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Spatial Distribution Dataset Development of Industrial Cultural Heritage in Electric Power Industry of China

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Abstract: To address the issue of the existing industrial cultural heritage list in the electric power industry lacking spatial attributes and struggling to meet digital management needs, this study has developed a spatial distribution dataset of industrial cultural heritage in China's electric power industry. The authors utilized the 2023 list of industrial cultural heritage in the electric power industry of central enterprises published by China State-owned Assets Supervision and Administration Commission of the State Council as the source data. It comprehensively utilized SFMAP address big data platform and publicly available online information to clean, spatially locate, and expand the attributes of the heritage data. The final dataset includes 25 core heritage sites, such as power plants, substations, and industrial factories, and establishes a complete attribute database that includes the name of the heritage, the affiliated unit, administrative division, latitude and longitude coordinates, and the main construction year. This dataset not only accurately reflects the current geographical distribution of electric power industry heritage but also outlines the historical context of industrial development through the attribute of construction year. The dataset is archived in .shp and .xls formats, consists of 7 data files, with a data volume of 191 KB (compressed into a single file of 33.0 KB).

Keywords: industrial cultural heritage; electric power industry; national level; spatial distribution; China

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Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2025.10.03.V1.

1 Introduction

According to The Nizhny Tagil Charter for the Industrial Heritage issued by The International Committee for the Conservation of the Industrial Heritage (TICCIH) in 2003, industrial heritage is clearly defined as various industrial relics with historical accumulation, technological innovation, social significance, or scientific value. Its scope covers a wide range of material remains, from production workshops and power facilities to associated social spaces[1]. As "living fossils" of urbanization, these heritage sites not only reflect the evolution of past economic structures and lifestyles but also embody irreplaceable collective memories and demonstrate enduring humanistic values[2]. On this basis, the term "industrial cultural heritage" further elevates the conceptual connotation. It transcends the mere perspective of material protection, particularly emphasizing the infusion of cultural and social attributes, aiming to reshape the humanistic spirit of the remains rather than merely treating them as residues of urban development.

The practice and exploration of industrial heritage protection in China can be traced back to the Symposium on Modern Architectural History hosted by Tsinghua University in 1986. However, in the early stage, the focus of relevant research was mainly on public and religious architecture, and industrial architecture did not receive due attention. On April 18, 2006, the National Cultural Heritage Administration of China organized the "Wuxi Forum" in Wuxi, Jiangsu Province. The Wuxi Proposal adopted at the conference became a landmark document in the process of industrial heritage protection in China. Compared with the international The Nizhny Tagil Charter for the Industrial Heritage, the Wuxi Proposal added intangible cultural heritage categories such as "processes, data records, and enterprise archives" to the definition of industrial heritage. This supplement fully reflects China's unique considerations in the cognition and practice of industrial cultural heritage[3]. In the same year, the National Cultural Heritage Administration of China issued the Notice on strengthening the protection of industrial heritage; In 2007, the third national cultural relics survey officially included industrial heritage in the scope of investigation; In 2013, industrial heritage was listed as a separate category for the first time in the selection of the seventh batch of national key cultural relics protection units. This series of measures clearly outlines the development trajectory of China's industrial heritage protection system gradually moving towards maturity and improvement[4].

As a key component of industrial cultural heritage, electric power industrial heritage can be regarded as the "industrial flame" that has been continuously passed down during the over-century-long development of the electric power industry, and it is also a precious treasure accumulated in the more than 140-year evolution history of the electric power industry[5]. In the context of the electric power industry where technological iteration is rapid and industrial upgrading is continuously advancing, the protection, inheritance and activated utilization of industrial cultural heritage have irreplaceable value for the development of the industry and cultural continuity[6]. On September 14, 2023, the List of industrial cultural heritage of central enterprises in the electric power industry was officially released. The list includes 25 representative heritage sites of different types such as museums, power plants, substations, industrial plants and electrical equipment, covering 2 major power grid companies, 5 major power generation groups, as well as core enterprises like China Three Gorges Corporation, Power Construction Corporation of China (POWERCHINA) and 2 major electrical groups. The dataset of this study collects the spatial location information of these 25 industrial cultural heritage sites in the above-mentioned list, including core fields such as heritage names, declaring entities, completion years and geographic coordinates. These data can not only provide basic support for analyzing the

spatial distribution characteristics of industrial cultural heritage in the electric power industry, but also play an important role in the practice of excavating, protecting and inheriting regional industrial cultural resources.

