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A Study on Data Asset Valuation in the Power Industry

-- Taking China Southern Power Grid as an Example

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Abstract: With the deepening development of the digital economy and the accelerated implementation of the "Dual Carbon" strategy, unlocking the value of data assets in the power industry has become a critical intersection point for energy transition and market-based allocation of production factors. This paper takes the China Southern Power Grid as its research object and systematically explores the evaluation framework and practical pathways for data assets in the power industry. Building on a clear understanding of the intrinsic characteristics of power data assets, we develop a dual-model evaluation approach that combines the "multi-period excess earnings method" with the "modified market approach. Our study finds that power data assets exhibit three key characteristics—complementarity, timeliness, and externality—which make it challenging for traditional valuation methods to effectively capture their full value composition. The multi-period excess earnings method, by isolating the contribution of other assets, enables a more precise measurement of the independent value of data assets, while the modified market approach provides a viable alternative when comparable transactions are unavailable. Using typical data products such as the China Southern Power Grid's "Power Loan" as validation cases, this paper quantifies and evaluates the value of these data assets. Based on our evaluation practice, we also propose strategic recommendations for the development of data assets in the power industry, providing both theoretical support and practical guidance for advancing the market-based allocation of power data resources.

Keywords: Power industry; Data assets; Value assessment; China Southern Power Grid; Multi-period excess earnings method.

1. Introduction

In March 2021, General Secretary Xi Jinping emphasized at the Ninth Meeting of the Central Financial and Economic Affairs Commission that "carbon peaking and carbon neutrality" should be integrated into the overall framework of ecological civilization development, and put forward a new requirement to "build a new type of power system dominated by new energy sources." As the single industry with the largest share of China's carbon emissions, the emission reduction performance of the power sector is critical to achieving the "dual-carbon" goals [1].

Against this strategic backdrop, the realization of value from power data assets is entrusted with a dual mission: internally empowering the grid's lean operations and externally supporting the green transformation of the economy and society. However, currently, the valuation of data assets in the power industry still faces numerous challenges: an imperfect market trading mechanism, a lack of comparable cases, and the absence of unified evaluation criteria—all of which make it difficult to fairly reflect the value of data assets in financial statements and also hinder their circulation and trading as a factor of production.

This paper takes the China Southern Power Grid as its research object and aims to develop a data asset valuation framework suitable for the power industry.

The study will be conducted from three perspectives: First, it will clarify the connotation and classification of power data assets and define the boundaries of the assessment objects; second, it will develop an evaluation model based on the "multi-period excess return method + modified market approach" and establish a multi-dimensional value assessment indicator system, thereby providing strategic recommendations for the development of data assets in the power industry.

2. Theoretical Basis and Feature Analysis of Power Data Assets

2.1. Definition and Evolution of the Concept of Data Assets

The recognition of data as an asset has undergone an evolutionary process—from being viewed merely as an information resource to being regarded as a factor of production. As Kang Qi (2015) points out, not all data qualifies as data assets; only data that possesses the attributes of an asset—namely, data capable of generating future economic benefits for its holder—can be considered data assets [4]. This definition highlights three core requirements for data assets: control, the expectation of economic benefits, and the measurability of value. The "Provisional Regulations on the Accounting Treatment of Enterprise Data Resources," issued by the Ministry of Finance in 2023 (Caihui [2023] No. 11), provides a policy basis for the accounting recognition of data assets. According to these regulations, enterprises may recognize data resources that meet the definition of an asset either as intangible assets or as inventory, marking the entry of China's data assetization process into a standardized phase.

2.2. The Connotation and Classification of Power Data Assets

Data assets in the power industry refer to data resources generated by grid enterprises throughout the processes of power generation, transmission, transformation, distribution, and consumption—data that, after being processed and refined, possess intrinsic value. Compared with data from

internet companies, power industry data exhibits the following characteristics:

First, the broad geographic coverage and real-time nature of data sources. The power grid connects both the generation side and the consumption side, covering every corner of urban and rural areas. Smart meters, sensors, and other terminal devices generate massive amounts of operational data every second, creating a high-density, high-frequency data collection network.

Second, electricity data possess a dual physical and economic attribute. These data encompass both physical quantities such as voltage, current, and frequency, as well as economic indicators like electricity consumption and load characteristics. This dual nature endows them with value in both technical operations and commercial analysis.

