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Analysis of Incentive Compatibility Mechanism for Content Services of Gas Companies under the Background of Universal Service

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Abstract: In recent years, the issue of gas billing has attracted widespread attention from the public, leading to a crisis of trust in gas public goods and services. From the perspective of universal service, based on the characteristics of the gas supply industry under monopoly conditions, this paper analyzes the reasons for the lack of motivation of gas companies to provide perfect content services, and uses incentive theory to explore the incentive compatibility mechanism of gas companies' content services, in order to promote gas companies to use the Internet, big data, cloud computing technology to provide consumers with perfect content services, so as to enhance social harmony and stability.

Keywords: Universal service, Gas license system, Monopoly, Content service, Incentive compatibility.

1. Introduction

Livelihood is no small matter. Gas supply, as an essential basic service in the daily lives of urban and rural residents, has attracted much attention for its transparent billing, reasonable pricing, and scientific charging. Once the phenomenon of "confused accounts" and "arbitrary charges" is exposed, it often spreads rapidly in online communities, becoming a focus of public concern, causing a crisis of trust, and leading to widespread questioning of the operation mode of gas public services by the public. The most typical example of the gas fee surge in April 2024 is in Sichuan, Chongqing and other places. Residents of Chongqing, Chengdu and other places have raised doubts on social media, claiming that in the absence of significant changes in lifestyle, there has been an unusual increase in gas fees and gas consumption, which has sparked sustained social attention. Subsequently, relevant government departments launched an investigation and Chongqing and Chengdu successively reported the results of the investigation on issues such as overcharging gas fees by gas companies. For gas fees that have been confirmed to have been overcharged through investigation, the gas companies will be ordered to fully refund them, and the gas operators will be held responsible for management, demanding a thorough investigation and rectification [1].

When the dust settles, reflecting on the upsurge of gas charges in Sichuan and Chongqing, we can't help thinking about how to establish an incentive and constraint mechanism for gas companies to provide improved content services in the digital economy era, so as to give full play to the advantages of the Internet to enable gas services, improve the convenience of gas services through content operations, improve consumption transparency, and popularize the knowledge of gas consumption safety, so that people can enjoy gas services while increasing happiness and security.

2. Improving Gas Content Services Has Become a Key Element of People's Livelihood

By reviewing all the annual reports on anti-monopoly law enforcement issued by the State Administration for Market Regulation since 2019, it can be found that anti-monopoly in the field of people's livelihood has always been a top priority for market supervision departments, and the gas service industry is also a key industry for abusing market dominance. The law enforcement cases in the gas industry over the years are summarized as shown in Table 1.

Table 1 data shows that some gas companies use their dominant market position to implement unfair high prices and restricted transactions, which not only disrupt market competition order but also harm the vital interests of consumers. Therefore, for the majority of consumers, how to conveniently and quickly obtain various information such as gas prices, metering, flow, billing, fees, services, etc. has become a focus of concern. In other words, providing content services related to gas company consumers and ensuring their full right to know has become an essential key link for gas companies to fulfill their universal services.

Table 1. Typical Cases of Antitrust Enforcement in the Gas Industry [2]

Case Name	Confiscation Amount (10000 yuan)	Penalty time	Law Enforcement Agencies
Industry monopoly agreement case involving 7 companies including Zhangjiajie New Era Petrochemical Co., Ltd	42.00	Nov. 2019	Administration for Market Regulation, Hunan Province
Case of abusing its market dominance by Hunan Zhongmin Gas Co., Ltd.	175.81	Jun. 2020	Administration for Market Regulation, Hunan Province
Case of abusing tis market dominance by Xinzhou Gas Co., Ltd	241.66	Jul. 2020	Administration for Market Regulation, Shanxi Province
Case of abusing its Market Dominance by Yixing Ganghua Gas Co., Ltd.	4044.22	Nov. 2021	Administration for Market Regulation, Jiangsu Province
Case of abusing its market dominance, Ningxia Changran Natural Gas Co., Ltd.	111.06	Apr. 2022	Market Supervision and Administration Department of Ningxia Hui Autonomous Region
Case of abusing its market dominance by Wuhu Bay Zhongran Urban Gas Development Co., Ltd.	889.07	Jul. 2022	Administration for Market Regulation, Anhui Province
Case of Abusing its Market Dominance by Chongqing Yongkang Gas Co., Ltd.	240.94	Oct. 2022	Administration for Market Regulation, Chongqing Province
Case of abusing its market dominance by Nanjing Zhongran Urban Gas Development Co., Ltd.	5040.07	Jan. 2023	Administration for Market Regulation, Jiangsu Province
10 companies including Nanjing Baijiang Liquefied Gas Co., Ltd., Nanjing Ranbo Gas Co., Ltd., and Nanjing Liquefied Petroleum Gas Operation Co., Ltd. have reached and implemented a monopoly agreement	827.35	Sep. 2023	Administration for Market Regulation, Jiangsu Province
Case of abusing its market dominance Datong Huarun Gas Company	859.95	Oct. 2023	Administration for Market Regulation, Shanxi Province

