Natural Gas Customer Classification and Application Based on Cluster Analysis Model

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Abstract. Celerated pace of market development in the natural gas industry, the country's gradual liberalization of natural gas prices, and the gradual opening of the upstream market to the public, the changing external factors will undoubtedly pose a huge challenge to the survival of natural gas marketing companies. The current natural gas sales pattern will be gradually broken, whether on the supply or demand side, a growing number of competitors will enter the market in the future to capture market share. This paper identifies the stages of natural gas customer relationship lifecycle management based on the proposed natural gas customer relationship lifecycle management, and summarizes the problems in its customer relationship management work by investigating and analyzing the business status of A natural gas sales company. A cluster analysis model was then established to classify customers. Finally, a development strategy for the identification stage, a graded service strategy for the development stage, a value enhancement strategy for the stabilization stage and a termination strategy for the recession stage of natural gas customer relationships are proposed to help natural gas sales companies achieve long-term and stable development.

Keywords: natural gas sales · customer relationship · lifecycle

1 Introduction

China's energy structure has changed dramatically in recent years as a result of national policies. Natural gas is gradually being cultivated as one of the main energy sources of China's modern energy system, according to *The opinion on accelerating the utilization of natural gas* [12, 15]. It is expected that the consumption of natural gas resources will generally increase in the next decade [2, 19]. In the future, the natural gas market will have more participants, and the natural gas industry will form a multivariate competition pattern. The introduction of foreign resources improves the supply capacity of natural

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gas resources in the upstream [13]. Upstream resources are being seized by an increasing number of local enterprises or large private enterprises, and the multivariate competition pattern intensifies the natural gas market's competition situation in the downstream. Pipeline transportation in the middle is solely the responsibility of The National Pipeline Network Company. Therefore, natural gas supply costs are expected to gradually decline and remain stable, and natural gas sales prices will gradually move closer to the prices formed under the market mechanism, and the growth of natural gas sales companies is fraught with difficulties. Faced with this situation, China's natural gas sales enterprises should take proactive measures to adapt to changing circumstances [3, 4, 5, 10, 14].

In the face of increasingly fierce competition in the natural gas industry, natural gas sales companies must have a comprehensive and standardized customer relationship management strategy. Despite the fact that The National Pipeline Network has been established, no relevant management policies or supporting facilities have been established or improved. Natural gas sales companies should seize the opportunity to capture market share first during a favorable window period when other competitors have yet to enter [1, 9, 16, 17].

2 Overview of Natural Gas Customer Relationship Lifecycle Managment

Customer lifecycle is an abbreviation for the full lifecycle of customer relationships, which refers to the trajectory of customer relationship levels over time. During this process, the customer's natural gas consumption and the profit brought to the natural gas sales company will change in a certain regular manner. Natural gas customer relationship lifecycle management is a systematic and dynamic approach to managing customer relationships based on the characteristics of the different stages of natural gas customer relationships by identifying, tracking, guiding and managing customers to maximize their long-term value [7][8].

3 Stage Division of Natural Gas Customer Relationship Lifecycle Management

Different division standards and stages of customer relationship lifecycle management exist. The gas consumption and gas consumption growth rate are selected as the division standards of the lifecycle stage, and the lifecycle of customer relationship is divided into four stages: identification stage, development stage, stable stage, and recession stage, based on a comprehensive consideration of the characteristics of natural gas products and under the condition of sufficient natural gas sources [11].

Identification stage.

This stage is characterized by the lack and asymmetry of information acquisition. First and foremost, the natural gas sales company is unaware of the target customers' actual demand, consumption capacity, reputation, and other information. Customers, on the other hand, may recognize the natural gas sales enterprise's brand, but they lack a thorough understanding of information such as the charging price, network layout, and

service content. Customers will choose the enterprise if they only obtain information and determine for themselves that the value of the product and service quality that a natural gas sales enterprise can provide is higher than that of other natural gas sales enterprises.

Development stage.

