

Hourly electric power load and transmission data at the provincial level in China

Haochi Wu¹ and Xiaoming Kan²

¹Zhejiang University, China. Email: wuhaochi@zju.cn

²Chalmers University of Technology, Sweden. Email: kanx@chalmers.se

ABSTRACT

This dataset offers hourly electric power load data for all 31 provinces in mainland China. Moreover, it incorporates information about the primary transmission grids connecting provinces, including both HVDC and HVAC lines.

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1 Hourly electric power load for 31 provinces in China

We provide annual electricity demand data for 31 provinces in mainland China, encompassing hourly load values for each province in the year 2018 (Appendix 1). Please see Appendix 2 for the examples of seven provinces (BJ, SX, JS, ZJ, JX, GD, and CQ, see Figure 1 for the abbreviation of each province in China). It includes time slice from 00:00 01 Jan to 23:00 31 Dec in 2018, all in UTC+8 time.

1.1 Method

Our initial step involves the retrieval of raw data from the National Development and Reform Commission¹. This data source provides us with the highest and lowest electricity demand for each day, along with representative daily load profiles for both regular workdays and typical holidays. This is the content of China's provincial power grids in 2018²⁻⁶. These data points manifest in the form of load curves for each province throughout the year 2018.

Subsequently, we engage in a process of data replication wherein we meticulously trace each pixel of the load curve⁷. This meticulous replication enables us to create electricity demand data that closely mirrors the original load curve.

The next phase pertains to the derivation of hourly load curves for workdays. To achieve this, we proportionately adjust the typical daily load profile for a workday to align with the highest and lowest electricity demand recorded on that particular day⁸. A comparable methodology is employed to derive hourly load curves for holidays. Please see below for the formula used to derive the hourly load curves for the workdays.

$$DP_{r,d}(h) = \begin{cases} (DL_{r,max}(d) - DL_{r,min}(d)) \cdot \frac{\left(TP_{r,workday}(h) - \min_{h \in \Phi^H} TP_{r,workday}(h) \right)}{\max_{h \in \Phi^H} TP_{r,workday}(h) - \min_{h \in \Phi^H} TP_{r,workday}(h)} + DL_{r,min}(d) & d \in \text{workday} \\ (DL_{r,max}(d) - DL_{r,min}(d)) \cdot \frac{\left(TP_{r,holiday}(h) - \min_{h \in \Phi^H} TP_{r,holiday}(h) \right)}{\max_{h \in \Phi^H} TP_{r,holiday}(h) - \min_{h \in \Phi^H} TP_{r,holiday}(h)} + DL_{r,min}(d) & d \in \text{holiday} \end{cases}$$

for $\forall r \in \Phi^R, \forall d \in \Phi^D, \forall h \in \Phi^H$

where $DP_{r,d}(h)$ signifies the power load at hour h on a workday in province r , while $TP_{r,workday}(h)$ and $TP_{r,holiday}(h)$ represents the power load at hour h in province r according to the typical workday or holiday curve; $DL_{r,max}(d)$ and $DL_{r,min}(d)$ stand for the highest and lowest daily power loads of province r on day d , respectively; Φ^R , Φ^D , and Φ^H denote the sets of regions encompassing the 31 provinces in China, the days forming the 365-day set in 2018, and the hours composing a day's 24-hour set, respectively.

In summary, our methodology involves sourcing, replication, scaling, and adjustment to produce hourly load curves for both workdays and holidays, based on the provided data from the National Development and Reform Commission.

