Data Article

Projection datasets of city- and grid-level building energy consumption for Hubei Province, China

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ABSTRACT

This data article takes a typical low-carbon pilot province in Middle China (Hubei) as an example to present the pathway of building energy conservation and emission reductions for different cities. The data contains middle-to-long-term predictions of provincial socio-economic factors (Gross Regional Production, population and urbanization rate), based on which building sector energy consumption under the base scenario could be estimated on provincial scale. Besides, energy demand and structures of the building sectors in cities from various categories are also provided by considering the spatial heterogeneity of city-level economic development and energy use intensities. This dataset could be used to calculate building sector emission reduction potentials on city scale so as to fill in the research gap of mitigation pathway modeling for multiple cities. Moreover, it also proposes a reasonable and convenient approach to allocate provincial targets concerning emission intensity and total amount control. Finally, the data offers high-resolution gridded projections for building energy consumption, which could be expanded to other sectors and cities to assist in more refined urban governance and atmospheric and climate modeling. The data presented herein are associated with the research article “Carbon mitigation of China’s building sector on city-level: pathway and policy implications by a low-carbon province case study” [1].

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1. Data

The data consist of key parameters and assumptions required by modeling future evolutions of city- and grid-level building energy consumption [1]. Table 1 listed province-level building energy consumption of three sub-sectors by fuel type, in which data of 2015 is collected from energy statistical yearbook and the values of 2020–2030 are predicted by the combination of trend analysis concerning total energy consumption and its structure. To be more specific, total amount is specified by provincial/mid-term energy development and emission control targets, while the demand increase rate of individual energy type is forecasted based on temporal extrapolation of historical records. When it comes to city-level carbon emission projections under different scenarios (Table 2), the relationship between historical socioeconomic data (Supplementary Material Table 1) and energy use intensity is drawn first,

### Table 1

|                | Coal       | Oil        | Natural Gas | Electricity |
|----------------|------------|------------|-------------|-------------|
| **Urban**      |            |            |             |             |
| 2015           | 154.88     | 66.91      | 82.13       | 226.45      |
| 2020           | 147.79     | 71.18      | 155.17      | 292.98      |
| 2025           | 114.78     | 95.11      | 253.21      | 457.88      |
| 2030           | 88.01      | 97.69      | 341.75      | 589.15      |
| **Rural**      |            |            |             |             |
| 2015           | 255.24     | 70.020     | 341.75      | 589.15      |
| 2020           | 304.82     | 81.86      | 9.70        | 134.28      |
| 2025           | 286.95     | 116.24     | 15.83       | 173.34      |
| 2030           | 242.02     | 126.42     | 21.36       | 200.31      |
| **Commercial** |            |            |             |             |
| 2015           | 350.52     | 75.04      | 85.90       | 248.38      |
| 2020           | 351.01     | 85.42      | 166.81      | 292.98      |
| 2025           | 286.95     | 110.96     | 300.69      | 425.18      |
| 2030           | 234.69     | 109.18     | 427.19      | 589.15      |
then future trajectory is estimated according to the characteristics of base and policy scenarios (Supplementary Material Table 2). Energy use intensities under S1 (base scenario), are assumed to be driven only by socioeconomic factors. And policy scenario S2 and S3 take into account electricity and renewable energy share increases and higher efficiency of building energy technologies, respectively. Parameters regarding clean energy proportions and efficiency improvement of the province were set based on literature review [2–5]. Then these parameters were adjusted for different groups of cities according to their socioeconomic development status. Additionally, natural gas consumption was used

![Fig. 1. General workflow chart of data preparation.](image-url)
as an example to display grid-level energy data (ASCII file in the Supplementary material), which was generated by spatial downscaling from city-level calculations.

2. Experimental design, materials, and methods

The data presented in this article aim to provide future building energy consumption and emissions with higher resolution, which could be applied to climate modeling and more refined low-carbon management. The dataset incorporates information on three geographic/administrative levels and is produced by using the systematic downscaling framework described in Ref. [6]. First, provincial statistics [7] were employed to identify the historical trends of total energy demand and the share of the building sector in it. Then city-level energy statistics such as household and commercial natural gas and electricity use were used to describe the distribution patterns of building energy use intensity by quantitatively linking them to socioeconomic parameters. These trend analyses derived from past data could then be used to model the spatial and temporal variations of future building energy demand for the province. More specifically, grid-level urban/rural population and Gross Domestic Production (GDP) were incorporated into these relationships to generate spatial proxies for energy consumption distributions within cities. The above process could be generalized as shown in Fig. 1.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104952.

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