This is the stage of rapid development of the customer relationship. When entering the customer development period, gas supply pipelines and equipment are put into use, characterized by an increasing number of transactions between the two parties. The gas sales company gradually grasps the long-term demand of the customer and gradually begins to adjust the production volume according to the size of the gas supply. At this stage, the customer's requirements for the comprehensive quality of the customer service manager and the completeness of the customer management system gradually increase. With the increase of mutual trust and reliance, the customer will make a series of repeated purchases from the same company and form a virtuous cycle.

Stabilization stage.

This stage is the best and highest stage a customer relationship can reach in its development. In the stabilization stage, the customer will want to establish a long-term ongoing business relationship and will have higher requirements for the quality and stability of the gas supply. The customer generates the most stable consumer demand, and the partnership established between the customer and the company is the most secure, and the customer can bring the most profit gain to the company, so it can be said that the customer stabilization stage is a favorable period for the company to maximize the lifetime value of the customer.

Recession stage.

This is the stage in the development process when the level of customer relationship reverses. This stage has the following characteristics: natural gas sales enterprises' profits decline, customers gradually reduce gas consumption, and they decide to end the existing business relationship and issue a termination notice. The main performance is the continued low volume of trade between the two parties,customers have begun to choose other gas suppliers or alternative fuels, customer payment is slow, customer complaints to the company are increasing, and some customers have stopped using the natural gas sales enterprise's services entirely.

4 The Current Situation and Problems of Customer Relationship Management of a Natural Gas Sales Company

4.1 The Current Situation of Customer Relationship Management of a Natural Gas Sales Company

Customer service management.

The Ministry of Market Development conducts natural gas market research and obtains the corresponding customer demand information based on the previous market research during the stage of customer identification, with customer demand as the primary factor. Creation of a natural gas demand database based on administrative region, direct supply and transfer, upstream gas supply enterprises, gas projects, and other factors. Governments at the county level and above in the location should apply to A natural

gas sales company (hereinafter referred to as A company) in accordance with the needs of gas projects during the customer development stage. A company conducts market research, submits market research reports, and solicits feedback on new customer development. Projects involving long-distance pipeline openings must be approved after a preliminary agreement on openings has been reached with pipeline companies. Following receipt of the gas supply commitment letter, the project gas supply unit division will transfer the customer manager responsible for project tracking management to the regional gas supply unit for customer management. To improve the transmission and distribution capacity of the natural gas peak shaving pipeline network, the company forms a pipeline safety management network covering every link and every person at the stage of customer stability. Establish an emergency management system, and prepare a sub-regional operational natural gas supply emergency plan. The company implements customer recession management measures during the customer recession stage. The company sends staff to understand the situation, inquire about the reasons, and strive to retain customers for units that intend to change other energy sources and competitive blocks that intend to change other gas sources.

Customer value management.

The Implementation Rules for the Grading of Natural Gas User Evaluation were developed by A Company. According to the gas consumption characteristics of customers, it will classify and score four aspects: customer payment, sales price, gas consumption and peak regulation, communication and coordination, scientifically evaluate customers, and establish high-quality customers group. Customer satisfaction is surveyed every year from three aspects: product quality, service attitude and service quality. Judging customer loyalty from customer contract signing cooperation and gas payment recovery.

Customer information management.

A company has established a customer basic information database and regularly and timely updates the file data of various customers to realize the information, data, and dynamic management of customer files in order to do a good job in the management of natural gas customers' registration, renaming, and cancellation. A company organizes the investigation of peak-shaving demand and the poor self-peak-shaving ability of the city gas companies, coordinates the peak-shaving ability of the supply and demand sides, and compiles the report on the investigation of the gas storage facilities of the city gas companies, which provides data support for the company to clarify the peak-shaving responsibility to the government and customers.

4.2 The Problems of Customer Relationship Management of A Company

The problems of customer service management.

