Research on Pricing Models for Energy Data Assets Considering Stage Differences

Qing Yuan, Xiaobao Yu, Jihui Wu, Shengzai Sun, Lu Nan, Qi Shen

School of Economics and Management, Shanghai University of Electric Power, Shanghai, China

DOI: https://doi.org/10.56293/IJMSSSR.2025.5605

IJMSSSR 2025
VOLUME 7
ISSUE 3 MAY – JUNE **ISSN: 2582 – 0265**

Abstract: In the marketization of data elements, electricity data exhibits distinct stage-specific characteristics. From the perspective of data elements, the ultimate realization of data value involves three stages: resourceization, assetization, and capitalization. This study focuses on the development and utilization of power industry data, analyzing specific customer profiles, profit cases, and business canvases for each of the three stages. Common profit mechanisms across different stages are summarized, and innovative profit models are proposed.

Keywords: Electricity data, Profit model, Business canvas

1. Introduction

The power industry is a vital component of the national economy, and the application of power big data has become a highly discussed topic in recent years. With advancements in information technology, the power industry generates vast amounts of data in production, operations, and management. These data contain valuable information and potential value. Therefore, research on power big data applications has become essential for advancing the industry's intelligence and digital transformation, as well as optimizing energy structures and operational efficiency.

In the marketization of data elements, research on electricity data asset pricing exhibits clear stage-specific characteristics. Early studies focused on pricing models for the resourceization stage. For example, Ding et al. (2020) developed a cost accounting system covering collection, storage, and cleaning processes based on cost compensation theory but overlooked the spillover effects of data application value. However, they did not differentiate data asset maturity. In exploring capitalization pricing, Liu (2023) linked power load data with carbon financial products to design an option pricing model but lacked mechanisms to adapt to the unique attributes of data elements.

Addressing stage differences, international scholars like Begenau et al. (2021) proposed a data asset lifecycle pricing theory, dividing data value evolution into three stages: raw resources, processed assets, and derivative capital, providing a theoretical foundation for stage-specific pricing. A domestic research team (State Grid Economic Research Institute, 2022) introduced the concept of a "three-stage pricing" framework for electricity data: a "cost + quality adjustment" model for resourceization, a dynamic "scenario value × time coefficient" mechanism for assetization, and a "discounted expected return + risk premium" composite model for capitalization. However, existing studies still have gaps in stage classification criteria and cross-stage value transmission mechanisms.

Current research faces three main limitations: (1) Traditional pricing methods lack adaptability—cost-based approaches undervalue data reuse, while income-based methods struggle to quantify cross-scenario synergies; (2) Stage classification is overly simplistic, focusing on technical maturity while ignoring policy constraints and market structures unique to the power industry; (3) A lack of full-cycle dynamic pricing models—existing studies address stage-specific pricing in isolation without establishing value transmission functions. This paper designs differentiated pricing models for electricity data assets based on their full lifecycle value evolution, laying a foundation for future research.

2. Data Development Stage Classification

The value evolution of data elements follows a three-stage path—resourceization, assetization, and capitalization—reflecting the co-evolution of the digital economy and institutional innovation.
Resourceization Stage: Raw data is collected, stored, and processed into structured resources via IT systems. However, issues such as unclear ownership and inefficient applications result in low value density and circulation efficiency.

Assetization Stage: Policy innovations enable data ownership confirmation, pricing, and circulation. Data becomes a measurable asset on corporate balance sheets, leveraging data platforms and AI for cross-domain integration and value extraction.

Capitalization Stage: Data is transformed into liquid capital through financial instruments like securitization and trusts. Models such as data-backed loans and government credit enhancement break physical boundaries, unleashing multiplier effects and reshaping value creation in the digital economy.

The spiral progression across these stages marks a shift from technology-driven to institution-driven digital economic development, providing a practical framework for modern data markets.