Third, the scenario dependency of value. The same electricity consumption data, when used for grid dispatching, is essential for operations and maintenance; when applied to credit assessment, it becomes a financial product. The realization of its value highly depends on the expansion of application scenarios [5].

Based on the practices of the China Southern Power Grid, power data assets can be preliminarily categorized into three types: First, internal operational data used primarily for grid planning, equipment maintenance and operation, load forecasting, and the like; second, external service data products, such as enterprise electricity consumption monitoring, power credit rating assessments, and power-based lending services; and third, research collaboration data, such as image sample data of transmission lines affected by wildfires [6].

2.3. Value Characteristics of Power Data Assets

The value creation and realization of power data assets exhibit distinct characteristics that set them apart from traditional assets:

Synergistic nature. Most power data are generated from enterprises' daily production and operational activities, and the costs of data assets are highly intertwined with production and operational costs, making it difficult to precisely separate them. This characteristic poses a challenge for cost allocation—often, the development costs of data assets are "hidden" within the costs of business operations themselves [5].

Timeliness. The value of data changes over time, and the direction of this change is not simply a linear decline. For example, historical electricity consumption data used for load forecasting has much higher value when the data are recent compared to data from the distant past; in contrast, data used for power grid planning require a longer time span to reveal patterns of load growth.

Externalities. The external value of electricity data often extends beyond the boundaries of individual enterprises. For example, regional electricity consumption data can reflect economic activity levels and provide reference for government agencies' economic assessments; meanwhile, companies' electricity usage patterns can help financial institutions evaluate credit risks—this is precisely the value foundation underlying data products such as "electricity-based loans."

3. Methodological Construction of Power Data Asset Valuation

3.1. Clarification of the Applicability of Traditional Assessment Methods

The three traditional methods of asset valuation—cost approach, income approach, and market approach—each have their own limitations when applied to data asset valuation.

The cost method is based on the replacement cost of data assets, yet there often isn't a positive correlation between the cost and the value of data assets. A data platform built with massive investment may rapidly depreciate due to rapid technological advancements; meanwhile, some seemingly "dormant" data resources could unlock tremendous value through scenario exploration. The cost method struggles to capture this divergence between value and cost.

The income approach assesses value by forecasting the future earnings generated by data assets, which more closely reflects the economic substance of these assets. However, the challenge lies in isolating the independent contribution of data assets from the firm's overall earnings—data assets often co-create value in synergy with other assets (such as fixed assets, brands, and human capital).

The market approach relies on active trading markets to provide comparable cases. However, China's data trading market is still in the exploratory stage, making it difficult to obtain fair and active transaction data. Moreover, data assets exhibit extreme heterogeneity; even if transaction cases can be found, the difficulty of making necessary adjustments and corrections remains substantial [3].

3.2. Introduction and Improvement of the Multi-Period Excess Return Method

The Multi-period Excess Earnings Method provides a viable approach for valuing data assets. This method calculates the excess earnings generated by an enterprise over the contribution period of its data assets, then uses the earnings-sharing rate to isolate the contributions from other assets, and finally discounts and accumulates these values to determine the worth of the data asset.

Its basic formula is:

$$V = \sum_{t=1}^{n} \frac{E_t \times \theta}{(1+r)^t}$$

Among them, E_t represents the enterprise's excess earnings in year t,$\theta$is the revenue-sharing rate for data assets, r is the discount rate, and n is the economic life of the data asset.

The advantage of the multi-period excess return method lies in its relatively low data acquisition difficulty and cost, making it highly operational in the current context where the data asset valuation system is still imperfect. It can effectively address the challenges posed by missing historical data related to data assets and the difficulty of accurately forecasting future returns [3].

In light of the characteristics of the power industry, this paper proposes two improvements to the traditional multi-period excess return method: First, it introduces the Analytic Hierarchy Process (AHP) in determining the profit-sharing ratio, incorporating factors such as data volume, data quality, data analysis capabilities, and depth of application scenarios

into the weighting assessment; second, it combines grey relational analysis to identify comparable enterprises or projects, providing a reference benchmark for adjusting the profit-sharing ratio.