Illustration of 31 provinces in China

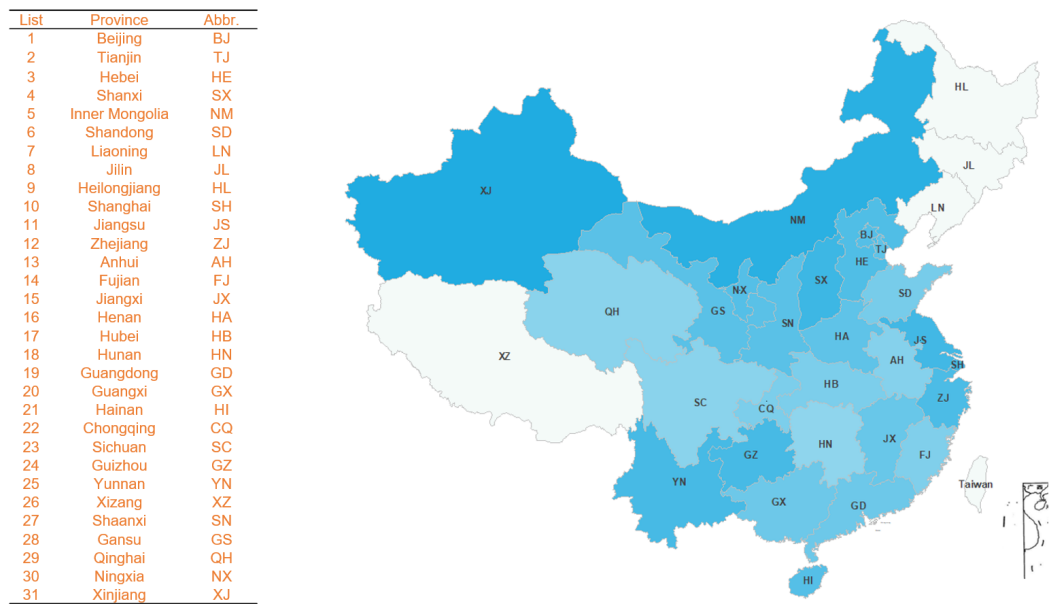


Figure 1. Abbreviation of provinces in mainland China.

2 Main Transmission lines

2.1 Data description

We also provide the data of major inter-provincial transmission connections, classified as HVAC and HVDC (see Appendix 3). The data were collected and updated to 2022 from multiple sources, including National Energy Administration⁹ and China Electricity Enterprise Federation^{10,11}. For those who are interested in the details of the major regional grids and the connections between provinces, please see Appendix 4.

References

1. National Development and Reform Commission. Notice on the Signing of Medium and Long-Term Electricity Contracts for the Year 2020 (NDRC Document No. 1982 [2019] - National Development and Reform Commission). https://www.ndrc.gov.cn/xxgk/zcfb/tz/201912/t20191230_1216857.html.
2. China Southern Power Grid. http://eng.csg.cn/About_us.
3. Ministry of Water Resources of the People's Republic of China. *China Water Conservancy Statistical Yearbook 2021* (China Water Conservancy and Hydropower Press, 2021).
4. Development, N. & Commission, R. Notice of the national development and reform commission on reducing general industrial and commercial electricity prices (2019)842. https://www.ndrc.gov.cn/xxgk/zcfb/tz/201905/t20190515_962447.html.
5. Development, N. & Commission, R. Provincial power grid transmission and distribution price table (2020). https://www.ndrc.gov.cn/xxgk/zcfb/ghxwj/202009/t20200930_1243682.html.
6. State Grid Corporation of China (SGCC). <http://www.sgcc.com.cn/ywlm/index.shtml>.
7. Rohatgi, A. WebPlotDigitizer (2022). <https://github.com/ankitrohatgi/WebPlotDigitizer>.
8. Li, B. *et al.* Modeling the impact of EVs in the Chinese power system: Pathways for implementing emissions reduction commitments in the power and transportation sectors. *Energy Policy* **149**, 111962, DOI: [10.1016/j.enpol.2020.111962](https://doi.org/10.1016/j.enpol.2020.111962) (2021).
9. China National Bureau of Statistics. *National Bureau of Statistics of China. China Energy Statistical Yearbook 2018* (China Statistics Press, Beijing, 2019).

10. China Electricity Council. *Annual Development Report of China's Power Industry*.
11. China Electricity Council. *China Electric Power Yearbook* (China Electric Power Press, 2020).