A company has classified natural gas customers for a long time based on management needs, industry attributes, gas scale, price sensitivity, and other factors. These customer classification methods do not accurately reflect the value of the customer. These classification methods are not adaptable enough to improve customer service and increase company value. Although the establishment of a one-stop customer service process, as

well as the implementation of the customer manager system, the implementation of one-stop customer service is not fully accurate in place because the customer process design is not fully optimized and reasonable, and the customer manager training is insufficient.

The problems of customer value management.

The value-added experience of key customers is currently receiving insufficient attention. A company should differentiate between customer groups and different types of customers, implement personalized services, and strengthen the organization of new business and service development based on customer segmentation, as well as introduce diversified business and personalized services. Natural gas is a natural monopoly commodity in the traditional customer management mode, with high conversion costs, dissatisfied customers in the process of using even A company's products and services, and generally difficult to convert. However, as market-oriented reforms continue to deepen, customer switching costs and barriers will decrease, necessitating the company's use of "service differentiation" as a key customer management strategy.

The problems of customer information management.

The data provided by A Company's information system is insufficiently complete and systematic for in-depth market and customer analysis. Customer information should be updated in a timely manner, at any time, to understand the customer's business dynamics, market changes, institutional changes, and other information acquisition is not timely, insufficient, and decision-making reference cannot be well supported. The early warning mechanism for customer churn in the customer management information system is not well established, and the cause analysis of rapid growth or loss of customers is insufficient.

5 Customer Clustering and Classification Study of Company A

According to the order of natural gas utilization, the existing gas-using industries are divided into three broad industry categories based on the characteristics of each industry and the different strategies adopted: the city gas industry category, the industrial fuel industry category, and the chemical and fertilizer industry category. After clustering the three industry categories according to gas consumption, sales volume and self-peaking capacity indicators, customers can be divided into four classes of A, B, C and D, which represent four customer classes of very important, important, relatively important and general customers, respectively.

5.1 Classification Index Selection and Standardization of Metric Data

According to the order of natural gas utilization according to the characteristics of each industry and the different strategies adopted (priority protection, key development, restriction, prohibition), the existing gas-using industries are divided into three broad industry categories: city gas industry category; industrial fuel industry category, including glass, metallurgy, light industry, electronics, machinery, petroleum refining, building materials, other industries, etc.; and chemical industry category.

Based on the characteristics of the natural gas industry, three indicators are selected as natural gas customer classification indicators: gas consumption, sales volume and

self-peaking capacity. Gas consumption reflects the market share, and the higher the gas consumption of a customer, the better it is for the company to achieve the goal of profit maximization. Sales reflect the customer's profit contribution to the enterprise. With gas consumption already used as an indicator for analysis and clustering, sales essentially reflect the customer's contribution to the enterprise's profit per unit, and the larger the sales, the greater the value of the customer. Self-peaking capacity is measured as the ability of customers to self-adjust gas consumption fluctuations, indicating the customer's gas consumption balance.

Since the selection of the unit of measure has a large impact on the clustering results, the data need to be standardized. The standardization method used in this study is to subtract its mean and divide it by its standard deviation, i.e.,

$$\overline{x_j} = \frac{1}{n}\sum_{i=1}^{n} x_{ij} \tag{1}$$

$$S_J = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(x_{ij} - \overline{x_j}\right)^2} \tag{2}$$

The raw data normalized values are:

$$x_{ij}^{'} = \frac{x_{ij-\overline{x_j}}}{S_j} \tag{3}$$

5.2 Cluster Analysis Algorithm and Model Building

The main clustering analysis algorithms are hierarchical approach, divisional approach, density-based approach, grid-based approach, and model-based approach [6]. In this study, the model-based approach is selected for cluster analysis calculation, i.e., a standard model is set first, and then the data sets that fit this model are found by the algorithm of clustering.

Taking the broad category of city gas as an example, we first selected four typical customers as standard customers among more than 300 gas customers of Company A. These four customers have distinctive characteristics, and the company can target its services and implement marketing strategies. The comparison of the four standard customer indicators is shown in Table 1.