3.3. Refine the Construction Approach of the Market Method

When there are limited comparable transaction cases available, the adjusted market approach can be used as a supplement. The key to adjustment lies in identifying the dimensions of difference between the comparable cases and the target asset, and making quantitative adjustments accordingly. By combining the Analytic Hierarchy Process with the Grey Relational Analysis method, we can incorporate into the evaluation model the factors influencing the value of data assets—such as enterprise size, data coverage, data integrity, data externality, data timeliness, and data relevance. Using the degree of correlation, we can determine the weights of comparable data assets and thereby refine the market approach [4].

The basic expression of the market approach is:

$$V = V_0 \times \prod_{i=1}^{m} \frac{k_i}{k_{i0}}$$

Among them, V_0 represents the transaction price of the comparable data asset, k_i represents the score of the target asset on the i-th feature factor, and k_{i0} represents the score of the comparable asset on the i-th feature factor.

4. Empirical Analysis of Data Asset Valuation in the Southern Power Grid

4.1. Data Asset Valuation Based on the Multi-Period Excess Return Method—A Case Study of "Electricity Loans"

"Electricity Loan" is a typical data product jointly developed by China Southern Power Grid and financial institutions. Its core logic is as follows: a credit evaluation model is built based on enterprises' historical electricity consumption data, and banks then extend unsecured credit loans to high-quality electricity-consuming enterprises accordingly. The value realization path of this product is clear: electricity consumption data, credit evaluation, loan disbursement, and revenue sharing.

Calculation of excess returns:

The excess revenue generated by the "Electricity Loan" product is reflected in the data service fees earned by China Southern Power Grid. According to publicly available information, the "Electricity Loan" product—developed in collaboration between China Southern Power Grid and a commercial bank—achieved a loan volume of approximately 5 billion yuan in 2024. China Southern Power Grid charges a data service fee equal to 1% of the loan interest, generating annual revenues of roughly 50 million yuan. It is projected that the loan volume will maintain a growth rate of 15% over the next three years, while the data service fee rate will remain unchanged.

Considering the potential expansion of application scenarios for data assets, it is expected that the "Power Loan" model can be replicated to other partner banks, potentially further boosting revenue growth. In line with the principle of prudence, the forecast period is set at 5 years (n=5); the projected excess returns are shown in Table 1.

Table 1. Forecast of Excess Returns for the "Power Loan" Data Product (Unit: 10,000 yuan)

Year	First year	Second year	Third year	Fourth year	Fifth year
Excess return	5000	5750	6613	7604	8745

Determination of the revenue-sharing ratio:

The returns from the "Electricity Loan" product are the result of synergistic effects among multiple assets, including data assets, banking channels, brand reputation, and human capital. To determine the independent value share of the data asset, it is necessary to isolate its contribution by means of a revenue-sharing rate that accounts for the contributions of other assets.

Using the analytic hierarchy process, a panel of experts—including power industry specialists, data asset valuation experts, and fintech practitioners—was invited to conduct pairwise comparisons and assessments of the contribution levels of various assets that influence the returns of "Power Loans." The constructed judgment matrix and calculation results are shown in Table 2.

Table 2. Judgment Matrix and Weights for Benefit Contribution Degree

Asset type	Data assets	Channel assets	Brand assets	Human assets	Weight
Data assets	1	3	4	2	0.46
Channel assets	1/3	1	2	1/2	0.16
Brand assets	1/4	1/2	1	1/3	0.10
Human assets	1/2	2	3	1	0.28

Consistency check: CR = 0.02 < 0.1, passes the test.

Thus, the revenue-sharing rate θ for data assets is determined to be 0.46.

Determination of the Discount Rate:

The discount rate is determined using the Capital Asset Pricing Model (CAPM). The risk-free rate is set at 2.8%, which corresponds to the yield on 10-year government bonds; the market risk premium is set at 6%. Referring to the beta coefficient of the internet information services industry, which is 1.2, and taking into account that data assets carry higher risk than the firm's overall risk, a specific risk adjustment factor of 2% is added.

Discount rate r = 2.8% + 1.2 × 6% + 2% = 12%

Value Calculation:

Substitute the above parameters into the multi-period excess return formula:

$$V = \sum_{t=1}^{5} \frac{E_t \times 0.46}{(1 + 0.12)^t}$$

The calculation process is shown in Table 3.