2 Metadata of the Dataset

The metadata of the Spatial distribution dataset of industrial cultural heritage in electric power industry of China[7] is summarized in Table 1. It includes the dataset full name, short name, authors, year of the dataset, data format, data size, data files, data publisher, and data sharing policy, etc.

Table 1 Metadata summary of the Spatial distribution dataset of industrial cultural heritage in electric power industry of China

Items	Description
Dataset full name	Spatial distribution dataset of industrial cultural heritage in electric power industry of China
Dataset short name	PowerICH_China_2023
Authors	Li, Y. Z., State Grid Customer Service Center, 502513735@qq.com Ma, J., State Grid Customer Service Center, 1306859767@qq.com Zhang, Y., State Grid Customer Service Center, 1030431434@qq.com Wu, F., SFMAP (Shenzhen) Co., Ltd, vance_woo@163.com Wang, H. L., SFMAP (Shenzhen) Co., Ltd, 1936637988@qq.com Chen, Y. Y., SFMAP (Shenzhen) Co., Ltd, 3150007286@qq.com Ye, P., College of Civil Engineering and Transportation, Yangzhou University, 007839@yzu.edu.cn Wang, S., Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, wangshu@igsnrr.ac.cn
Geographical region	China
Year	2023
Data format	.shp, .xls
Data size	191 KB
Data files	(1) The industrial cultural heritage of centralized enterprises in the electric power industry and their spatial distribution; (2) statistics on the number of industrial cultural heritage in the electric power industry by different superintend, province, the year of construction
Foundations	National Natural Science Foundation of China (42471503, 42301522); Chinese Academy of Sciences (XDB0740200-01); Ministry of Science and Technology of P. R. China (2022YFF0711601); State Grid Customer Service Center (FT20240232)
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(1) *Data* are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use *Data* subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute *Data* subject to written permission from the GCdataPR Editorial Office and the issuance of a *Data* redistribution license; and (4) If *Data* are used to compile new datasets, the 'ten per cent principal' should be followed such that *Data* records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[8]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS, GEOSS, PubScholar, CKRSC

3 Methods

Based on the List of industrial cultural heritage of central enterprises in the electric power industry released in 2023, the authors collected and integrated relevant cultural resources of various industrial cultural heritage sites through the "Internet +" model. Administrative divisions and geographical coordinates of each industrial cultural heritage were obtained based on the SFMAP address big data service platform, and visualized as the spatial distribution of industrial cultural heritage in the electric power industry of China with the support of ArcGIS. The technical workflow for the development of this dataset is shown in Figure 1.

3.1 Data Sources

On September 14, 2023, the official website of China State-owned Assets Supervision and Administration Commission of the State Council (SASAC)[1] issued a notice entitled "Release of the List of industrial cultural heritage of central enterprises in the electric power industry in Beijing". A total of 25 industrial cultural heritage sites from 11 central enterprises were included in the list (Table 2). The published list contains 2 types of information: the name of the industrial cultural heritage and the competent authority to which the heritage belongs.