Secondly, in the cluster analysis, the sum of squared differences between the other customers n and each of the four standard customer quantities are calculated separately. That is, the following calculation is performed.

$$Z_{na} = (K_{qn} - K_{qa})^2 + (K_{vn} - K_{va})^2 + (K_{pn} - K_{pa})^2$$

$$Z_{nb} = (K_{qn} - K_{qb})^2 + (K_{vn} - K_{vb})^2 + (K_{pn} - K_{pb})^2$$

$$Z_{nc} = (K_{qn} - K_{qc})^2 + (K_{vn} - K_{vc})^2 + (K_{pn} - K_{pc})^2$$

Table 1. Comparison table of 4 standard customer indicators.

User Name	Gas consumption (Kq, 100 million cubic meters/year)	Sales (Kv, 100 million RMB/year)	Self-peaking capacity (Kp, 10,000 cubic meters/day)	Features
a	35	73	200	High gas consumption, high sales, balanced gas consumption
b	20	42	80	Higher gas consumption, higher sales, general fluctuations in gas consumption
c	10	21	20	Average gas consumption, average sales, large fluctuations in gas consumption
d	3	5	2	Small gas consumption, small sales, large fluctuations in gas consumption

$$Z_{nd} = (K_{qn} - K_{qd})^2 + (K_{vn} - K_{vd})^2 + (K_{pn} - K_{pd})^2 \tag{4}$$

Among them: $Z_{\text{na}}, Z_{nb}, Z_{nc}, Z_{nd}$--refers to the sum of the squared differences of the three indicators of the nth customer and the 4 standard customers respectively;

$K_{qn}, K_{qa}, K_{qb}, K_{qc}, K_{qd}$-- refers to the annual gas consumption value of customers n, a, b, c, d;

$K_{\text{vn}}, K_{va}, K_{vb}, K_{vc}, K_{vd}$-- refers to the annual sales value of customers n, a, b, c and d;

$K_{pn}, K_{pa}, K_{pb}, K_{pc}, K_{pd}$- refers to the n, a, b, c, d customer self-peaking ability.

Finally, the minimum value of $Z_{\text{na}}, Z_{nb}, Z_{nc}, Z_{nd}$ is selected as the customer classification corresponding to the nth customer.

Similarly, the classification of industrial fuel customers and chemical and fertilizer industry customers was calculated by cluster analysis.

5.3 Classification Results and Analysis

5.3.1 Urban Gas Customer

Urban gas is an important component of urban energy structure and provides high-quality gas fuel for urban industry, commerce, and residents' daily lives.

Class A customers have the largest gas consumption and sales, and the mean value of the two indicators is also the highest. It has strong market pioneering and demonstration capabilities, which can help enterprises gain a significant market share and be classified as very important customers.

The number of class B customers is large, as is the average gas consumption and sales, as well as the contribution to the enterprise's unit profit and market share. Customers in class B are valuable and can be classified as important customers.

The number of class C customers is small, and their average gas consumption and sales are small, whereas the number of class D customers is large, but their average gas consumption and sales are the smallest, and their contribution to the enterprise's unit profit is small. C and D customers have a low overall value and are classified as general customers.

5.3.2 Industrial Fuel Customer

Natural gas is used as an industrial fuel in a variety of industries, including steel, nonferrous metals, ceramics, cement, glass, light industry, medicine, and food.

Customers in Class A have the smallest user scale, but their average amount and overall proportion of the three indicators of gas consumption, sales, and peak shaving value are large, and their unit contribution is very large, making them very important customers.

Class B customers have a small customer base, but their total gas consumption, total sales, and peak shaving volume are all higher, and the average value of the three indicators is higher, indicating that they contribute significantly to the company's unit profit. Customers in the Class B category are extremely valuable and can be considered very important.

Class C customers have similar total gas consumption, total sales, and peak shaving volume to Class B customers, so they can be classified as Class B customers. Therefore, Class C customers are important customers.

