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Name	Shuli Liu	
Affiliation	Beijing Institute of Technology	
<h2 style="color: red;">Invited Keynote Speaker</h2>		
Presentation Title	A study of an indirect expansion solar-assisted air source heat pump with hybrid thermal energy storage for space heating in North China: efficient-economic-environmental analysis	
Abstract	<p>The insufficient heating capacity and low coefficient of performance have always been obstacles that inhibit the application of air source heat pump (ASHP) systems in cold regions. This study proposes an indirect expansion solar-assisted air source heat pump (IX-SAASHP) system to improve the heating performance of ASHP. The IX-SAASHP consists of solar collectors, a hybrid thermal energy storage tank, and a dual-source heat pump. An optimized switching method is proposed to tackle the refrigerant redistribution problem for the dual-source heat pump. An experiment is carried out to study the thermodynamic performance of the IX-SAASHP system. The experimental results indicate that the average COP of solar heat pump mode is increased by 50.0% compared with air source heat pump mode due to the higher evaporating temperature. Based on the experimental results, an efficient-economic-environmental analysis of the IX-SAASHP system for space heating is conducted in six northern cities in China. The IX-SAASHP system has the highest annual average COP of 2.53 in Jinan and realizes the shortest payback period of 5.1 and 5.7 years in Xining and Harbin. In the north region, it is practical to set a subsidy on the additional initial cost to promote the IX-SAASHP system. Applying the IX-SAASHP system in the northwest region is suitable for its better energy and economic performance. The analysis result indicates that the IX-SAASHP system shows great significance for decarbonizing the space heating system in the northeast region.</p>	
Biographical Sketch	<p>Shuli Liu is Professor in the School of Mechanical Engineering, Beijing Institute of Technology, China, with about 20 years research experience. She aims to integrate the key strands of: application of renewable energy and sustainable technology; PCM thermal energy storage and Thermal chemical energy storage; building energy performance (materials, construction and lifecycle, etc.) and low carbon behaviors of occupiers and operators, to achieve a smart, Eco home for the future. She has been involved in 13 research projects funded by NSFC, EPSRC, KTP, and industry partners such as Tata Steel, Triton Shower and Orbit House Group Ltd, etc. over £1.7 million. Shuli has over 100 journal and conference publications. She is CIBSE member and fellow of higher education academy, UK. Shuli is also member of World Society of Sustainable Energy Technologies, UK and IBPSA, England.</p>	