3. Monopolistic Characteristics of Gas Supply and Their Impact

The state implements a strict licensing system for gas operations to ensure their safety and compliance. At the same time, due to the franchise system bundling the transmission, distribution, and sales of natural gas terminal markets, a situation of one or several enterprises operating in a specific region has been formed.

According to traditional economic theory, monopoly can lead to low efficiency. Gas companies engage in non productive profit seeking activities in order to obtain and maintain a monopoly position, thereby obtaining excess profits, which is a typical rent-seeking behavior. According to American economists J. Buchanan and Anne Krueger, "rent-seeking" is a behavior in which individuals maximize value and cause social waste without creating social surplus. In his 1967 paper "On the Welfare Costs of Taxes, Monopolies, and Theft, " American economist Gordon Tullock pointed out that traditional economics severely underestimates the social welfare losses caused by monopolies, and in fact, the social welfare losses caused by monopolies are far from being estimated in a general sense.

What is the economic loss of rent-seeking activities? For a rational rent-seeking agent, the cost they are willing to pay for rent-seeking activities will not exceed the rent brought by their monopoly position. In fact, in many cases, the competition for obtaining a monopoly position in the market is very fierce, and the cost of rent-seeking is often close to or even equal to all monopoly profits. This means that rent-seeking losses will be greater than the monopoly efficiency losses in traditional monopoly theory. Therefore, in a market with numerous participants, the total economic loss of the entire rent-seeking activity is equal to the sum of the costs of all individual rent-seeking activities. With the intensification of market competition, the economic efficiency losses caused by rent-seeking will continue to increase.

Specifically in the gas service market, the potential content service efficiency losses that gas companies' rent-seeking behavior may bring may include the following aspects:

-The driving force for innovation in self content services. After obtaining a business license, gas companies often lack competitive pressure and innovation drive due to their stable monopoly position. They can obtain monopoly rent as long as they complete the universal services required by the government. Using the Internet platform to carry out content services has brought more market demand, so they are relatively slow to the profound changes brought by digital services to all walks of life. Although providing content services can enable users to consume transparently and improve their satisfaction with gas services, it also means a reduction in rent for gas companies.

-Inhibit the enthusiasm for content services in multilateral markets. In the gas service market, gas companies are in a monopolistic position, and due to the lack of competitors, they not only lack the motivation to improve their service level. Gas companies will also inhibit other enterprises in the industry chain from improving their service levels. For example, residents or businesses are end-users of gas meters. For gas meter manufacturers, they have the motivation to provide after-sales service, understand needs, expand value-added services, increase brand awareness and loyalty, and provide market basis for product development. However, under the licensing system, gas meters are purchased by gas companies and then provided to end users, which not only increases the purchasing power of gas meters, but also increases the rent-seeking space of gas companies in gas meter installation, gas metering, and other aspects. Therefore, gas companies consider terminal procurement and installation as part of their monopoly position, which suppresses the innovation and service enthusiasm of gas meter manufacturers.

-Causing loss of consumer welfare. Gas companies often maintain their profits by reducing the provision of gas consumption information, which can lead to information asymmetry for consumers and result in low-quality services that harm consumer welfare. These factors can all lead to low efficiency in the operation of the gas market.

In conclusion, although the gas company uses the Internet platform to provide content services, it is a Pareto improvement. However, due to the monopolistic position of gas companies, the possibility of such Pareto improvement is relatively small.