Class D customers, despite their size, have the lowest gas consumption, sales, and unit profit contribution, indicating that their value is low. They belong to the general customers.

5.3.3 Chemical and Fertilizer Industry Customer

Natural gas, as an industrial raw material, can be used to produce many chemical fertilizer products, such as methanol, urea, ammonia, acetic acid through purification, separation, steam conversion, oxidation, chlorination, vulcanization, nitrification and dehydrogenation.

Although Class A customers are small in size, their averages in terms of gas consumption, sales, and peak gas volume are far higher than the overall average, implying that they contribute significantly to the company's unit profit. Customers in the Class A category are extremely valuable and can be considered very important.

Class B customers are small in scale, but their average gas consumption and sales are large. Therefore, it can also be considered important customers.

Because class C customers' total gas consumption, sales volume, and peak shaving volume are small, their contribution to enterprise unit profit is small, and their customer value is small, they are classified as general category customers. Although class D customers have the largest scale, their average gas consumption, sales volume, and peak gas consumption are all significantly lower than the overall average, and their contribution to enterprise unit profit is minimal. Overall, the value of C and D customers is low, and they belong to the general class of customers.

6 Customer Relationship Lifecycle Management Strategy of A Company

6.1 Development Strategy of Natural Gas Customer Relationship Identification Period

6.1.1 Marketing Ideas for the Natural Gas Customer Relationship Identification Period

Marketing during the natural gas customer relationship identification period is an exploratory and experimental phase of the relationship between natural gas sales company and its customers. During this phase, the company proactively seeks information about the customer and provides the customer with information about the company to ensure that information channels are open. The company and the customer seek the intersection of their goals, evaluate each other's intentions, each other's performance, and consider the potential responsibilities, rights and obligations of both parties if a long-term relationship is established [18].

6.1.2 Strategic Focus for the Natural Gas Customer Relationship Identification Period

Identifing potential customers and focusing on developing high-value customers.

Market development account managers should connect and coordinate well with local governments, intervene early in the planning and construction of industrial parks, assist local governments in formulating preferential policies for attracting investment in industrial parks, increase the industrial gathering capacity of industrial parks, and expand the scale of gas consumption. Sort potential customers into categories, focusing on and reserving some with higher gas consumption, higher price tolerance, higher peaking value, and interruptibility.

Providing "customized gas service solutions".

Professional services provided to customers before, during, and after the sale of natural gas are referred to as "customized gas service solutions." The account manager assists the customer in understanding and adapting to the company's products or services, provides accurate information to the customer via various channels, guides the customer in using the company's products or services, stimulates the potential customer's desire to purchase, and assists the customer in making a purchase decision. The customer makes a transaction decision after learning about the company's products and services.

Establishment of key account manager for market development and dedicated account manager for daily management.

A key account manager is established to serve such important customers, so that there is a dedicated person to make further contact with key customers. The key account manager is responsible for collecting and giving feedback on the individual needs of key customers, participating in the development of targeted sales programs, and tracking the effectiveness of the implementation of sales programs. During the market development period, in addition to the key account manager, who is responsible for all matters during the development period, a full-time account manager should be assigned to the corresponding jurisdiction to participate in the initial development and contact work, so as to be familiar with the gas demand of key customers and to implement daily management services for key customers after the official start of gas consumption.

6.2 Classified Service Strategy for Natural Gas Customer Relationship Development Period

6.2.1 Marketing Ideas for Natural Gas Customer Relationship Development Period

Customers in the growth phase enter a phase of rapid customer relationship development, in which early-stage potential customers interested in the company's products or services make purchase decisions about the products, and as the customer's production and operation potential gradually comes into play, the amount of gas used by both parties to trade gradually increases. At this stage, the basic idea of marketing work is to identify and target important customers who have higher current value to the company and higher future value-added potential.

