Application status and optimization prospect of China's electricity prosperity index

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Abstract. Electric power data can more realistically and objectively reflect the development trend of the national economy. The application of the boom index based on electric power data is an effective way for macroeconomic monitoring and early warning. This paper combes the application of the power prosperity index of the power industry, especially power grid companies, and finds that there are problems such as insufficient application of power data, traditional synthesis methods, irregular data processing, unscientific selection of benchmark indicators, and incomplete evaluation of index validity. Finally, the paper proposes the future direction of the research and application of power boom index optimization.

1. Introduction
Power data has obvious advantages such as wide coverage, strong timeliness, accurate statistics, and flexible time scales. Especially, power consumption data is regarded as a "barometer" and "thermometer" for the development of the national economy, of which industrial power consumption is "Keqiang" The most important component of the index, and other power data have become an important component of monitoring macroeconomic or industrial operations to varying degrees.

In macroeconomic monitoring and early warning, the economic prosperity analysis method provides an important reference for the actual economic operation management department to make decisions by monitoring the macroeconomic operation status and inflection points. The economic prosperity analysis is more commonly used in the prosperity index method, which divides indicator series into leading, consistent, and lagging indicator groups based on the correspondence between indicators and benchmark indicators (the reference system for observation, monitoring and early warning targets). After that, the synthetic leading prosperity index, consistent prosperity index and lagging prosperity index are calculated. Taking macroeconomics as an example, the leading economic index can predict economic changes several months in advance, and the highest reference value for decision-making; the consistent economic index can describe the current status of macroeconomic operations; the lagging economic index is mainly to confirm the changes of economic cycles.

2. Non-power system boom index application
Since the prosperity index method was first disseminated in China from universities and macroeconomic research institutions, and the nationwide monthly electricity data statistics started as early as 2002, non-power system units (such as university researchers, social research institutions, and other scholars) studied and applied electricity data earlier.
Non-power system units have three main applications for power data: First, they have become one of the indicators of the macroeconomic prosperity index. The literature [1-3] all regard power generation as the macroeconomic The consistent indicators of WS are used in the analysis of the WS prosperity index, traditional composite index, and multi-dimensional framework prosperity index; the Ministry of Industry and Information Technology uses industrial power consumption as a consistent indicator of the industrial economy, and releases the industry monthly Monitoring and early warning report. The second is the research and application of the power industry prosperity index. [4] used the electricity consumption of Hubei Province as a benchmark, and select the urban and rural residents' life, agriculture, forestry, animal husbandry and fishery, light and heavy industry, construction industry, transportation industry, commercial catering and accommodation, textile industry, pharmaceutical manufacturing, petroleum processing electricity consumption as the indicator framework diffusion index and composite index. [5] used the growth rate of power generation as a benchmark, applied a mature prosperity index method, and combined with the economic indicators of the power industry to construct a power industry boom Index, and compare the similarities and differences between the power industry cycle and the macroeconomic cycle. [6] based on the growth rate of total profit in the power industry, the growth rate of total taxes, fixed The five indicators of asset investment growth rate, the number of employees, and the growth rate of main business income have constructed the CEIBS power industry prosperity index, which is not divided into leading, consistent, and lagging indexes, but is only a representation of the current status of the general power industry operation. The industry prosperity monitoring platform of the State Council Development Research Center has constructed the prosperity index of major industries and service industries, including the power, heat production and supply industry prosperity index, including the composite index, diffusion index and industry total index. The third is to assist the prosperity analysis of other industries. Through the development of the steel industry prosperity index, [7] used the growth rate of sales revenue of the power supply industry as one of the leading indicators, and the correlation coefficient of the time difference between this indicator and the benchmark indicator reached more than 0.9.

Although non-power system researchers have taken the lead in the application of power data, the above studies have problems such as insufficient application depth of the power grid and electricity data, short time span, and poor continuous application., resulting in weak support for daily operation decisions of power companies.

3. Application of Boom Index in Power System
In this paper, the application of the power system internal prosperity index refers to the development and application of practices based on monthly and above high-frequency data such as the power grid company's electricity capacity and industry expansion installed capacity. Cooperative research.

The power system prosperity index method is applied late, but the practice of mining applications is unsettled. Different from the application of power data by non-power system units, power systems, especially power grid companies, apply the prosperity index method relatively late. [8] earlier used Hubei as an example to apply a composite index to monitor and warn the power supply and demand situation; Shanghai Electric Power University and East China In cooperation with the Energy Regulatory Bureau, the Shanghai Electric Power Early Warning Monitoring System was established in 2014, including conventional content such as the power diffusion index, composite index, comprehensive prosperity index, and prosperity signal lights, which continue to be used until now.

