

Natural Ventilation Potential in China and its Impact on Building Energy Efficiency

PROBLEM

China has been undergoing rapid economic expansion and industrial developments for the last two decades, making it the engine of the world's economic growth. However, as a result, the energy consumption and associated CO₂ emissions have increased dramatically. The building sector is a critical contributor to China's energy consumption, and the sector's life-cycle energy accounts for over 40% of China's total energy use. HVAC systems that heat, cool, and ventilate the building comprise approximately 47% of energy consumption in buildings across China. On the other hand, natural ventilation (NV) is the process of supplying and removing air to and from an indoor space without the use of mechanical system. It is often perceived as an energy efficient and healthy solution for building ventilation, with great potential to reduce energy consumption. Recently, a great deal of attention has been paid to advanced NV technologies in Europe and the United States. However, much work is needed in China before this potential can be realized.

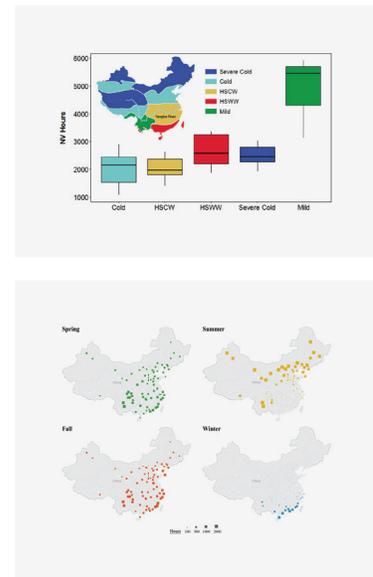


Figure 2. Climate and seasonal considerations

GUIDING QUESTIONS

This research project quantifies the energy savings potential of mixed-mode ventilation (natural and mechanical combined) at a national scale in China, taking into account the influence of ambient air pollution.

What is the impact of ambient air pollution on the NV potential in China?

Which cities/regions have the largest potential?

What is the implication on electricity savings and carbon reductions?

PROJECT DESCRIPTION

In this study, we estimate the maximum natural ventilation hours of 76 cities of China based on local weather data, taking into account the influence of ambient air pollution. In addition, we predict the energy savings by natural ventilation in office buildings of 35 major Chinese cities. The seasonal variation of NV hours and the differences among five climate zones are also examined. The associated electricity saving, carbon reduction and economic impact at the national scale are discussed as well.

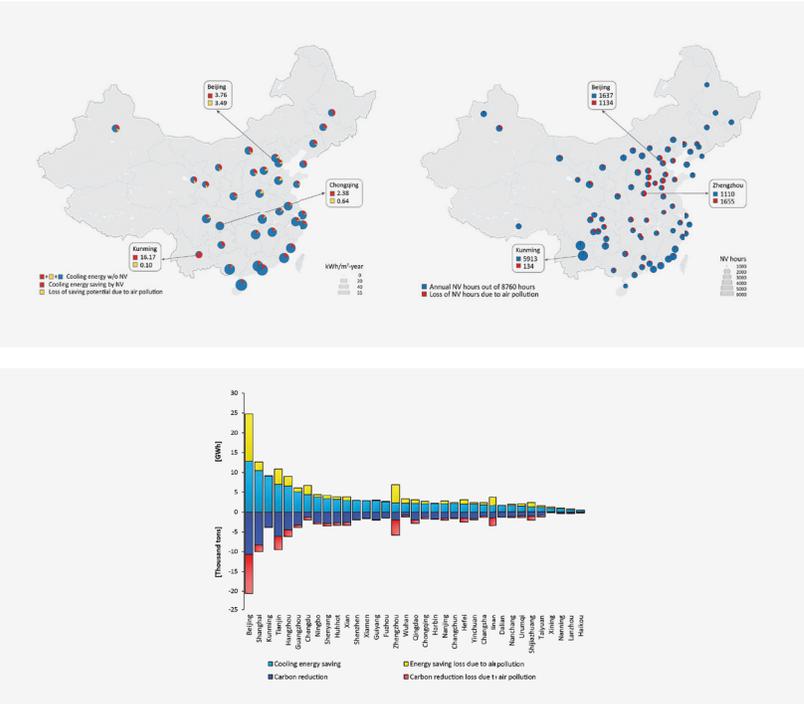


Figure 4. Maximum natural ventilation and associated savings and reductions.

IMPACT

The utilization of natural ventilation in China reveals a substantial potential to save energy. Predicting the NV potential is essential to building design, energy consumption assessment, and policy-making. In order to encourage the harnessing of NV potentials, this study aims to:

Provide guidelines for improving current building design codes and energy policies.

Quantify the negative impact of ambient air pollution on NV potential.

Create a large public database of NV potential in China for architects and building operators.