6.2.2 Strategic Focus During Natural Gas Customer Relationship Development

Hierarchical service strategy during the development of customer relationships in the city gas industry.

For Class A city gas customers, the development of downstream industrial and commercial customers should be appropriately restrained in the near future. Class B and C customers have similar basic conditions and are basically customers of city and county gas companies, and the basic strategy during the gas supply tension phase should still appropriately support the development of such customers. Class D city gas customers have a large number of customers with a low base volume of natural gas sales, and their development should be appropriately restrained in a situation where the supply of natural gas exceeds the demand to avoid putting more pressure on the company's gas supply.

Customer hierarchy management strategy for industrial user group customer relationship development period.

For large direct supply industrial customers, their growth should be highly valued and nurtured. In the near-term shortage of natural gas supply, more attention should be paid to the potential peaking capacity of their volume advantage. The situation is similar for industrial customers in categories B and C, which are mainly in the chemical, steel and glass industries. In times of tight gas supply, we should implement a "selective support strategy". We should focus our resources on customers with long-term prospects or unique competitive advantages in the industry in order to support their rapid growth, while restricting companies with poor prospects in the industry to prevent them from

competing for gas supply. The number of industrial customers in category D is large, but the volume is small. In times of tight gas supply, it is recommended to select some fast-growing and high-profit margin customers in the D category to carry out a "pilot price push" to increase the acceptable price of natural gas for a portion of the gas supply.

Chemical and fertilizer industry customer classification management strategy.

Gas volume regulation by season and the investigation of new pricing mechanisms. Lower gas prices during the low season and higher gas prices during the high season can be used to encourage or discourage natural gas consumption, resulting in a smooth natural gas demand.

6.3 Value Enhancement Strategy for Natural Gas Customer Relationship Stabilization Period

6.3.1 Marketing Ideas for Natural Gas Customer Relationship Stabilization Period

The stabilization period is an advanced stage in the company's customer relationship development. At this point, customer relationship management should be considered from two perspectives: the current period of limited gas supply and the future period of ample gas supply and competition from multiple gas suppliers. Although the company must achieve the basic goals of stable market share expansion and increased economic efficiency in both periods, it is clear that the company's approach to customer management should be different in the face of a tight gas supply situation and competition from multiple gas suppliers.

6.3.2 Value Enhancement Strategy for Natural Gas Customer Relationship Stabilization Period

Strategies to enhance the value of customer relationships during the stabilization period in the city gas industry.

Class A city gas customers have entered a period of stability, and their sales growth tends to level off and will not increase gas consumption excessively during periods of gas supply constraint. The basic strategy for these customers should be to maintain the status quo. The basic situation of B and C city gas customers is relatively similar, and they generate an average of tens of millions of RMB in sales. Although they are currently in a period of tight gas supply, they should still be supported with strategies to form a good market base, considering the future competitive landscape. As most of the customers in category D are located in small and medium-sized cities, with the development of urbanization in the future, the rate of residential natural gas gas gasification will further increase. From the perspective of future competition, measures should be taken to appropriately encourage them to further develop new customers in crossover areas where competitors have already entered or where competitors are highly likely to enter in the future, even under the general environment of tight gas supply in the near future, so as to expand market share.

Value enhancement strategy for industrial user base stabilization period.

A class industrial customers with large sales, relatively high gas supply prices and high profit levels should be the focus of the company's support, but the growth rate of such

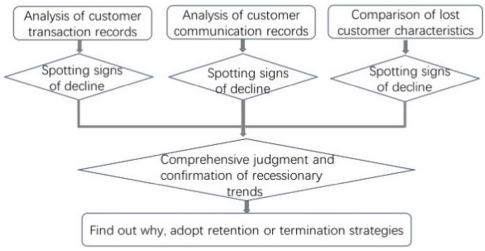

Fig. 1. Customer relationship decline warning model.

customers is slowing down, which is more appropriate in the current state of tight gas supply, but the long-term future should focus on the development of the industry in which the customer is located in the foreground. For medium-sized customers in categories B and C, it is appropriate to adopt selective support strategies during periods of gas supply tension. Most industrial customers in category D are smaller in size, have lower sales and limited future growth potential, and it is appropriate to adopt general maintenance strategies during periods of gas supply tension. For small and medium-sized customers, customers with higher corporate profit margins and lower gas costs should be selected to consider a trial push-price strategy, study the price acceptability of different industries, and pilot a one-household-one-price policy to help gradually accumulate operational experience, identify potential problems, and pave the way for promoting the strategy among large customers in the future.

