Energy budget targeting index model based on energy consumption dual control

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Abstract: Aiming at the problems that it is difficult to avoid " one size fits all " when carrying out the dual control of energy consumption in local areas, the lack of clear rules and effective tools to support the dual control of energy consumption, and the asynchronous control of total energy consumption and intensity, a dual control of energy consumption targeting index model is proposed. According to the level of energy efficiency, different industries and enterprises are finely distinguished, and one industry, one index and one enterprise, one accounting are implemented. The priority of energy use is tilted to industries and enterprises with high energy efficiency levels, so that energy consumption is distributed more scientifically and reasonably among industries and enterprises within the industry, and the energy consumption structure of the whole region is optimized and reshaped.

1. Introduction

At the Fifth Plenary Session of the 18 th CPC Central Committee, the "double control" action of total energy consumption and intensity was proposed. The "14th Five-Year Plan" further pointed out that the total energy consumption and intensity should be improved. The power supply company undertakes the strategic task of exploring energy technology, which plays an important supporting role in promoting the dual control of energy consumption and improving the level of energy consumption control. In the process of assisting the government to carry out the work of energy consumption double control, it is found that the current energy consumption double control work faces three major pain points : first, when the local government carries out the work of energy consumption double control, even if the enterprise classification comprehensive evaluation mechanism is introduced as a reference, it is still difficult to avoid the phenomenon of "one size fits all" ; secondly, the current energy consumption dual control work lacks the support of clear rules and effective tools. On the one hand, the basis of regulation and decision-making is relatively vague. On the other hand, the calculation and verification of relevant data depends heavily on manual participation, and there is room for power rent-seeking. Third, the total energy consumption and intensity control are not synchronized. The current dual control of energy consumption basically focuses on the total energy consumption, and lacks attention to the energy consumption per unit value added.

In view of the above problems, how to put an end to the inaccuracy and unfairness in the allocation of energy consumption double control reduction and new energy consumption indicators, promote regional industry to create more industrial added value with the same total energy consumption, and guide industrial iterative upgrading is the current research focus of energy budget allocation. Therefore, innovating the energy budget management mechanism and establishing a set of energy budget management system mechanism suitable for the local situation will help to promote the completion of the dual control target task of total energy consumption and intensity[1].

2. Overview of energy budget management

Energy budget management is a concept introduced into the field of energy management by the field of financial management[2]. The energy budget management in this paper refers to the government 's decomposition, monitoring, statistics, reporting, supervision, assessment, rewards and punishments and other phased, whole process and systematic management of the use of energy rights. Doing a good job in energy budget management is of great significance to promote the refinement, scientific and informatization of energy management, improve the ability and level of energy management, realize the efficient allocation of energy resources, and ensure the completion of the "14th Five-Year" energy conservation and energy consumption total control objectives[3].

The energy budget management intends to make the limited total energy consumption indicators flow between regions and years, so as to achieve dynamic management. That is, considering the economic and social development plan, total energy consumption control and energy-saving target tasks, major productivity layout, etc., integrating the available energy consumption increment in each region, implementing measures to reduce energy consumption

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stock (reduction) such as eliminating backward production capacity stock energy, energy-saving technological transformation, and developing new energy renewable energy, waste heat and pressure power generation and other energy sources that are not included in the statistical scope ("open" energy), the total energy consumption budget indicators are approved, and more budget indicators are allocated to areas with large energy consumption stock reduction and "open" energy utilization[4].

3. The main problems of energy budget management

First, it is difficult to unify the method of determining the annual energy budget reference value. The benchmark value of energy budget is an important base for the allocation of energy budget indicators and the basis for the construction of energy budget management system. At present, the determination of the benchmark value of energy consumption budget is mainly based on the three types of energy evaluation and approval value, the average or maximum value of actual energy consumption in the past three years, and the industry benchmark limit standard. Each method has its own advantages and disadvantages, and it is difficult to take into account all enterprises in the region.

Second, the implementation effect of energy budget varies greatly. The most direct purpose of governments at all levels to carry out energy budget management is to complete the dual control index of energy consumption of higher levels of government. However, at present, energy budget management mainly covers key energy-consuming enterprises in high-energy-consuming industries. The proportion of energy consumption of such enterprises in regional energy consumption varies greatly, and the implementation effect of energy budget management will be quite different. It may occur that the annual budget target can be achieved, but the energy consumption dual control target cannot be achieved.

Third, the lack of strong support for energy data platform. At present, some cities have established digital platforms to monitor and manage energy-using enterprises. However, it is mainly based on the visual data collection and monitoring management of the government side, but the government side and the enterprise side cannot interact on the platform, lacking the online ' two-way early warning and flexible regulation ' function.