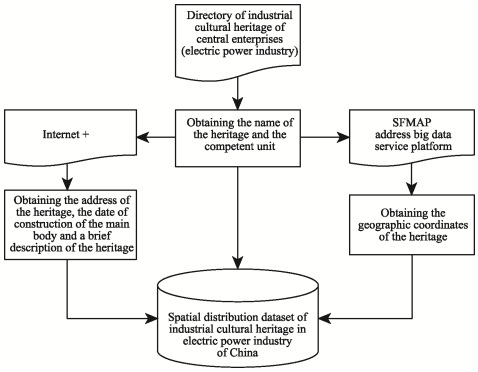

Figure 1 Flowchart of the dataset development

Table 2 Directory of industrial cultural heritage of central enterprises (electric power industry)

No.	Name of the heritage	Competent authority	No.	Name of the heritage	Competent authority
1	Shanghai Zhabei Power Plant	State Grid Corporation of China	14	Yilihe Power Plant of Huadian Yunnan Power Generation Co., Ltd.	China Huadian
2	220 kV Liangting Substation	State Grid Corporation of China	15	Original site of Jiamusi Power Plant	China Huadian
3	Fengman Hydropower Station	State Grid Corporation of China	16	Lvshuihe First-class Power Station	China Huadian
4	Former site of British Hankou Electric Light Company (Hubei Electric Power Museum)	State Grid Corporation of China	17	Equipment of the electrical control room of Unit 1–3 in Plant A	State Power Investment Corporation of China
5	Jingpo Lake Power Plant	State Grid Corporation of China	18	Geheyan water conservancy project	China Three Gorges Corporation
6	Guangzhou Electric Power Exhibition Hall	China Southern Power Grid	19	Jiaozuo Power Plant	China Energy Investment Corporation
7	Former site of Yunnan Kunhu Power Plant	China Southern Power Grid	20	Maotiao River Cascade Hydropower Station of Hongfeng Hydropower Plant	China Energy Investment Corporation
8	Yunnan Kaiyuan Nanqiao Power Plant	China Southern Power Grid	21	Laohudong Power Station	China Energy Investment Corporation
9	Equipment of the main electrical panel control room and No. 8 turbine generator set in the old factory of Xigu Thermal Power Company	China Huaneng	22	Guodian Power Huanren Power Plant	China Energy Investment Corporation
10	Train power station of the 12th Station of Zhalainuoer Coal Company	China Huaneng	23	Office buildings and workshops in the front area of Harbin Electric Turbine Factory	Harbin Electric Corporation
11	Old factory area of Huxian Thermal Power Plant	China Datang	24	"Dongdian Yinji" Industrial History and Culture Park	Dongfang Electric Corporation
12	Xiaqingyuandong Red Historical Hydropower Station	China Datang	25	Industrial plant heritage of Jiajiang Hydraulic Engineering Bureau of Sinohydro Engineering Bureau 7 Co., Ltd.	Power Construction Corporation of China
13	Beijing Huadian Hydropower Co., Ltd.	China Huadian			

[1] SASAC. http://www.sasac.gov.cn/n2588030/c28875776/content.html.

3.2 Industrial Cultural Heritage Attribute Data Collection

Cultural heritage is a valuable wealth left to mankind by history, and cultural heritage resources are a collection of valuable cultural heritage-related resources that have been included and processed[9]. The systematic protection and living inheritance of industrial cultural heritage not only rely on the release of authoritative protection lists, but also require a comprehensive grasp of the multidimensional cultural information of heritage. However, the existing lists are mainly based on the name of the heritage and the competent authority as the main information carrier, which is difficult to meet the needs of refined protection, spatial analysis and public dissemination. Therefore, this study adopted the "Internet +" mode, through the in-depth search of authoritative media reports, official websites of enterprises, cultural heritage databases and other online resources, to supplement heritage information such as the specific address of the heritage, the date of its construction, and its historical functions, and also to provide data support for the subsequent inheritance of the industrial cultural heritage and its value assessment.