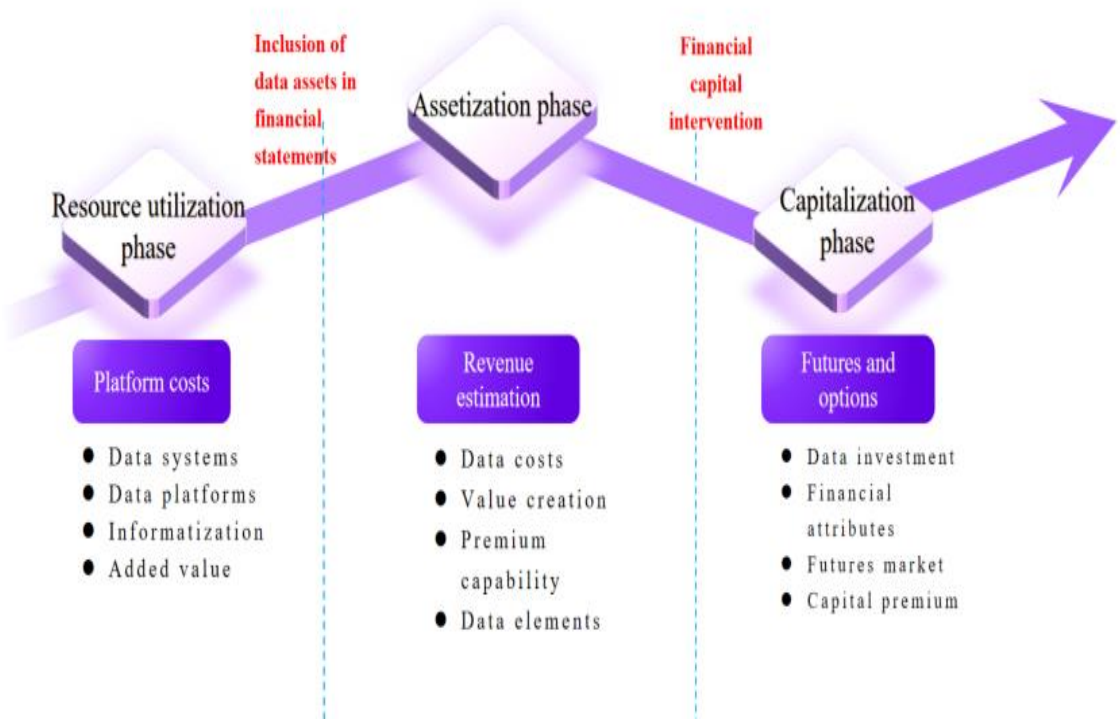

Figure 1. Data Development Stage Classification

3. Differentiated Pricing Models

The business canvas model systematically integrates nine core elements (customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, cost structures) to visualize business models, clarify market opportunities, and optimize resource allocation.

This paper proposes three pricing models for each stage, analyzed via business canvases (Table 1).

Table 1. Business Canvas Analysis of Pricing Models

No.	Pricing model	Stage	situation of application	New Profit Model
1	Multidimensional data services	Resourceization	Southern Grid Cloud	Data Ecosystem Value-Added
2	Cloud data subscription		Zhejiang Power Cloud	
3	Decentralized pricing	Assetization	Power Ledger	Layered Energy Asset Service
4	Digital transaction model		Energy Flex	
5	One charge per person	Capitalization	Dianzhihui	Customized Service + Insurance Model
6	Financing loan services		Digital China	

(1) Resourceization Stage Pricing Model—Data Ecosystem Value-Added Services(Figure 2)

1) Targeted Data Advertising:Utilizing user electricity consumption habits, appliance types, and other data collected through electricity data cloud services, user profiles are accurately analyzed. By collaborating with home appliance manufacturers and smart home device suppliers, targeted product advertisements are delivered to user groups with distinct electricity consumption characteristics via interfaces on the electricity cloud service platform or mobile apps. Revenue is generated through metrics such as ad impressions, click-through rates, or sales commissions negotiated with partners.

2) Energy Community Co-creation:An energy community platform is established based on electricity data cloud services, attracting power users, energy-saving experts, and energy suppliers. Users share energy-saving tips and consumption insights within the community. Energy suppliers are charged promotional fees for platform access, enabling targeted user outreach. Additionally, paid one-on-one energy consulting services are offered to users, where experts provide personalized energy-saving solutions based on their electricity data.