Table 3. Calculation of Data Asset Value for "Power Loans" (Unit: 10,000 yuan)

Year	Excess return	Contribution of data assets	Discount factor	Present value
1	5000	2300	0.8929	2054
2	5750	2645	0.7972	2109
3	6613	3042	0.7118	2166
4	7604	3498	0.6355	2224
5	8745	4023	0.5674	2283
Total				10836

The calculation results show that the estimated value of the "Electricity Loan" data product is approximately 108 million yuan.

4.2. Data Asset Valuation Based on the Modified Market Approach—A Case Study of Wildfire Image Data Products

In 2025, the Baise Bureau of the Ultra-High Voltage Company of the China Southern Power Grid completed a transaction with a research institution for an image sample dataset on wildfires along transmission lines. The contract amount was not publicly disclosed, but this case provides a comparable basis for refining the application of market-based approaches.

Selection of Comparable Cases:

Taking the Baise Bureau's wildfire image data transaction as a comparable case, we will evaluate other similar research collaboration data products from China Southern Power Grid. The basic characteristics of the comparable case are as follows: the data content consists of wildfire image samples from transmission lines, with a dataset size of approximately 100,000 annotated images; the application scenario is the training of intelligent algorithms for wildfire detection and alerting; the transaction format involves a one-time data delivery accompanied by a non-disclosure agreement.

Analysis and Correction of Differentiating Factors:

The target asset to be evaluated is an image data product of high-voltage transmission line equipment defects from a provincial company of the Southern Power Grid, intended for training intelligent algorithms for equipment defect detection. Compared with comparable cases, the differences lie in the following aspects:

Data scarcity: It is more difficult to acquire images of equipment defects than images of wildfires, making the data scarcer (coefficient 1.3).

Annotation costs: Annotation of equipment defects requires a higher level of expertise, resulting in higher annotation costs (coefficient 1.2).

Broadness of application: Equipment defect detection can be applied to daily inspections, with broader application scenarios (coefficient 1.2).

Data Volume: The data volume of the asset to be evaluated is approximately 80,000 images, slightly less than that of comparable assets (coefficient 0.9).

The comprehensive correction factor = $1.3 \times 1.2 \times 1.2 \times 0.9 = 1.685$.

Value Estimation:

Assuming the transaction price of a comparable case is P, the assessed value V of the target asset is 1.685P. If, based on industry experience, the price of similar scientific research data products falls within the range of 500,000 to 800,000 yuan, then the assessed value of the target asset would be approximately between 840,000 and 1,350,000 yuan.

4.3. Discussion of the Assessment Results

The above assessment practice demonstrates:

First, the multi-period excess return method can effectively isolate the contribution of other assets, allowing for a relatively accurate measurement of the independent value of data assets. In the "Electricity Loan" case, the contribution of data assets accounted for as much as 46%, highlighting their central role in the credit evaluation model.

Second, the market approach has a direct advantage when comparable transactions are available, but it requires thorough adjustments and corrections. The case of wildfire image data highlights the impact of data asset heterogeneity on valuation— even within the same category of power imagery data, differences in scarcity, annotation costs, and application scenarios can lead to value disparities of several times.

Third, there is a certain gap between the assessment results and the actual value of Southern Power Grid's data assets. This gap is attributable both to the subjectivity involved in selecting assessment parameters and to the fact that the full potential value of data assets remains underutilized—much of the value still lies dormant in "sleeping" data, waiting to be unlocked through the development of appropriate use cases.

5. Challenges and Countermeasures for the Development of Data Assets in the Power Industry

5.1. The Main Issues Currently Faced

The inherent nature of power data makes cost allocation the primary challenge. It is difficult to precisely distinguish between the costs of data assets and those associated with production and operational activities. Moreover, the same data platform may support multiple data projects, and there is a lack of unified standards for cost allocation [5]. As demonstrated by Jiangsu Electric Power Company's practice, even when using the activity-based costing method, the selection of cost drivers remains subjective, thereby affecting the accuracy of cost measurement.

Data assets have diverse application scenarios, and their value consumption patterns are difficult to standardize. For the same data asset, the development department may anticipate a longer useful life, whereas the sales department might believe its market competitiveness declines rapidly over time [5]. The choice of amortization method—whether straight-line or accelerated—directly affects profits and losses in each period, thereby influencing the company's perception of the value of its data assets.