3.3 Industrial Cultural Heritage Spatial Data Acquisition

On September 14, 2023, the official website of the SASAC published a notice regarding the "Release of the List of industrial cultural heritage of central enterprises in the electric power industry in Beijing". The list includes the names of the heritage sites. While address descriptions of each industrial cultural heritage site can be obtained through internet searches, the associated geographical coordinates are lacking. SFMAP (Shenzhen) Co., Ltd., a subsidiary of SF Express, maintains a semantic address database of 14 billion entries, and its official website provides an online geocoding service through the address big data service platform. This study obtained the geographical coordinates of each central enterprise power industry cultural heritage site using SFMAP geocoding API (Application Programming Interface). However, some industrial cultural heritage sites in the published list have historical names, and some have overly brief address descriptions, making it difficult to directly obtain relevant geographical coordinates through the geocoding API. This study employed the following methods to acquire spatial data of industrial cultural heritage sites.

(1) Geocoding based on heritage addresses

For certain industrial cultural heritage sites, the address descriptions are sufficiently detailed, including specific road names and house numbers. For these sites, geographical coordinates were directly obtained by accessing the geocoding API using their address descriptions. The industrial cultural heritage sites of the power industry under central enterprises, for which geographical coordinates were successfully retrieved based on their address descriptions in this study, along with their corresponding address details, are presented in Table 3.

(2) Geocoding based on heritage names

Some industrial cultural heritage sites are still in normal operation and production. Therefore, geographical coordinates can be directly obtained by accessing the geocoding API based on their heritage names. In this study, geographical coordinates of two industrial cultural heritage sites were successfully acquired using their names, namely "Yilihe Power Plant of Huadian Yunnan Power Generation Co., Ltd." and "Jiaozuo Power Plant".

(3) Geocoding based on associated landmarks

Certain industrial cultural heritage sites, such as substations, hydropower stations, and electrical units, involve specialized equipment with sensitive information and are thus excluded from the publicly accessible place name categories in ordinary internet maps. Additionally, some industrial cultural heritage sites are listed under historical names in the published directories. For these heritage sites, 2 strategies were employed: (1) Internet searches were conducted to identify specific landmarks within or adjacent to their factory

Table 3 Description of selected industrial heritage sites and their addresses

No.	Name of the heritage	Address of the heritage
1	Shanghai Zhabei Power Plant	No. 4000, Jungong Road, Yangpu District, Shanghai
2	Former site of British Hankou Electric Light Company (Hubei Electric Power Museum)	No. 22, Hezuo Road, Jiang'an District, Wuhan City, Hubei Province
3	Guangzhou Electric Power Exhibition Hall	No. 162, Taikang Road, Yuexiu District, Guangzhou City
4	Former site of Yunnan Kunhu Power Plant	No. 830, Chunyu Road, Majie, Xishan District, Kunming City, Yunnan Province
5	Equipment of the main electrical panel control room and No. 8 turbine generator set in the old factory of Xigu Thermal Power Company	No. 78, Gulang Road, Xigu District, Lanzhou City, Gansu Province
6	Beijing Huadian Hydropower Co., Ltd.	No. 219, South Reservoir Road, Xiwengzhuang Town, Miyun District, Beijing
7	Original site of Jiamusi Power Plant	No. 950, East Chang'an Road, Jiamusi City, Heilongjiang Province
8	Laohudong Power Station	Laohudong, Laohudong Village, Xiangfeng Town, Laifeng County, Enshi Prefecture, Hubei Province
9	Office buildings and workshops in the front area of Harbin Electric Turbine Factory	No. 345, Sandadongli Road, Xiangfang District, Harbin City, Heilongjiang Province
10	"Dongdian Yinji" Industrial History and Culture Park	Dongfang Electric Machinery Co., Ltd., No. 188, West Huanghe Road, Jingyang District, Deyang City, Sichuan Province
11	Industrial plant heritage of Jiajiang Hydraulic Engineering Bureau of Sinohydro Engineering Bureau 7 Co., Ltd.	No. 40, Xihe Road, Jiajiang County, Leshan City, Sichuan Province

premises, and the geographical coordinates of these landmarks were utilized as proxies for the heritage sites; (2) For heritage sites with sensitive types, geographical positioning was restricted to their administrative divisions for national security considerations. The industrial cultural heritage sites for which coordinates were obtained via associated landmarks, along with their corresponding landmarks, are detailed in Table 4.