4. The Driving Force Behind Enterprise Content Services in The Context of Universal Service

4.1. Universal Service Is a Fundamental Obligation of Gas Companies

The Constitution clearly stipulates that China implements socialist public ownership of the means of production, namely, ownership by the whole people and collective ownership by the working masses. It stipulates that "all investments of state-owned enterprises in the state-owned economy ultimately belong to all workers, and the existence and development of state-owned enterprises are directly related to the vital interests of all workers, with significant public welfare and important responsibilities for maintaining national economic stability and security. In order to maintain stable development of the national economy and ensure national security, the government must take various measures to control the economic lifeline of the entire country. This indicates that the government bears a universal service obligation at the macroeconomic regulation level, while state-owned enterprises bear relatively specific and detailed universal service obligations.

The Energy Law of the People's Republic of China stipulates the obligation of universal energy services in Article 12 of the General Provisions and Article 58 of Chapter 4 on Energy Supply and Use. The definition of universal energy services is as follows: Universal energy services are energy services provided by the government directly or through special energy management entities (various energy enterprises) with the state as the responsible entity to meet the basic living needs of citizens. As the basic content of universal energy services, gas supply services are undertaken by the government, and gas companies that have obtained operating licenses should assume specific guarantee obligations when fulfilling their universal service legal obligations [4].

At any time, universal energy services have the same connotation: the goal is to meet the basic living needs of citizens, and it is a guarantee and bottom line service. Universal energy services should include at least the following types of projects: (1) meals; (2) Lighting; (3) Summer cooling and winter heating needs. It is obvious that gas supply, as a basic universal energy service, has significant necessity and legal basis for providing comprehensive content services. This constitutes an external constraint for gas companies to provide comprehensive content services, or in other words, providing comprehensive content services is a basic content of gas companies' universal services and also a basic obligation for gas companies to fulfill universal services.

4.2. The Internal Driving Force for Gas Companies to Provide Comprehensive Content Services Is Insufficient

From an economic perspective, enterprises are rational individuals, and the long-term endogenous driving force is profit seeking. However, as a public good, gas supply services require large investment in urban gas pipeline construction, high development costs, and long profit cycles. Due to the existence of this contradiction, they will comprehensively consider various factors such as politics and public opinion, and choose a path of pursuing maximum self-interest in balancing and playing games.

To provide users with comprehensive content services, it is necessary to establish a technical service platform. Based on cutting-edge technologies such as the Internet of Things, big data, and cloud computing, cloud servers, cloud storage, virtual networks, and application services are interconnected to build a cloud network integrated smart gas content service platform, as shown in Table 2:

Table 2. Architecture of Smart Gas Content Service Platform

Application Layer	Business Services: Business Introduction, Account Opening, Transfer, Business Appointment, Business Progress Inquiry
	Information Announcement: Online Store Search, Price Disclosure, Gas Stop Notice, Safety Knowledge, Information Disclosure
	Payment management: Usage inquiry, Billing inquiry, Fee payment
	Security management: Real-time Monitoring, AlarmPush, Alarm Processing
	Basic management: device management, user management
Network Layer	Mobile network, WiFi, Lo-Ra...
Perception Layer	Gas meter, Gas detector, Gas alarm

However, for a typical traditional industry like gas services, building a smart content service platform that covers the end-to-end process of gas service is a challenging task.

The high difficulty of technical implementation and shortage of professional talents make smart gas platforms highly dependent on cutting-edge technologies such as the Internet of Things, big data, and cloud computing. The application of these technologies requires professional technical support and talent reserves. At present, there is a widespread problem of high technical implementation difficulty and a shortage of professional talents in the industry.

The issue of data security for smart gas platforms involves a large amount of data collection, transmission, and processing. Ensuring the security and privacy of data has become an important concern. Once data is leaked or illegally exploited, it will cause serious losses to both businesses and individuals. Therefore, it is necessary to establish a comprehensive data security mechanism, including measures such as data encryption, access control, and security auditing.

Insufficient infrastructure construction. At present, the infrastructure construction in some areas is still insufficient, mainly due to the fact that the market share of smart gas meters has only reached 50%, which makes it difficult to aggregate real-time consumption data.

The difficulty of market promotion and low user awareness make smart gas, as an emerging industry, relatively difficult to promote in the market. Many users lack the necessary understanding of smart gas meters and have insufficient power to replace them. Therefore, it is necessary to increase market promotion efforts and popularize the relevant knowledge of smart gas to users through publicity, training, demonstration projects, and other means.

