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### Key technologies for the novel solar driven heating and cooling systems

The paper addressed several key technologies that enable solar driven heating and cooling systems for buildings to operate in efficient and effective ways. In terms of the solar heating, the multiple-throughout-flowing featured panels-array in combination with micro-channel structure for individual panels are the most creative technologies that has proven to be able to achieve 10% higher solar thermal efficiency and 100% higher energy efficiency ratio compared to the existing solar thermal system. In addition, the coupled heat storage/exchanger with the double containers is able to speed up heating time and increase the heat transfer capacity of the system, and is regarded as an additional initiative. The cost balance approach is applied to determine the quantity and area of the PV panel, leading to a new way of achieving the zero-bill heating operation in an economic way. In terms of the solar cooling, the innovative super-performance dew point cooling involving advanced fiber materials, superior thermal-assisted pressing approach for bonding of the fiber material with dry side material, as well as intelligent control of the pump and fan is detailed. Furthermore, the solar driven adsorbent bed cyclic system using the solar radiation and solar based microwave energy was introduced.

### Recent Publications

1. Peng Xu, Xiaoli Ma, Xudong Zhao and Kevin Fancey (2017) Experimental investigation of a super performance dew point air cooler. *Applied Energy* 203:761-777.
2. T M O Diallo, X Zhao, A Dugue, P Bonnamy, F J Miguel, A Martinez, T Theodosiou, J Liu and N Brown (2017) Numerical investigation of the energy performance of a ventilated façade system employing a smart modular heat recovery unit and a latent heat thermal energy system. *Applied Energy* 205:130-152.
3. Jinzhi Zhou, Xudong Zhao, Xiaoli Ma, Zhenyu Du, Yi Fan, Yuanda Chen and Xinghui Zhang (2017) Clear-days operational performance of a hybrid experimental space heating system employing the novel mini-channel solar thermal & PV/T panels and a heat pump. *Solar Energy* 155:464-477.
4. Wansheng Yang, Hao Deng, Zhangyuan Wang, Xudong Zhao and Song He (2017) Performance investigation of the novel solar-powered dehumidification window for residential buildings. *Energies* 10:1369.
5. Zhiyin Duan, Xudong Zhao and Junming Li (2017) Design, fabrication and performance evaluation of a compact regenerative evaporative cooler: Towards low energy cooling for buildings. *Energy* 140:506-519.

### Biography

Xudong Zhao is the Director of Research and Professor in the School of Engineering and Computer Science at University of Hull, UK. He is a distinguished academia in the areas of sustainable building services, renewable energy and energy efficiency technologies, and mechanical engineering. Over more than 30 years of professional career, he has led or participated in 57 research projects funded by EU, EPSRC, Royal Society, Innovate-UK, Royal Academy of Engineering, China Ministry of Science and Technology and industry with accumulated fund value of approximately £18 million, 40 engineering consultancy projects worth £5 million, and claimed 11 patents.

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