EMERGING TECHNOLOGIES IN BUILDING ENERGY EFFICIENCY

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The U.S. building stock are under continuous aging and deterioration with deferred maintenance that hinders their operation. Existing buildings account for more than 86% of the annual construction cost in the U.S. and often suffer from lack of acceptable level of thermal comfort, indoor air quality (IAQ) as well as high energy use and costs. Considering future energy constraints (e.g. global warming and energy resources) and cost (e.g. capital cost and operational cost) suggest a need for a paradigm shift in our current understanding of energy efficiency and indoor environmental quality (IEQ) of the older existing building stock. Major technological advances beyond our current knowledge are much needed to design energy efficient buildings and retrofit large numbers of buildings at scale. Our technologies advances should be converged on high performance building enclosure materials, advanced building controls, intelligent building mechanical systems, efficient building lighting fixtures, and smart building plug-load management. For example, currently, majority of the residential buildings and a significant number of commercial buildings in the U.S. do not have any building automation systems, suggesting an emerging need to develop low-cost building automation systems specifically for residential buildings. This presentation covers a wide range of much needed technological advances on different building components and systems in order to design energy efficient buildings or retrofit large numbers of buildings. The aim of this presentation is not only to provide opportunities to reduce energy consumption in older existing buildings but also to shed light on new solutions to harvest energy through buildings.