4. Targeting index model construction process

Based on the targeted index model of energy budget based on energy consumption double control, the development and application of the model are carried out around the energy consumption per unit value added, the energy efficiency level and production capacity are comprehensively considered, and the model system based on the three basic coefficients is established to avoid the error caused by the single coefficient model. After scientific calculation, a simple and easy-to-use targeted index is obtained to realize the accuracy, fairness and science of energy consumption double control. The model construction process is as follows :

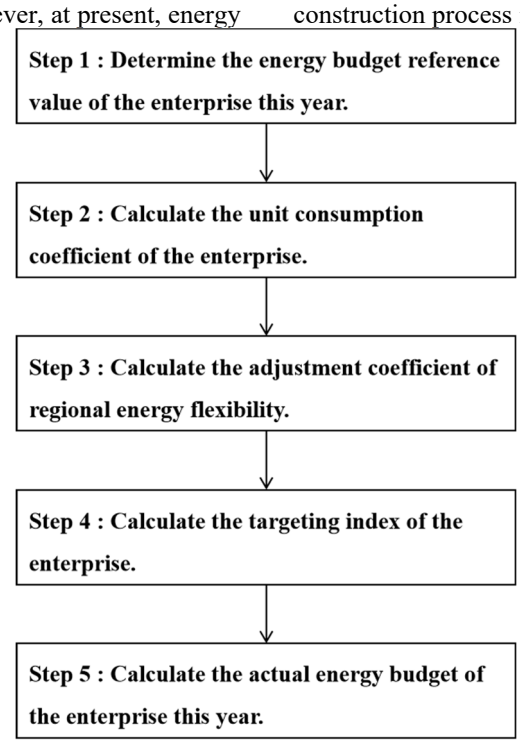

Figure 1. Energy budget targeting index model flow chart

4.1 Determine the annual energy budget reference value of the enterprise

To determine the energy budget reference value of the enterprise this year is to add the total comprehensive energy consumption of the enterprise in the previous year and the new release energy consumption in the current

year to determine the energy budget reference value of the enterprise this year. Using formula :

$$e_{Fj} = e_{Cj} + e_{Nj} \quad (1)$$

In the formula, $\mathbf{e_{Fj}}$ is the energy budget reference value of enterprise j this year, $\mathbf{e_{Cj}}$ is the total comprehensive energy consumption of enterprise j in the previous year, and $\mathbf{e_{Nj}}$ is the new energy release of enterprise j this year.

4.2 Determine the energy consumption coefficient of enterprise unit value added

Determine the unit value added energy consumption coefficient of the enterprise (referred to as the unit consumption coefficient of the enterprise), is calculated by the unit value added energy consumption of the enterprise in its industry level. Using formula :

$$r_j = \frac{p_j - p_L}{p_U - p_L} \quad (2)$$

$$p_{U、L} = p_M \pm \max(p_M - p_{min}, p_{max} - p_M) \quad (3)$$

In the formula, $\mathbf{r_j}$ is the unit consumption coefficient of enterprise j ; $\mathbf{p_M}$ is the unit added value energy consumption of enterprise j 's industry i ; $\mathbf{p_j}$ is the unit added value energy consumption of enterprise j ; $\mathbf{p_U}$ 、 $\mathbf{p_L}$ are the upper and lower limits of energy consumption per unit value added in the industry i of enterprise j ; $\mathbf{p_{max}}$ 、 $\mathbf{p_{min}}$ are the maximum and minimum value of unit value added energy consumption in the industry where enterprise j is located.

4.3 Determine the regional flexible adjustment coefficient

Determining the flexible adjustment coefficient of the whole region is to multiply the energy budget reference value of all enterprises in this year by the unit consumption coefficient of the enterprise and sum it to obtain a calculation process amount. The total comprehensive energy consumption of all enterprises in the previous year is divided by the calculation process amount, which is the flexible adjustment coefficient of energy consumption in the whole region. Using formula :

$$F_{flex} = \sum_1^n e_C \div \sum_1^n (e_{Fj} \times r_j) \quad (4)$$

In the formula, $\mathbf{F_{flex}}$ is the flexible adjustment coefficient of energy consumption in the whole region ; **n** is the number of all enterprises in the region.