Table 4 Industrial cultural heritages and their associated landmarks

No.	Heritage item	Associated landmark	Reference source
1	220 kV Liangting Substation	Geleshan, Shapingba District, Chongqing City	Official media[10]
2	Fengman Hydropower Station	China Fengman Hydropower Museum	Web encyclopaedia[11]
3	Jingpo Lake Power Plant	Jingpo Lake Red Education Base of Heilongjiang Electric Power Co., Ltd.	Official media[12]
4	Yunnan Kaiyuan Nanqiao Power Plant	Nanqiao, Kaiyuan City, Honghe Hani and Yi Autonomous Prefecture, Yunnan Province	Featured sites[13]
5	Train power station of the 12th Station of Zhalainuoer Coal Company	Zalainuoer Coal Industry Co., Ltd.	Official media[14]
6	Old factory area of Huxian Thermal Power Plant	Training Base of Datang Shaanxi Power Generation Co., Ltd.	Official media[15]
7	Xiaqingyuandong Red Historical Hydropower Station	Xiaqingyuandong Power Station of Yuneng (Group) Co., Ltd.	Featured sites[16]
8	Lvshuihe First-class Power Station	Lvshuihe Tropical Rainforest Resort	Social media[17]
9	Equipment of the electrical control room of Unit 1-3 in Plant A	Chifeng Thermal Power Plant	Official media[18]
10	Geheyan water conservancy project	Geheyan Reservoir	Web encyclopaedia[19]
11	Maotiao River Cascade Hydropower Station of Hongfeng Hydropower Plant	Hongfeng Hydropower Plant, Qingzhen City, Guizhou Province	Web encyclopaedia[20]
12	Guodian Power Huanren Power Plant	Heyu Hydropower Development Company of Guodian Power Development Co., Ltd.	Featured sites[21]

4 Data Results

4.1 Dataset Composition

The Spatial distribution dataset of industrial cultural heritage in electric power industry of China consists of 2 parts: (1) the location vector data of industrial cultural heritage (.shp); and (2) the attribute data of the industrial cultural heritage, including the name of the heritage, the declared unit, the address of the heritage, and the administrative divisions, etc. (.xls). The names of each attribute field in the dataset and their examples are shown in Table 5.

Table 5 The attribute fields of the dataset

Items	Description
Index	0, 1, 2, 3, …, 25
Name of the heritage	Shanghai Zhabei Power Plant, 220 kV Liangting Substation, Fengman Hydropower Station, …
Competent authority	State Grid Corporation of China, China Southern Power Grid, China Huaneng, …
Address of the heritage	No. 4000, Jungong Road, Yangpu District, Shanghai; Geleshan, Shapingba District, Chongqing; Jilin City, Jilin Province; …
Year of completion of the main body	1930, 1972, 1937, …
Heritage profile	State Grid Shanghai Zhabei Power Plant is one of the earliest thermal power plants in China, built in 1911; ...
Associated landmark	China Fengman Hydropower Museum, Jingpo Lake Red Education Base of Heilongjiang Electric Power Co., Ltd., Chifeng Thermal Power Plant, …

4.2 Data Results

The industrial cultural heritage of central enterprises in the electric power industry shows significant systematic distribution characteristics. From the dimension of competent authorities, State Grid Corporation of China (5 items), China Huadian (4 items) and China Energy Investment Corporation (4 items) ranked in the top three (Figure 2), with the top four units accounting for a total of 72.7%, highlighting the concentration of cultural heritage in large central enterprises. In terms of geospatial distribution, Yunnan (4 items), Sichuan (2 items), Chongqing (2 items) and other southwestern provinces, as well as Hubei (3 items) and Heilongjiang (3 items) form the main clusters (Figure 3), in which the regional centre cities and special terrain areas are relatively more concentrated, and this spatial pattern is highly consistent with the historical trajectory of the internal relocation of industries during the war period and the Third Front Construction. In terms of time dimension, the industrial cultural heritage of the electric power industry was built across the period of 1905–1994 (Figure 4), showing 3 construction peaks—the period of national industrial boom in the 1930s (5 items), the wave of industrialization at the beginning of the founding of the nation in the 1950s (7 items) and the period of the Third Front Construction in the 1960s and 1970s (8 items), outlining the evolution of China's electric power industry from colonial capital domination, national independent development to comprehensive independent innovation. 81.8% of the heritage are still functioning power generation facilities, which have the dual value of industrial production and historical testimony.

