

## Research on Pricing Models for Energy Data Assets Considering Stage Differences

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**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

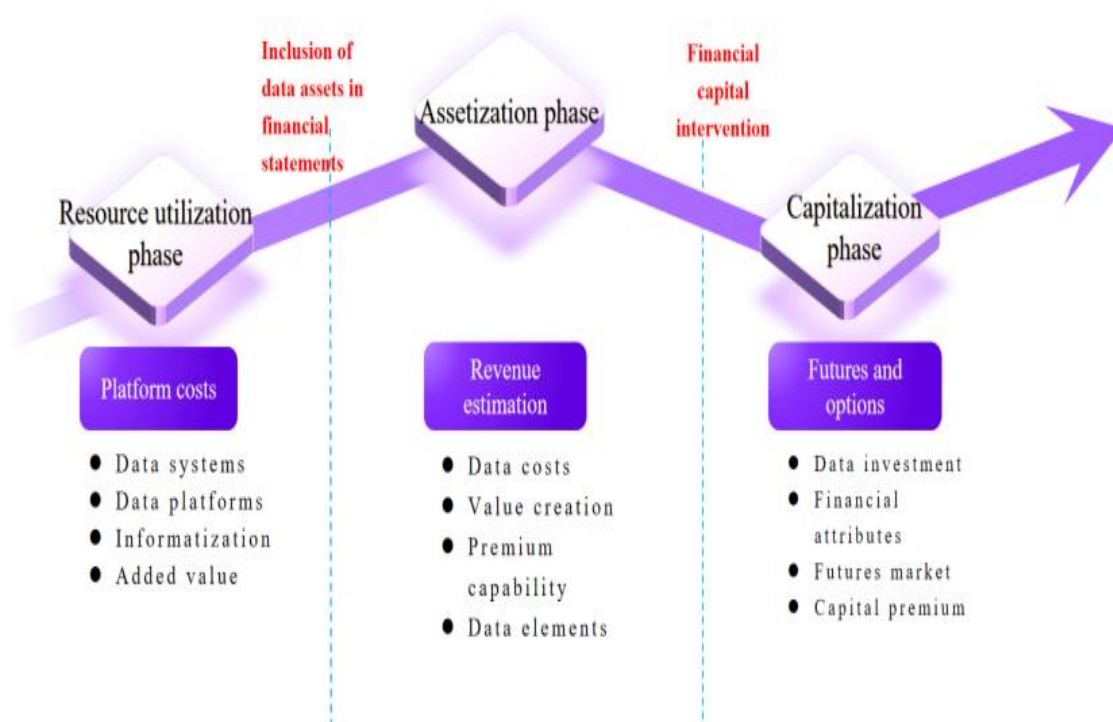
The value evolution of data elements follows a three-stage path—resourceization, assetization, and capitalization—reflecting the co-evolution of the digital economy and institutional innovation.

**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.

KP: Key Partnership Energy production enterprises, equipment manufacturers, software developers, research institutions	KA: Key Activities Collection, organization, storage and analysis of power data; Optimization and upgrading of platform functions; Design and maintenance of basic power data service packages; Development of various value-added services	VP: Value Propositions Offer accurate and timely data-related functions (aggregation, sharing, analysis, etc.) to address data compliance, security, and sharing issues in the power industry, facilitate the digital and intelligent transformation of the industry, help users understand their electricity usage, and assist in electricity consumption decision-making.	CR: Customer Relationships Establish long-term and stable cooperative relationships with customers; Provide online customer service support and promptly answer questions; Regularly collect user feedback to optimize services.	CS: Customer Segments All parties related to the power industry, such as energy production enterprises, power-consuming enterprises, and government regulatory agencies; primary user groups with relatively shallow demand for power data, such as small enterprises, individual business owners, and ordinary residential users.
	KR: Key Resources Brand advantage in the power industry; A large amount of power industry data resources; Professional data collection technical means; Professional power data operation team		CH: Channels By leveraging the company's influence and resources, promotion is carried out through establishing cooperative relationships; official website, mobile APP, offline business halls, power service hotlines, etc.	
CS: Cost Structure Platform construction and maintenance costs, data collection equipment purchase and maintenance costs, data collection and storage costs, technology research and development costs, system operation costs, personnel costs			RS: Revenue Streams Charges for data access and data transaction; subscription fees for basic power data services; Fees for value-added services such as auditing, energy consumption optimization, and alarm services based on big data analysis; Professional service fees for power equipment monitoring;	

Figure 2. Business Canvas for Resourceization Stage Profit Model



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

<b>KP: Key Partnership</b> Cooperate with leading enterprises in the power and energy industry or even the government, and also collaborate with academic institutions to promote technological research and development.	<b>KA: Key Activities</b> Data integration and technological innovation, with a focus on the development and application of blockchain and AI technologies.	<b>VP: Value Propositions</b> Optimize energy management and trading efficiency through technology; Promote the application of distributed energy to reduce reliance on traditional energy; Enhance user benefits by converting energy data into tradable assets through digital means.	<b>CR: Customer Relationships</b> Emphasizes automation and transparency; Puts emphasis on reliability commitments.	<b>CS: Customer Segments</b> Serves diversified participants in the energy industry, covering household users, enterprises, power grid companies, and equipment manufacturers, etc., demonstrating penetration into multiple links of the energy industry chain.
	<b>KR: Key Resources</b> It possesses core technology patents and certifications, and has independently developed AI and blockchain technologies.		<b>CH: Channels</b> Rely on the technology platform to achieve energy data interaction; Expand the market through partners; Provide mobile or web tools to enhance user experience.	
<b>CS: Cost Structure</b> High R&D investment, with technology development as the core expenditure, and the cost of market expansion is also quite significant.			<b>RS: Revenue Streams</b> The main revenue models are service fees and subscription fees; and both are attempting to explore derivative benefits from energy trading.	

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)



<b>KP: Key Partnership</b> Equipment manufacturing, third-party law firms, third-party evaluation institutions, third-party financial institutions, government departments, etc. (covering cooperation in aspects such as equipment supply, third-party, and policy support)	<b>KA:Key Activities</b> Provide data products, system maintenance, database updates, and data resource organization. Facilitate the table financing of data products.	<b>VP: Value Propositions</b> Treat data products as data assets, incorporate them into the enterprise's financial statements and obtain credit financing; The launch of data products enhances the efficiency of credit approval and the level of risk management.	<b>CR:Customer Relationships</b> Offer customized services; Help with data asset pledge financing.	<b>CS:Customer Segments</b> The clients are mainly financial institutions, energy trading platforms, and private high-tech enterprises for financing. There are also state-owned companies (mainly local digital industry operation groups and bond-issuing local government investment companies) among them.
	<b>KR:Key Resources</b> Brand advantages, core technology patents, multi-dimensional index system and evaluation model, legally collected enterprise electricity consumption data.		<b>CH:Channels</b> By leveraging the enterprise's influence and resources, establish cooperative relationships through memorandums of understanding or contracts.	
<b>CS:Cost Structure</b> Data product research and development and maintenance costs, listing costs, financial costs, data collection and storage costs, system operation costs, personnel costs, etc.			<b>RS:Revenue Streams</b> Grant financing based on data products as data assets, or both parties negotiate the pricing according to factors such as service scope, service duration, and data volume, and sign a fixed-price contract.	

**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.

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