6.4 Natural Gas Customer Relationship Termination Strategies During Decline

6.4.1 Marketing Ideas for Natural Gas Customer Relationships In Decline

During the entire life cycle of natural gas customer relationship development, the stage of natural gas customer relationship decline occurs when the relationship level reverses. Companies must have a mechanism in place to detect the decline of customer relationships, based on a customer relationship decline warning model, which identifies customers who have a tendency to decline, classifies them according to the causes and probability of decline, and develops targeted recovery strategies or abandons them.

6.4.2 Strategic Focus During Natural Gas Customer Relationship Decline

Customer relationship decline alert.

The company should establish a customer relationship decline early warning model, and take appropriate measures once the signs of customer decline are detected. The early warning signs of customer relationship decline come from three aspects: analysis of customer transaction records, analysis of customer communication records, and comparison of lost customer characteristics derived from data mining.

Analysis of the causes of the decline.

The causes of customer relationship decline can come from factors such as the company itself, competitors, customers, and the external environment. The company's own factors include several aspects: gas quality, service, price, customer relations and

retention strategies. Competitors contribute to the decline in customer relationships by comparing the quality of natural gas, service quality, price, and business development between the two parties. The decline caused by the customer itself is reflected in the decline caused by objective factors such as the customer's own economic situation and industry development constraints. The external environment causes the decline in customer relationships mainly in terms of macro policies and other factors.

Customer decline relationship classification implementation strategy.

According to the frequency and controllability of the causes of customer relationship decline, customers in relationship decline can be divided into four categories: highly valued customers, sufficiently valued customers, appropriately valued customers and natural customers.

Highly valued customers: the probability of factors causing customer decline is high, and the company has a high degree of control over these factors, which can be greatly improved by efforts, and this area is a key area of concern for the company.

Sufficiently valued customers: the probability of factors that cause customer decline is high, but these factors are less controllable for the company and more difficult to change. This area should attract sufficient attention to the company, in an effort to reduce the spread of adverse effects outward, while helping the company from a passive situation to an active situation.

Appropriately valued customers: the probability of occurrence of factors that cause customer decline is low, but the company has a high degree of control over these factors. The company should pay proper attention to this area, on the one hand, these factors need to be improved, on the other hand, the improvement strategy can reduce the impact of these causes in the customer.

Natural customers: The probability of factors causing customer decline is low, and the company has little control over these factors. For this area, the company can adopt an abandonment attitude and not spend too much effort on this area.

7 Conclusions

China's energy demand has reached a medium growth stage due to the country's rapid economic development. Along with the introduction of foreign natural gas resources and the independence of The National Pipeline Network, natural gas sales companies must address how to deal with changes in natural gas supply and demand and formulate appropriate management strategies in order to achieve long-term and stable growth. This paper divides the full lifecycle management of the company's customer relationship into four stages based on the lifecycle theory of customer relationship and the marketing characteristics of A natural gas sales company: identification stage, development stage, stabilization stage, and recession stage. The existing customers of A natural gas sales company are then classified using cluster analysis, and the characteristics of each type of customer are accurately portrayed in an all-around manner, with corresponding marketing strategies formulated for customers in various life cycle stages, in order to achieve effective management of valuable customers throughout their lifecycle and to improve customer service levels on a broad scale.