4.4 Identify enterprise targeting index

The determination of enterprise targeting index is to multiply the unit consumption coefficient of the enterprise by the flexible adjustment coefficient of energy consumption in the whole region, which is the enterprise targeting index. Using formula :

$$t_{Tj} = r_j \times F_{flex} \quad (5)$$

4.5 Determine the annual actual energy budget of the enterprise

Determining the actual energy budget of the enterprise this year is to multiply the reference value of the energy budget of the enterprise this year by the enterprise targeting index, which is the actual energy budget of the enterprise. Using formula :

$$e_{Aj} = e_{Fj} \times t_{Tj} \quad (6)$$

5. Numerical example

Taking a textile enterprise as an example, the above targeting index model is used to allocate the actual energy budget of the enterprise in 2022. First of all, based on the total energy consumption of the enterprise in 2021 and the new energy release in 2022, the energy budget reference value of the enterprise in 2022 is determined.

Table 1. The energy budget reference value in 2022

Total comprehensive energy consumption in 2021	26262tons of standard coal
New energy releases in 2022	484tons of standard coal
Energy budget reference value for 2022	26746tons of standard coal

Secondly, the energy consumption coefficient of the unit added value of the enterprise is calculated by the level of the energy consumption of the unit added value of the enterprise in its industry, and the unit consumption coefficient of the enterprise is 0.9733.Then, the energy budget reference value of all enterprises in this year is multiplied by the unit consumption coefficient of the enterprise and summed to obtain a calculation process quantity. The total comprehensive energy consumption of all enterprises in the previous year is divided by the calculation process quantity, and the flexible adjustment coefficient of energy consumption in the whole region is 1.019.Then, based on the unit consumption coefficient of the enterprise and the flexible adjustment coefficient of energy consumption in the whole region, the product is obtained, and the enterprise targeting index is 0.9919.Finally, the enterprise 's actual energy budget of 26528 tons of standard coal is calculated by multiplying the reference value of the enterprise 's energy budget in 2022 by the enterprise targeting index.

The targeted index model is applied to allocate the actual energy budget of the region in 2022. Compared with the energy consumption per unit value added in the same period last year, the energy consumption per unit value added of the seven high energy-consuming industries decreased by 5.41 %, and the energy consumption per unit value added of the industrial units in the whole region decreased by 9.26 %, indicating that the application effect of the targeted index model is more significant.

Table 2. The change of unit consumption before and after the application of the model

industry	Unit consumption in the same period of 2021	Adjusted unit consumption in 2022	Unit consumption amplitude
Seven high energy-consuming industries	1.3920ton of standard coal / ten thousand yuan	1.3167ton of standard coal / ten thousand yuan	-5.41%
Industry in the whole region	0.7323ton of standard coal / ten thousand yuan	0.6645ton of standard coal / ten thousand yuan	-9.26%

6. Conclusion

Energy budget management is an important means to effectively control the excessive growth of energy consumption, optimize energy allocation and promote fine management and control. The energy budget targeting index model based on dual control of energy consumption can first eliminate the inaccuracy and unfairness in the distribution work under the principle that the higher the energy efficiency level is, the less energy is used and the more new energy is used. Secondly, from the perspective of management, it can promote regional industry to create more industrial added value with the same total energy consumption, thus reducing the energy consumption per unit added value of regional industry. Finally, the priority of energy use can be tilted to enterprises with better energy efficiency level, forcing enterprises to carry out more extensive and in-depth technological innovation, complete industrial iterative upgrading and enterprise positioning remodeling, and create new value for the industrial chain.

References

1. Liu R,Wang Xm,Yue G, et al.（2017）Research on the mechanism of energy budget management system [J]. Energy And Environment,4:7-9.
2. Chen Xg,Wu Dj.（2018）It is of great significance to promote the construction of energy consumption online monitoring system[J]. energy saving and environmental protection,23-25.
3. Xing Lu,Shan Bg.（2012）The international experience and enlightenment of China 's total energy consumption control[J]. Chinese Energy Sources,9:14-16.
4. Li Z.（2021）Research on Beijing 's energy budget management mechanism during the "14 th Five-Year "Plan period[J]. Research,70-71.
5. Xu Hf,Zhou Xj,He H, et al.（2023）Research and Thinking on Energy Budget Management in Counties of Zhejiang Province[J]. Shanghai Energy Conservation,1:47-52.
6. Wu B,Gao Hw.（2021）Analysis of carbon emission reduction effect of energy
7. consumption " double control" policy[J]. Chinese Energy Sources,6:39-45.
8. Wang Jk.（2017）Research on energy consumption increment assessment and energy consumption allocation mechanism[J].Energy-saving Technique,(35)3:283-288.
9. Zhejiang Development and Reform Commission.（2019）Interim Measures for the Administration of the Third Party Audit Institutions for the Paid Use and Transaction of Energy Rights in Zhejiang Province[EB].
10. State Council.（2021）Carbon Peak Action Plan by 2030[EB/OL].
11. Zhejiang Development and Reform Commission.（2022）Zhejiang 's ' 14th Five-Year ' energy development plan[EB/OL].