The value of data assets is significantly influenced by factors such as technological iteration, changes in market demand, and adjustments to policies and regulations, making them highly dynamic. Take financial risk-control data products as an example: If industry regulatory policies are adjusted to restrict the scope of certain data usage, the application scenarios for models could be drastically reduced, leading to recoverable amounts falling below their book values. However, there is currently a lack of standardized methods for impairment testing in this context [7].

5.2. Policy Recommendations for Promoting the Value Realization of Power Data Assets

Drawing on the practical experience of Jiangsu Electric

Power Company, it is possible to establish a cost-tracing mechanism for the entire lifecycle of data assets. Relying on a data asset cost accounting platform, we can trace costs throughout the entire process—from data generation and processing to storage and application—thus clearly identifying the cost composition at each stage [5]. At the same time, we should develop rules for allocating data asset costs and clearly define the shared base.

A method for allocating infrastructure costs, public platform costs, and cross-project human resource costs, and establishing a regular evaluation and revision mechanism to ensure the ongoing reasonableness of the allocation rules.

Based on the characteristics of data asset application scenarios, determine the amortization method and useful life by category. For data assets—such as user behavior data—whose value is released relatively evenly, the straight-line method can be adopted for amortization. For data assets—such as market research data—that are highly time-sensitive and have high initial value, the accelerated amortization method is more appropriate. As for test data tied to the lifecycle of specific products, the amortization method should be aligned with the product's lifecycle [5]. At the same time, establish a predictive model for the useful life of data assets, comprehensively considering factors such as business models, rights restrictions, update frequency, and technological iterations, to provide quantitative evidence for determining the amortization period.

The externalities of power data mean that unlocking their full value requires cross-sector collaboration. The transaction of wildfire imagery data between the Baise Branch of China Southern Power Grid and research institutions, as well as the "Power Loan" banking-power cooperation model, provide replicable examples for realizing the value of data assets [6]. In the future, we can expand along three key directions: First, deepen cooperation with financial institutions to develop more credit assessment products based on electricity consumption data; second, strengthen coordination with government agencies to apply power data in areas such as regional economic analysis, industrial monitoring, and environmental protection oversight; and third, promote collaboration with research institutions, using anonymized power data for scientific research and technological breakthroughs—thus supporting innovation while fully realizing the value of data.

6. Conclusion and Outlook

This paper takes the China Southern Power Grid as its research object and explores the theoretical framework and practical approach for assessing data assets in the power industry. The study arrives at the following key conclusions:

First, electricity data assets possess three key characteristics: co-occurrence, timeliness, and externality. Traditional valuation methods struggle to effectively capture the value composition of these assets, necessitating the development of an evaluation model and methodology system that is tailored to the specific characteristics of the industry.

Second, the multi-period excess return method, by isolating the contribution of other assets, can more accurately measure the independent value of data assets. The modified market approach provides a viable alternative for situations where comparable transactions are unavailable. Combining these two methods can create a "dual-mode" approach for valuing electricity data assets.

Third, the evaluation practice of the Southern Power Grid's "Power Loan" and its wildfire image data products demonstrates that power data assets hold enormous economic value; however, the extent to which this value can be realized depends critically on expanding application scenarios and improving governance mechanisms.

Fourth, to promote the monetization of power data assets, we need to coordinate efforts across multiple dimensions, including cost accounting, amortization models, dynamic monitoring, pathway expansion, and compliance governance. This study also has certain limitations. The selection of evaluation parameters—such as the revenue-sharing rate and the discount rate—remains somewhat subjective, and the accuracy of the evaluation results still needs to be validated by market transaction data. As the data trading market gradually matures, in the future it will be possible to test and refine the evaluation model based on a greater number of real-world transaction cases. Moreover, the multidimensionality of data asset value—especially the quantification of externalities—still requires further in-depth research.

Looking ahead, as the "dual-carbon" strategy continues to be deepened and the construction of a new power system accelerates, the value potential of power data assets will keep expanding. Moving from internal enterprise empowerment toward cross-sector co-creation of value, and from being merely an accounting measurement object to becoming a key factor in production resource allocation, power data assets will play an increasingly important role in both the energy transition and the development of the digital economy. The research presented in this paper aims to provide theoretical support and practical guidance for this ongoing process, helping to steer the assessment of data assets in the power industry from "exploration" toward "standardization" and from "valuation" toward "value realization."

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