References

1. Fan Cao. (2022). Independence of Pipeline Network: Research on the Legal Mechanism of the Market-oriented Reform on Natural Gas Pipeline Network in China. J. Jinan Journal (Philosophy & Social Sciences) (02), 109–121.
2. Haokai Huang. (2022). Characteristics and development trends of the global LNG market in 2021. J. International Petroleum Economics. (04), 79-91.
3. Hong-xun Li & Fang-shu Qiao. (2021). Research on the relationship between international crude oil price fluctuation and China's LNG import price. J. Price Monthly (07), 18–25.
4. Hanquan Huang, Weimin Xu & Xiaolu Dai. (2021). The Reason, Impact and Countermeasures of Natural Gas Prices in International Market. J. Price Theory and Practice (10), 5–8.
5. Jianping Zhang, Runmin He, Xiaoqin Zou, Zizi Li & Xuesong Yang. (2021). Digital transformation of China's natural gas marketing business in the new pattern. J. Natural Gas Industry (09), 169–177.
6. Jian Chai, Jie Lin &Ting Liang. (2021). A Study of Linkage between Crude Oil and Natural Gas in North American Market: Based on the Empirical Analysis of Bayesian DCC-GARCH Model and LSTAR Model. J. Management Review (07), 16–28.
7. Lan Zhou. (2016). Gas use behavior analysis of industrial customers and development of customer management. J. Journal of Systems Management (02), 63–77.
8. Lan Zhou & Jian Li. (2020). Thinking on the customer evaluation system and precision marketing in wholesale of natural gas. J. International Petroleum Economics (01), 78–81.
9. Meng Liang, Qi Zhang & Yingying Peng. (2021). Building paths of China's natural gas security guarantee system under opening-up conditions. J . Natural Gas Industry (11), 161–169.
10. Qiu-sheng Kong & Si-bin Hu. (2021). Analysis on current situation of coal to natural as companies and ideas for getting rid of difficulties. J. Modern Chemical Industry (09), 1–10.
11. Qiping Du, Can Yuan, Yawen Yang, Lingrui Luo & Lijun Wang. (2021). Several suggestions on the implementation of whole-life-cycle management for natural gas customers. J. Natural Gas Technology and Economy (06), 58–62.
12. Runmin He, Wei Xiong, Yawen Yang & Yuhan Ren. (2018). Analysis and Research on Natural Gas Market Development in China. J. Natural Gas Technology and Economy (06), 21–24+82.
13. Rong Zhang & Shan Li. (2021). Game of Natural Gas Import Between China and EU under the Influence of Reserve Preferences. J. Journal of Systems Management (04), 729–742.
14. Sensheng Li, Yanzhi Duan & Li Wang. (2020). Effect of adjusting "Central Pricing Catalog" on natural-gas market in SichuanChongqing area. J. Natural Gas Technology and Economy (02), 61–66.
15. Xiaoqin Zou,Mei Hu,Qingke Ruan,Shuiqing Yang,Xiaokui Li & Jian Zhou. (2011). Cumulative temperature effects in short-term city gas load forecasting. J. Natural Gas Technology and Economy (03), 58–60+80.
16. Zhiwei Luo, Gang Zuo & Bo Li. (2022). Dispatching operation mode of natural gas shippers under the system of transportation and marketing separation. J. Natural Gas Industry (03), 120–128.
17. Zi'ang Jiang, Zaiyong Yang, Xiaoqin Zou, Zhixiong Wang & Yawen Yang. (2018). Strategic thinking on accelerating the construction of modern natural gas market system in China. J. Natural Gas Industry (10), 120–127.
18. Zhiming He,Xiangyu Wen,Wen Qiu,Chang Ye & Yangjie Wu. (2018). Exploring a natural gas marketing model that focuses on value creation. J. Natural Gas Technology and Economy (02), 62–65+84.
19. Zhen Wang , Yinghao Kong & Wei Li. (2021). Review on the development of China's natural gas industry in the background of "carbon neutrality". J. Natural Gas Industry (08), 194–202.