

Research on Development Model of Heat Supply

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Abstract: In this paper, the heating mode is analyzed in depth with specific data. In this study, based on the principle of sustainable development, several sets of indicators were selected to measure heating. In the empirical research, this paper mainly adopts the analytic hierarchy process to deal with the data of the heating mode, and uses the factor evaluation method to measure the index.

Keywords: Heating; Mode; Analytic hierarchy process; Factor evaluation method

1. Introduction

The sustainable development model of urban heating is determined by many factors, such as economy, environment and management. This is the comprehensive embodiment of the ability of economic development and the improvement of environmental protection capability [1]. With China's accession to the twenty-first Century agenda, too much emphasis on economic evaluation and neglect of the environment has failed to correctly evaluate various heating modes. This paper makes a comprehensive and systematic analysis on the advantages and disadvantages of several commonly used modes in urban heating, and establishes an evaluation index system for the sustainable development model of urban heating. The evaluation of the sustainability of urban heating mode is a decision optimization problem, and its overall requirement is to achieve comprehensive improvement in economic, environmental and social benefits.

2. The Content of the Evaluation of Urban Heating Sustainable Development Model

In the traditional urban heating mode research, the evaluation of the heating mode is focused on the economic and technical characteristics of each heating mode. In the evaluation of urban heating sustainable development model, the scope of evaluation technology not only includes economy and technology, but also the rational utilization of resources and the improvement of environmental quality.

3. Evaluation Index System of Sustainable Development Mode of Urban Heat Supply

3.1. Basic principles of establishing evaluation index system for sustainable development mode of urban heat supply

The index system is the basis for evaluating the sustainable development mode of urban heating, and is also the basis for comprehensively reflecting the sustainable development level of urban heating. The goal of sustainable development of urban heat supply is multiple, which includes economic, technological, resource goals and environmental goals. Therefore, the selection of the index system for urban heating sustainable development should be based on different objectives, and at the same time, we should adhere to the principles of science, comprehensiveness, hierarchy, comparability and operability.

3.2. Establishment of evaluation index system for sustainable development of urban heat supply

In order to evaluate the sustainable development mode of urban heating, it is necessary to give specific operational measurable means and measurable index system. Based on the connotation of the sustainable development of urban heating, according to the basic principles of scientificity, comprehensiveness, hierarchy, comparability and operability, the index system is designed to reflect the economy, technology, environmental protection and future development ability of different modes of urban heating. The index system is composed of three levels and 26 indicators, namely, the target level, the project level and the index level.

4. Evaluation Method of Urban Heat Supply Sustainable Development Model

In this paper, a comprehensive evaluation model of urban heating sustainable development is established by analytic hierarchy process. Its basic train of thought is: first, we should divide the problems we need to analyze according to the nature of the problem and the general goal we have to achieve. The problem is decomposed into different components, and the factors are aggregated according to different levels according to the interrelated

influence and affiliation between factors. A multi-level analysis structure model is formed, and the final system comes down to the ranking problem of the lowest level of weight or the relative order of relative merits of the highest level. In the face of complicated social, economic and scientific management problems, analytic hierarchy process can quantify those which are originally non quantitative indicators or factors, so that qualitative analysis and quantitative analysis are combined. Thus simplifying the analysis and calculation of the system and ensuring the scientization of the decision.

4.1. Hierarchical

The analytic hierarchy process (AHP) is used to analyze the sustainable development model of urban heating. First, the factors that affect the sustainable development of urban heating should be divided into a tree, which can be analyzed on the basis of the "level".

4.2. Structure judgment matrix and consistency check

In sorting calculation, the ranking of each level can be simplified to a series of pairwise factors. By calculating the maximum eigenvalue of the judgment matrix and its eigenvector, the relative weight of a certain level factor relative to the factor of the upper level is calculated. If the relative weight of an element at the level of the upper level is taken into account, then the next level of factors can be compared to the next level, and the relative weight of the next level of factors can be obtained. In order to get the relative weight of the lowest level factor relative to the total target level, the hierarchical structure is calculated from top to bottom. The scale scale used here is a 1~9 scale method using T L Saaty.

Table 1. 1~ 9 Ratio Gradation Method

Scale	Meaning
1	The two factors are of the same importance
3	Compared to two factors, one factor is slightly more important than the other
5	Compared to two factors, one factor is more important than the other
7	Compared to two factors, one factor is more important than another
9	Compared to two factors, one factor is more important than another
2	The median of the two adjacent judgments mentioned above

After determining the scale of 1~9 ratio, the Delphi method is adopted in this paper, and the judgment matrix of each level index is formed after the results of the experts are synthesized.

5. Study on the Sustainable Development Model of Heating in Harbin

5.1. Raw data for sustainable development evaluation of different modes of heating in Harbin

Taking the evaluation of Harbin city heating sustainable development model as an example, this paper introduces the guiding and decisive role of evaluation process and evaluation results on the research of urban heating sustainable development model. At present, the main heating modes in Harbin are cogeneration, gas fired boiler room, coal fired boiler room, dispersed gas boiler room, separate household gas stove, low temperature nuclear heating and heat pump heating. The economic indicators of the evaluation model of sustainable urban heating development are shown in Table 2.

Table 2. Economic Indexes for Various Modes(B 1)

B 1	1	2	3	4	5
Total system investment cost	10192.2	10338.2	9366.8	7318	7552.65
Value at the end of the period of economic life	1019	1034	937	732	755
The annual operating cost of the life period	315.7	322.5	309.7	219.5	184.2
Annual value of fuel cost	368.3	1951.3	473.5	2022.7	2073.1
Total cost annual value	1912.1	3519.3	1911.8	3123.9	3167.4

The technical index, thermal comfort index, reliability index and resource availability index of each heating mode are evaluated by the expert collective evaluation and the investigation of the users.

5.2. The comparison of the 26 indexes and the dimensionless processing of the original data

The judgment matrix of the 26 indexes is shown in Table 2. Among them, the judgment matrix of B 1 to B 7 is slightly, which is calculated and all matrices have satisfactory consistency. From the perspective of all

heating modes, the sustainable development of cogeneration is the largest, so it should be vigorously promoted. In recent years, the popularity rate of cogeneration in Harbin has been growing at a rate of 5 percentage points each year. This shows that the evaluation method of sustainable development established by this model can reflect the actual situation, and also has a certain feasibility and rationality for the evaluation of the sustainable development model of urban heating.

6 . Conclusions

The purpose of this paper is to provide a new method for the study of the sustainable development mode of urban heating. The analytic hierarchy process (AHP) is introduced into the study of urban heating sustainable development model, which is a quantitative analysis of the multiple factors that affect the choice of urban heating sustainable development mode. Due to the limited level of the author, the evaluation model established is still insufficient and needs to be refined, which needs to be perfected in the future practice.

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