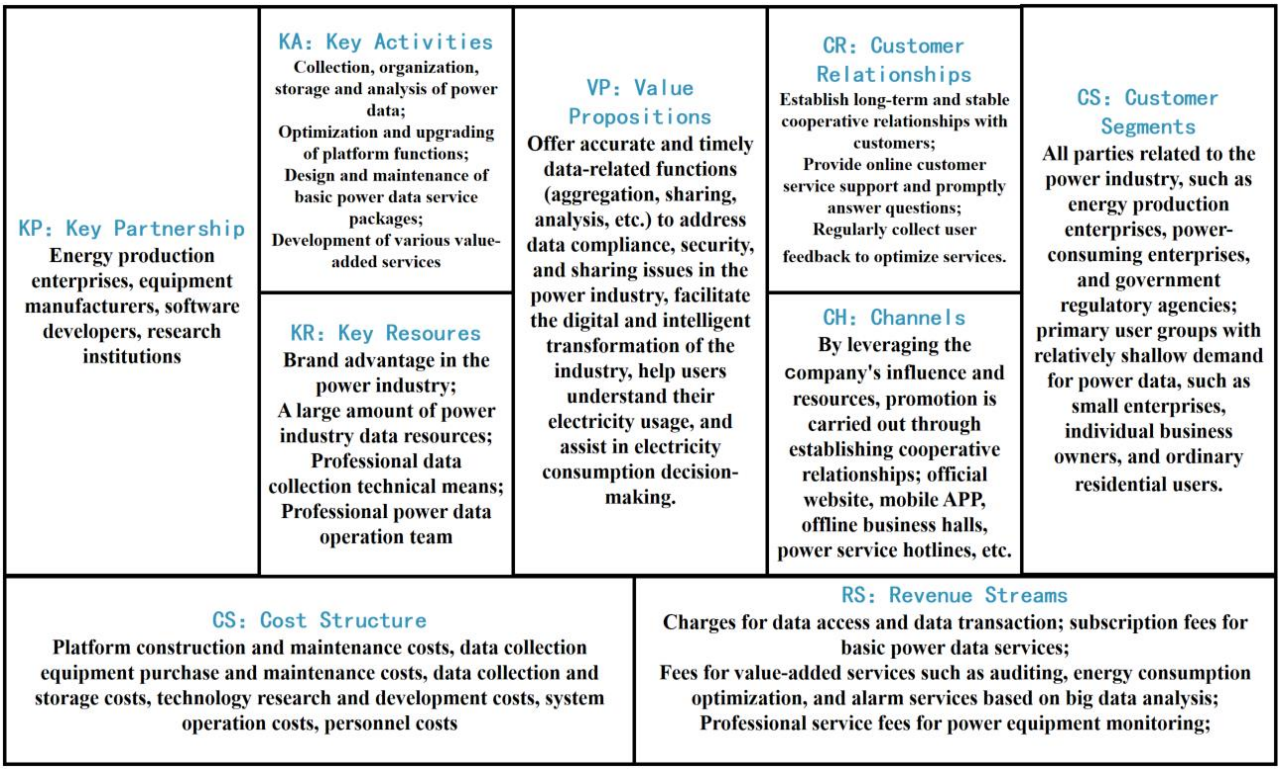

Figure 2. Business Canvas for Resourceization Stage Profit Model

(2) Assetization Stage Pricing Model—Layered Energy Asset Services (Figure 2)