In 2015, the State Grid Corporation of China relied on the State Grid Energy Research Institute to build a State Grid Corporation Prosperity Index Model System (referred to as the SGCC index), including the electricity consumption prosperity index, users' willingness to use electricity index, power demand index, and power industry prosperity index. The power supply and demand index. The SGCC index comprehensively applied the data inside and outside the power system, and initially realized the complete analysis of "look at the economy through electricity" and "look at the electricity through economy". Since then, the model method system has been promoted and optimized in Jiangsu, Henan, Tianjin, Fujian and other provincial power grid companies. At the same time, some ground breaking
research has also been conducted in individual units of the State Grid Corporation system. For example, Anhui Grid Corporation has forecasted the growth of electricity consumption in regions and key industries through the construction of the electricity prosperity index. Sichuan Power Grid Corporation selects key cyclic industries through the relationship between micro-listed company finance and electricity consumption, and then builds an economic index. State Grid Big Data Center innovates the evaluation method of power prosperity index.

Guangdong Power Grid Corporation of China Southern Power Grid Corporation also explored the power prosperity index earlier. At present, China Southern Power Grid Corporation has established a power boom early warning and monitoring system (including diffusion index and synthetic index, boom signal lamp) in its business area based on economic, energy, power and other data index characteristics. Innovation [14]. The main application of the power company's electricity prosperity index is shown in the table below.

Table 1. Summary of main applications of power system prosperity index analysis methods

| Institute                    | Year | Main features                                                                 | Leading index length | Common problems                                                                 |
|------------------------------|------|-------------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------|
| State Grid Energy Research Institute | 2011 | Taking Hubei Province as an example, the prosperity index is applied to early warning of power supply and demand; the indicators relate to power supply and demand, meteorology, and economic indicators [8] | 1-2 month            | a) Insufficient application of power data other than power; b) The synthesis method of prosperity index is more traditional; c) The sample period is short and the data processing process is relatively rough; d) Unscientific choice of economic benchmarks; e) The prosperity index optimization adjustment mechanism that adapts to changes in China's economic structure has not been established; f) Insufficient evaluation of the power prosperity index. |
| Shanghai Electric Power University | 2014 | Cooperate with the East China Energy Regulatory Bureau to establish a power prosperity index platform and construct a power diffusion index, a composite index, a comprehensive prosperity index and a prosperity signal based on Shanghai's power and economic data; the prosperity index application lasts longer | 4-6 months          |
| State Grid Corporation       | 2015 | Established a national power grid company prosperity index system of electricity consumption prosperity index, user's willingness to use power index, power demand index, power industry prosperity index, and power supply and demand index (SGCC Index). | 1-2 months          |
| State Grid Anhui Company     | 2015 | Application of electricity prosperity index to forecast electricity consumption in regions and key industries [9] | --                   |
| Guangdong Power Grid Corporation | 2015 | Every quarter, through comprehensive analysis of electricity data such as electricity consumption, newly installed capacity, number of newly installed users, and macroeconomic data, forecast the economic trend of important industries; the forecast accuracy rate reaches 97%; including index by region and industry Guangdong Power Grid Big Data Platform | 3 months            |
| State Grid Jiangsu Company  | 2015 | The SGCC index method is applied in Jiangsu; the prosperity index is used to predict the electricity consumption of the whole society; the sample sequence is extended, and the sample is processed in stages in 2010 [10] | 3 months            |
The SGCC index method is applied in Henan Province; expand the database to the 4E dimensions of economy, energy, power, and environment [11] 3 months

According to the characteristics of the economic and traditional industries, the economic indicators are defined; based on the historical data of the economic index, the power consumption extrapolation model is established [12] 4 months

Mainly analyze and monitor the impact of different load fluctuations on the electricity market --

According to the characteristics of economic, energy, power and other data indicators, establish the early warning and monitoring system of electricity boom in five southern provinces, including diffusion index and synthetic index, boom signal; use composite independent information weighting method to transform the original non-linear model into electricity boom Innovative method of exponential linear model --

The SGCC index method has been applied in Fujian Province and its prefecture-level cities; popularized for high energy-consuming industries and traditional industries [13] 1-2 month

Identify important strong-cyclical industries through the correlation between the financial and electrical power of listed companies, and weight these industries with equal weights to form an economic boom index line (Li Fuxin et al., 2018) --

Establish the power synthesis index based on the industrial increase value; evaluate the effectiveness of the power prosperity index through the trend consistent evaluation method and the predictive evaluation method 3 months

Note: Some applications do not indicate the source, the information is from the Internet query, and the other is mainly from the internal report of the State Grid Corporation.