The construction of a smart gas platform requires significant investment, including expenses for hardware equipment, software systems, and personnel training. This increases the operational burden on gas companies and affects their enthusiasm for promotion.

In fact, providing comprehensive content services not only increases the software and hardware investment costs of enterprises in content platform construction, but also has other indirect effects, such as the problem of smart gas meters causing existing meter readers to lose their original positions and need to be resettled for employment; After consumer information becomes more transparent, it will reduce the problem of rent-seeking space for gas companies.

Therefore, although society is constantly advancing and the awareness and ability of gas company operators to fulfill their social responsibilities will continue to improve, these alone cannot meet the growing needs of the Chinese people for the development of public utilities, let alone their demand for a better life. This contradiction will exist for a long time in the future. [3] This means that, starting from the essence of the enterprise, the internal driving force for gas companies to provide comprehensive content services is insufficient.

4.3. Lack of External Constraints on Gas Companies Providing Content Services

The effectiveness of the gas business license system in providing universal information services fundamentally depends on the system itself. In the process of adjusting the structure of China's socialist market economy system, the gas business license system also needs to be continuously optimized and improved. During this process, the deficiencies in the gas business license system have led to a weakening of its universal service function, resulting in insufficient external constraints for gas companies to provide comprehensive content services.

Insufficient institutional external constraints mainly refer to the incomplete and inadequate laws, regulations or rules in the field of gas operation, resulting in incomplete, inaccurate and untimely information provided by gas companies to consumers in the process of providing content services. The insufficient institutional constraints are mainly manifested in three aspects: firstly, the legal system is not perfect, some aspects in the field have not yet been written into laws and regulations, and there are still institutional gaps in some key links. For example, in the current management measures for gas business licenses, there are no normative requirements for gas companies to provide content services. Secondly, from the perspective of existing laws and regulations, some of them are no longer suitable for new needs and lack timeliness. For example, today, with the continuous development of the Internet and big data, consumers lack effective ways to query their own gas consumption details, but lack corresponding laws and regulations to clarify this requirement. Thirdly, inadequate implementation and ineffective enforcement of laws and regulations. The lax supervision and inaction of law enforcement agencies have led to the repeated abuse of market dominance by gas companies.

The surge in gas fees in Chongqing and the frequent disputes over gas fees are a concentrated reflection of the lack of external constraints, which has led to low service quality and insufficient service awareness of gas companies, greatly reducing public trust in gas companies. The main reason for the occurrence of this incident is objectively the lack of corresponding regulations and effective supervision in market supervision, which has led to information asymmetry among the people in the consumption process. Due to the imperfection of relevant Internet regulatory laws, regulations and rules, as well as the opportunistic tendency of gas companies, people can not accurately obtain the basic information they need, such as gas metering and pricing, or even get the wrong information when consuming gas. At the same time, the lack of system also allows some unscrupulous gas companies to use their information advantages to deceive consumers and seek illegal benefits. In addition, due to the lack of effective supervision by relevant departments, it is usually only after complaints or lawsuits are filed that quality supervision personnel intervene. The handling results are mostly simple apologies and compensation, and the crackdown is not strong enough. The cost of violating the system is too low, which seriously weakens the gas content service.

5. Design of Incentive Compatibility Mechanism for Gas Content Services

Due to the special nature of public goods in the gas supply industry, the essence of the incentive compatibility mechanism design for gas content services under the gas license system is to establish a balance mechanism between enterprise profit goals and universal service objectives.

5.1. Establish a Natural Gas Universal Service Fund to Ensure the Source of Funding for Content Services, Thereby Solving the Cost Pressure of Gas Companies' Content Services

China has established a universal service fund system, mainly including the Telecommunications Universal Service Fund and the Postal Universal Service Fund. Referring to the universal service fund model of telecommunications and postal services, establish a gas universal service fund at an appropriate time, clarify the sources and quality of natural gas universal service funds, and specify that the funding sources of the natural gas service fund can be diversified, such as levying universal service funds or surcharges, government financial expenditures or subsidies, profits of universal service enterprises, etc. [5] At the same time, it is clarified that the Gas Universal Service Fund can be used to improve consumer content services, including intelligent transformation of gas meters, platform construction, real-time data collection, aggregation, and distribution, and so on.