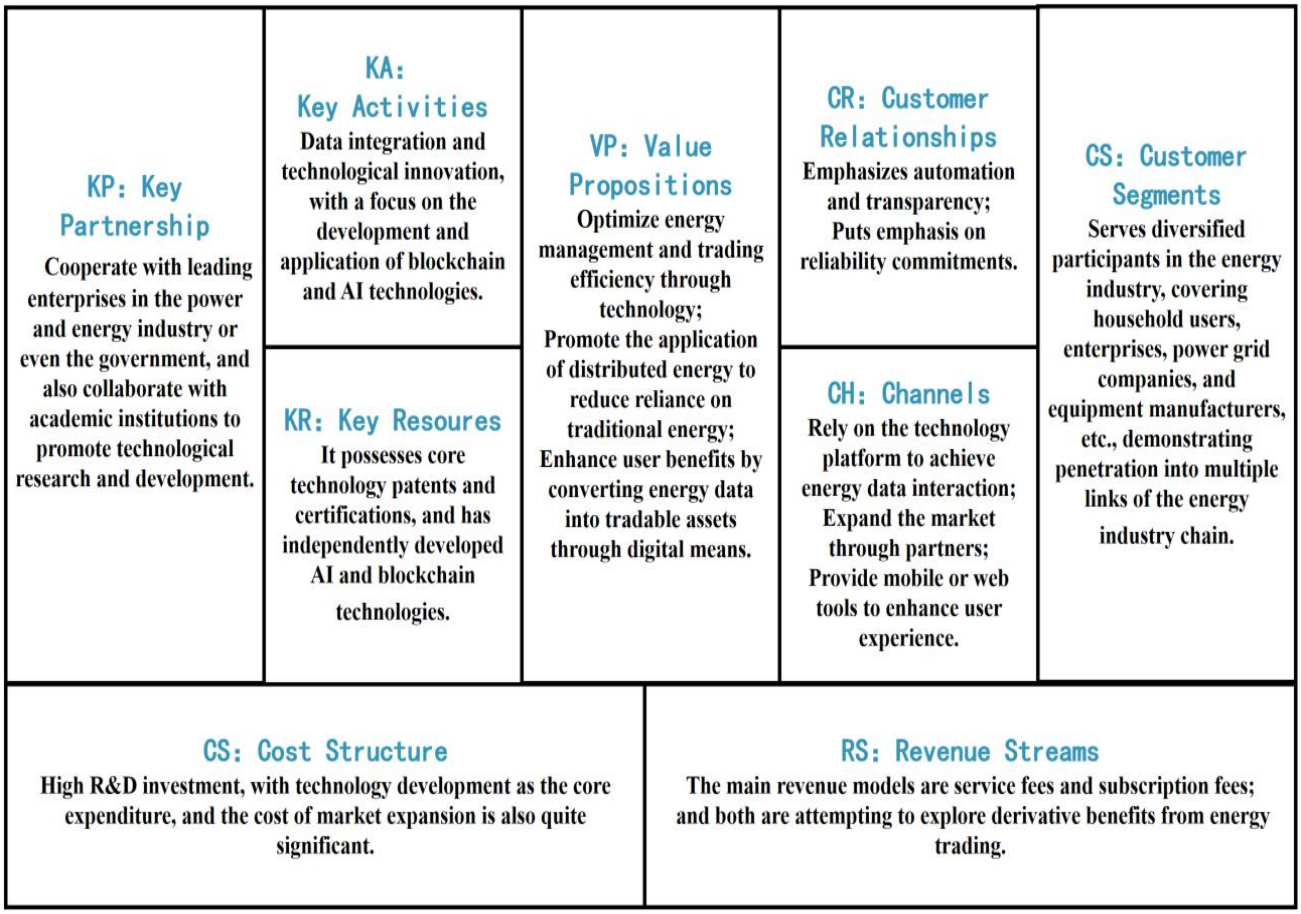

Figure 3. Business Canvas for Assetization Stage Profit Model

1) Underlying Asset Securitization: Data assets are stratified based on liquidity rules, and different tools are employed for pricing or charging. Securitization of Underlying Assets: Ownership of distributed energy equipment is securitized into tradable shares and fragmented into small tokens via blockchain. Blockchain technology ensures transparent asset ownership, while AI-driven predictions enable dynamic pricing for each token.

2) Mid-layer Derivatives: The monetizable value generated by energy assets—such as electricity sales revenue and peak-shaving service fees—is divided into financial products with varying risk levels.

Stable Layer: Fixed income from energy storage peak-shaving fees or service charges.

Growth Layer: Floating income from electricity sales profits.

Speculative Layer: Contracts closely tied to electricity price fluctuations, carrying the highest and most unstable risk-reward profiles.

3) Top-layer Ecosystem Incentives: Users can participate in platform governance, with voting rights proportional to their transaction volume on the trading platform. The platform collects governance fees from these activities.

(3) Capitalization Stage Pricing Model—Customized Service + Insurance Model (Figure 2)