Through analysis, it is found that these power grid enterprises have some outstanding problems in the application of the prosperity index method, which needs to be optimized in subsequent applications. First, power data mining is inadequate. Existing research has focused on the application of electricity consumption data. There are few data analyses on investment, prices, expansion reports, electricity payment, equipment utilization hours, and complaints in the power industry. The second is that the application methods of boom index synthesis are relatively traditional. These methods have matured in the 1970s, and many new index synthesis methods and models have appeared, but they have not been valued by relevant researchers in the power industry. The third is the small sample time span and rough data processing. Some research sample periods are only within 5 years, and it is difficult to judge whether the changes in the electricity prosperity index are in line with the complete periodic fluctuations of the macro economy. Grid companies have a lot of data from micro users to the industry, but it is inevitable that there are statistics and poor management. The existence of abnormal data may neglect
important indicators. Therefore, in order to prevent the phenomenon of "garbage is close, garbage is out" during analysis, the power data must be refined. Fourth, the selection of macroeconomic benchmark indicators is unscientific. With the change of China's economic structure, the proportion of industrial added value has gradually declined, and the proportion of added value of the service industry has continued to rise. Therefore, the representativeness of industrial added value as the macroeconomic benchmark index has weakened, and a more comprehensive monthly index is needed as the benchmark index. Fifth, the dynamic adjustment mechanism of the electricity prosperity index. China is still a developing country that has not yet realized industrialization. Various economic and social structures are undergoing drastic adjustment. Not only will the statistical caliber change, but the nature of the indicator will also change, leading to the failure of the original reasonable index system. Of course, this is a common problem in the application of the prosperity index method. Sixth, the evaluation method of the validity of the prosperity index is relatively simple, mainly through whether the advance index change or the inflection point warning is fulfilled.

4. Other prosperity index applications
The "prosperity" refers to the cyclical fluctuation of the macro economy. Therefore, in a broad sense, in addition to the above-mentioned prosperity index method, other indexes that can reflect the macroeconomic "temperature" can be regarded as prosperity indexes. Among them, the most famous was the "Keqiang Index", in which the weight of industrial power consumption growth rate was 40%. In the State Grid Corporation system, the housing vacancy rate based on electricity (such as the ratio of housing with less than 5 kWh of electricity consumption in a quarter), and the industrial operating rate (such as statistics on the power consumption of a company that is more than 15% higher than the same period of the previous year in a certain month) Ratio) analysis report, which has been highly valued by the national government departments; the new coronary pneumonia epidemic hit in 2020, and the macro economy was stagnant. In response to the central government's request to speed up the resumption of production, the power resumption index represented by Zhejiang Power Grid Company was timely. Sexual analysis provides an important reference for government decision-making; the State Grid Big Data Center has made assumptions about the industry kinetic energy index and the electricity consumption behavior index of small and medium-sized enterprises.

China Southern Power Grid Corporation has built a "manufacturing big data index" based on electricity consumption and reported data, combined with external data such as high-speed freight, customs exports, loans, railway transportation, and regional flow of people. Industry manufacturing industry and even micro enterprises conduct early warning and monitoring.

5. Conclusions
The method of prosperity index has been widely used in the power industry. However, considering the problems that still exist in the application of the electricity prosperity index, and the high expectations of the value of electricity big data inside and outside the power industry, It is recommended to further research and optimize the application of electricity prosperity index from the following four aspects:

1) Improve the quality of power data. Improve the power data statistics management system, unify data standards, reduce offline manual operations, and vigorously improve the quality of original data.

2) Strengthen the prosperity index method and improve the system. Make full use of the intellectual resources of external scientific research institutes and get close to the frontier methods of the business index to improve the level of data processing and the effectiveness of the index; strengthen the data classification management and promote the appropriate joint mining and application of power data.

3) Establish an optimized adjustment mechanism for the electricity prosperity index. Establish a complete set of power prosperity index evaluation standards, comprehensively consider economic structural changes and index validity, and make timely adjustments to the power prosperity index.

4) Expand the connotation and application of the electricity prosperity index. Continue to improve the statistical labeling system of power indicators and enhance the flexibility of data application; closely
track major policy requirements and theoretical frontiers, and timely construct and apply new power prosperity index methods.

Acknowledgments
This research was financially supported by the State Grid Energy Research Institute's self-reliance project (Company Platform Economic Development Evaluation Model Construction and Application Research).

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