficient measures in buildings are still limited. This talk explores a new interdisciplinary area, "Sustainable Human-Building Ecosystem (SHBE)," that integrates human behavioral science and social and economic sciences in tandem with the sciences of building design, engineering, and metrology for data validation of building energy consumption and occupant comforts. The developed collaboration strategies and standardized data platform could lead to significant reductions in the uncertainty of predicting human adaptation to energy efficiency and sustainability of building ecosystems; which will, in turn, address fundamental questions such as, "what are the benefits of sustainable building investment to people at a personal, business, or urban planning level?" A recently formed SHBE Research Coordination Network (RCN) will be introduced. This RCN aims to foster a new understanding of the complex interactions among the key elements of human-building ecosystems and to work towards a set of new theories for integration of predictive models to explore the following hypothesis: Integrating occupant behaviors with built environment performances validated from large field data sets can lead to significant reductions in the uncertainty of predictive models for human adaptation to energy efficiency and sustainability of building ecosystems. Examples of such modeling work include building physical system and environment modeling; human behavior modeling; social/policy impact modeling; dynamic life cycle assessment (LCA) and business ecosystem modeling; and model integration and validation. A case study of energy, environmental and life cycle cost reduction potential of ground source heat pump (GSHP) in a hot and humid climate is also presented.

BIOGRAPHY:

Dr. Yong X. Tao is ASME Fellow and Editor-in-Chief of Heat Transfer Research with more than 24 years of research and teaching experience. Prior to joining University of North Texas, he was the Associate Dean of the College of Engineering and Computing at Florida International University in Miami, and a Professor of Mechanical and Materials Engineering. An internationally known researcher in fundamentals of thermal sciences, refrigeration system performance, and renewable energy applications in buildings, he was also Director of the Building Energy, Environment, and Conservation Systems Lab (BEECS) and Multi-Phase Thermal Engineering Lab (MPTE) at FIU. Dr. Tao has a Ph.D. in Mechanical Engineering from the University of Michigan, and a B.S. and M.S. in Mechanical Engineering from Tongji University in Shanghai, China.