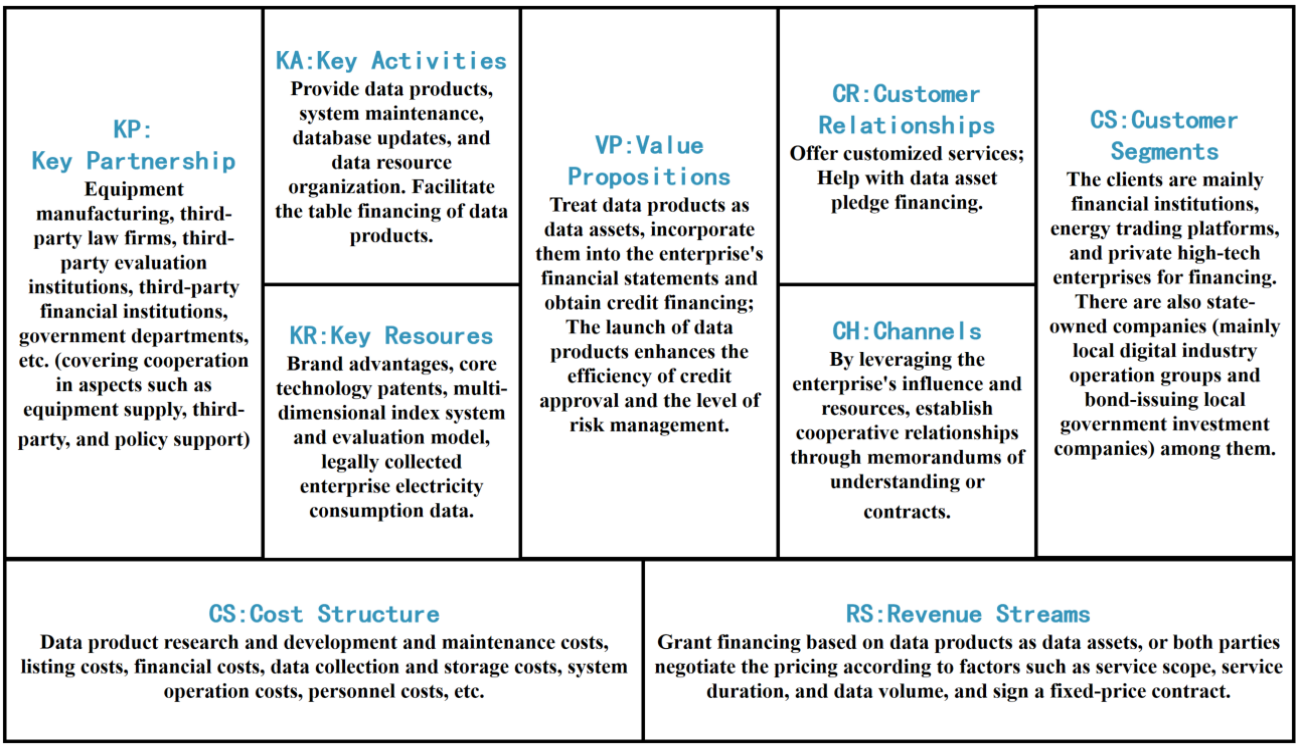

Figure 4. Business Canvas for Capitalization Stage Profit Model

This business model combines electricity data products with insurance services, creating dual revenue streams: Electricity Data Products: Provide customized data solutions for industry clients.

Insurance Products: Develop risk protection products based on electricity data analytics.

By establishing contracts under a one-on-one charging model, financial institutions gain access to electricity data products and tailored services, significantly improving credit approval efficiency and risk management capabilities. Simultaneously, insurance companies offer coverage for digital assets and products, making clients who purchase data products more inclined to adopt related insurance offerings. Through precise data analytics, operational efficiency is enhanced, risks are mitigated, and professional risk protection is secured. Additionally, insurance companies gain specialized risk assessment expertise in the power industry, reducing underwriting risks.

3. Conclusion

The value evolution of data elements progresses through resourceization, assetization, and capitalization. Resourceization focuses on foundational value extraction via data services; assetization transforms data into measurable assets for value appreciation; and capitalization integrates data into financial instruments for higher-level value creation. Case studies across stages cater to power companies and financial institutions, addressing needs in energy management, operational optimization, and credit financing.

Acknowledgments

The paper is supported by and the Shanghai College Students Innovation and Entrepreneurship Program (202410256080) .

References

1. Wang Jian,Wang Xi,Ma Chaoqun,Kou Lei. A survey on the development status and application prospects of knowledge graph in smart grids[J]. IET Generation, Transmission & Distribution,2020,15(3).

2. Zheng, Sida,Cheng, Jie,Xiong, Hongzhang,Wang, Yanjin,Wang, Yuning. A transient fault data management algorithm for low-voltage station based on overall situation power big data[J]. Applied Nanoscience,2022(prepublish).
3. Wu Qiutong,Zhang Muxin,Liao Liying. Analysis of electricity stealing based on user electricity characteristics of electricity information collection system[J]. Energy Reports,2022,8(S4).
4. Wang Haixin,Yuan Jiahui,Qi Guanqiu,Li Yanzhen,Yang Junyou,Dong Henan,Ma Yiming. A data-driven load forecasting method for incentive demand response[J]. Energy Reports,2022,8(S4).
5. KowalskaStyczeń Agnieszka,Owczarek Tomasz,Siwy Janusz,Sojda Adam,Wolny Maciej. Analysis of Business Customers' Energy Consumption Data Registered by Trading Companies in Poland[J]. Energies,2022,15(14).
6. Huang, X. N., Shen, Y., Liu, L., Hu, Z. D., Gu, J., Wang, L. L., & Jiang, C. W. (2022). Spatial agglomeration model of regional manufacturing industry based on industrial electricity data. China Electric Power, 55(10), 150-160.
7. Yu, X. B., Zhang, T. H., & Deng, S. W. (2022). Research on optimization of electricity data element pricing mechanism under digital background. Integrated Smart Energy, 44(7), 81-89.