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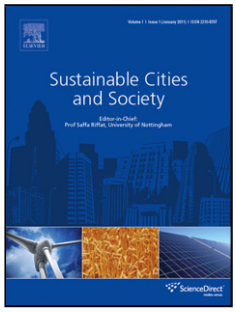

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PII: S2210-6707(17)31051-X
DOI: https://doi.org/10.1016/j.scs.2018.01.014
Reference: SCS 927

To appear in:

Received date: 12-8-2017
Revised date: 9-1-2018
Accepted date: 9-1-2018

Please cite this article as: Gao, Xiangkui., Yuan, Yanping., Wu, Hongwei., Cao, Xiaoling., & Zhao, Xudong., Coupled Cooling Method and Application of Latent Heat Thermal Energy Storage Combined with Pre-cooling of Envelope: Optimization of Pre-cooling with Intermittent Mode.*Sustainable Cities and Society* https://doi.org/10.1016/j.scs.2018.01.014

Coupled Cooling Method and Application of Latent Heat Thermal Energy Storage Combined with Pre-cooling of Envelope: Optimization of Pre-cooling with Intermittent Mode

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Highlights

- An intermittent operational mode for PE of the new coupled cooling system is proposed.
- A simplified numerical model of intermittent cold storage is established.
- PE is divided into two periods, with their own respective evaluation indices proposed.
- An interchanging continuous/intermittent cold storage strategy is proposed.
- Energy consumption can be reduced by 68–78% as compared to the continuous mode.

Abstract：The coupled cooling method combining latent heat thermal energy storage and pre-cooling of the envelope (PE) is a new free-cooling method that is suitable for exposure to high temperatures and other types of harsh environments. PE plays the most critical role in the coupled cooling method. Long-term, continuous PE cannot only reduce energy storage capacity, but it also causes numerous energy waste. Thus, an intermittent operational mode is firstly proposed to improve the heat transfer performance and reduce energy consumption. A simplified numerical model of intermittent thermal storage is established, and the subsequent effects of intermittent ratio (IR) and intermittent period (IP) on cold storage performance have been systematically investigated. Furthermore, the operational period is divided into a cold storage period (CSP) and a cold preservation period (CPP), each with their own respective evaluation indices. Long-term intermittent PE is optimized, and an interchanging continuous/intermittent cold storage strategy is proposed. Under the current operating conditions, as compared with the conventional continuous mode, the duration of CSP is extended by 0–26%, yielding an annual cold storage energy