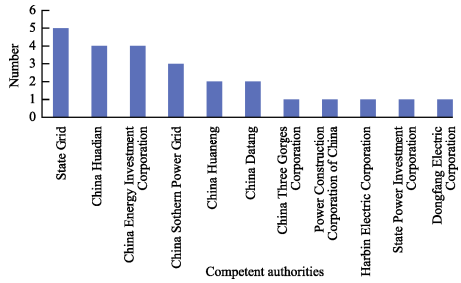

Figure 2 Statistics on the number of industrial cultural heritage in the electric power industry by different competent authorities

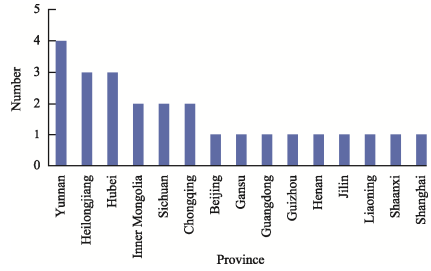

Figure 3 Statistics on the number of industrial cultural heritage in the electric power industry in different provinces

5 Discussion and Conclusion

As an important carrier recording the process of industrial civilization and bearing the memory of technological innovation, the systematic protection and dynamic inheritance of electric power industrial cultural heritage cannot be separated from the support of standardized data. Based on the list released by the SASAC in 2023, this dataset integrates authoritative network resources and spatial data from the SFMAP address big data service platform through the "Internet +" model. It comprehensively integrates multi-dimensional information such as heritage names, declaring units, completion years, administrative divisions and geographic coordinates, and fully covers the key development nodes of China's electric power industry from 1905 to 1994. This dataset can effectively serve the spatial pattern analysis, value evaluation and formulation of digital protection strategies for industrial cultural heritage.

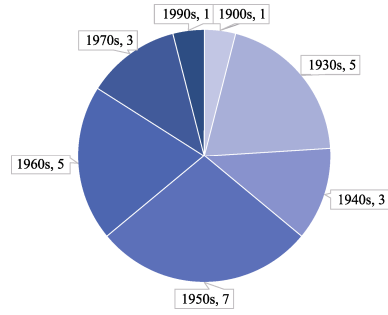

Figure 4 Statistics on the number of industrial cultural heritages in the electric power industry by time of construction

However, limited by data sources and collection methods, this dataset still has certain limitations in the research and development process. In terms of spatial positioning accuracy, due to the fact that some substations and hydropower facilities' addresses are ambiguous due to historical place name changes, this study uses associated marker positioning or the central point of administrative divisions instead. Although this processing method can meet the analysis of spatial distribution characteristics at the macro-scale, it is insufficient in the restoration of the internal pattern of the factory area and precise navigation at the micro-scale. Future research can expand the scope of the heritage list, improve the accuracy of spatial data, and improve the historical attribute dimension by combining field surveys, remote sensing image interpretation and public crowdsourcing data on this basis, so as to promote the quantitative and refined research in the field of industrial cultural heritage.

Author Contributions

Li, Y. Z., Ma, J., and Zhang, Y. designed the algorithms of dataset. Wu, F., Wang, H. L., and Chen, Y. Y. contributed to the data processing and analysis. Wang, S. made data validation. Ye, P. wrote the data paper.

Conflicts of Interest

The authors declare no conflicts of interest.

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