The universal source of gas funds can alleviate the cost pressure of content services for gas companies. Funds are allocated based on the quality, degree, and social evaluation of each enterprise's fulfillment of content obligations. In other words, the final allocation plan for fund use is based on merit based allocation, by establishing a universal service performance evaluation system, quantifying the obligations of each enterprise's content services, and ultimately allocating funds according to different proportions based on the performance indicators of fulfilling obligations.

At the same time, improving the management system and separating the projects that gas companies provide universal services from for-profit projects can not only stably raise gas universal service funds from the profits of various enterprises, but also provide a detailed basis for allocating funds based on the degree of implementation of universal service obligations. At the same time, we will synchronously improve the supporting management system, such as third-party institutions independently supervising the use of funds and timely publicizing and reporting the supervision to the society to ensure the efficiency of fund use.

5.2. Improve Administrative Constraints on Gas Content Services

In modern market economy, there are tangible hands - government macroeconomic regulation, and intangible - market regulation. They are all effective means of allocating various resource elements in the market, complementing each other and complementing each other. Both are indispensable. Firstly, market regulation plays a fundamental and decisive role in resource allocation. Secondly, the government is not only the fundamental public service provider for gas, but also plays the role of the decision-making center and command center for the entire gas universal service. The supply and demand relationship in the gas market not only has its own objective development laws, but also determines that people's needs cannot be fully realized by the market itself due to the large investment in gas supply, long construction period, and the public welfare nature of gas content services. That is to say, as a typical public good, the pure market mechanism of gas services will inevitably lead to market failure. Therefore, pure market mechanisms cannot produce the expected gas service effects in society, and the government should intervene. Therefore, administrative constraints are the fundamental means to ensure universal gas content services.

Therefore, in relevant government regulatory documents, in addition to price control, the supporting requirements for gas content services can also be clarified, including gas metering standards, charging standards, real-time flow and cost information, etc., to ensure the timeliness, accuracy, and comprehensiveness of content services, thereby reducing information asymmetry and fully guaranteeing consumers' right to know.

5.3. Establish Social Constraints for Gas Content Services

Social public opinion is a signaling mechanism that can effectively display the service quality of gas companies. The surge in gas fees in Chongqing was first sparked on the Chongqing political platform. It can be seen that public opinion supervision on the Internet platform can form social constraints on the content and service quality of gas companies.

Secondly, the government and gas companies can also open up channels for public opinion supervision to the society and actively accept public opinion supervision. For example, Suizhou Zhongran Company voluntarily announced up to 27 supervision and complaint methods and channels, making it convenient for the general public to choose and helping Suizhou Zhongran Company improve service quality and efficiency. In order to continuously improve service quality, the company has designated a dedicated person to be responsible for coordinating various channels of complaint work, tracking complaint acceptance, problem handling, follow-up visits, complaint information reporting, and service improvement throughout the process, and handling them in accordance with relevant regulations. Complaints will be processed and returned to users within 5 working days after acceptance [6].

5.4. Market Constraints for Improving Gas Content Services

The gas business license is not only the "ID card" for gas business enterprises to operate legally, but also an important means to protect the legitimate rights and interests of consumers.

The Management Measures for Gas Business License issued by the Ministry of Housing and Urban Rural Development of China in 2019 clearly stipulate the review system, only stipulating the necessary conditions for applying for the license, without specifying the quantity standards for issuance. The main reason for this is that it is difficult to quantify the standard for the number of licenses that should be issued in a region. If the number of licenses issued is too large, it will be difficult for enterprises to survive; If the issuance quantity is small, it is easy to lead to rent-seeking behavior by abusing market position. In response to this phenomenon, it can be considered to leave the problem to the market to decide, adopt a license auction system, and clearly set content service requirements for participating enterprises to ensure consumers' right to know. Thus, through market mechanisms, a reasonable number of operating licenses can be determined, which not only maintains the full competitiveness of gas supply, but also ensures that gas operators provide comprehensive content services to safeguard consumers' right to know.

6. Conclusion

The government usually adopts a licensing system to manage gas supply services as public goods, but the monopolistic effect brought by the licensing system leads to insufficient motivation for gas companies to provide consumers with comprehensive content services. However, consumers need sufficient right to know, which has led to a series of social hotspots regarding gas billing issues. To provide comprehensive content services for gas companies, this article suggests designing a sound incentive compatibility mechanism, including universal service funds, administrative constraints, social constraints, and market constraints, in order to improve the operational efficiency of the gas market and enhance consumer welfare.

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