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International
Journal
Of Modern Engineering Research (IJMER)

Comparison of Energy Consumption of Four States

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ABSTRACT In order to compare of energy consumption of four states, we establish the entropy weight coefficient method model, and use TOPSIS algorithm to get our solution. We assert that Texas has the best use of clean energy.

KEYWORDS: entropy weight coefficient method model, regression model, clean and renewable energy.

Date of Submission: 06-04-2018 Date of acceptance: 21-04-2018

I. INTRODUCTION

Energy production and usage are a major portion of any economy. In the United States, many aspects of energy policy are decentralized to the state level. Additionally, the varying geographies and industries of different states affect energy usage and production. In 1970, 12 western states in the U.S. formed the Western Interstate Energy Compact (WIEC), whose mission focused on fostering cooperation between these states for the development and management of nuclear energy technologies. An interstate compact is a contractual arrangement made between two or more states in which these states agree on a specific policy issue and either adopt a set of standards or cooperate with one another on a particular regional or national matter.

The demand for energy of a country will directly affect the formulation and implementation of energy policy such as energy strategy planning, energy supply and demand distribution and energy conservation and emission reduction. To do a good job in the above planning is of great significance to the sustained and healthy economic development of a country. Obviously, different regions and industries in different countries also affect energy use and production. On the border between the United States and Mexico, there are four states - California (CA), Arizona (AZ), New Mexico (NM), and Texas. This paper discusses the widespread use of clean and renewable energy form a realistic new energy contract.

In this paper, Determine which of the four states in 2009 appears to have been the "best" profile of using clean renewable energy.

II. MAIN RESULTS

In system science, entropy is an indicator of the degree of systematic disorder, and it can also measure the useful information provided by the data. Therefore, entropy can be used to determine the weight. When there is a big difference between the evaluated objects in a particular index, the entropy value is small, indicating that the index should provide more effective information when the index weight should be larger; on the contrary, the smaller the difference, the larger the entropy, indicating The smaller the amount of information provided by the indicator, the smaller the indicator weight. When the value of each of the evaluated objects reaches the same one, entropy reaches the maximum, which means that this indicator does not provide any useful information to make a decision, so we can consider removing it from the evaluation indicator system. Therefore, entropy coefficient method is an objective method of empowerment. Determining weight by calculating entropy is simply a way of determining the weight of each indicator based on how much the value of each of the measures is evaluated.

Suppose there are m evaluation indexes and n evaluation objects, that is, the original data matrix For indicator i, the greater the difference between the indicator values x , the greater the contribution of the indicator to the overall assessment. If the index value of one index is the same, then this index will not play an important role in the comprehensive evaluation. The main steps to determine the weight using the entropy coefficient method

are as follows: the original data matrix standardization
Assuming there are m evaluation indexes and n evaluation objects, the original data matrix is as follows:
In order to normalize the matrix, the result is:

$$Y=\begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1n} \\ y_{21} & y_{22} & \cdots & y_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ y_{m1} & y_{m2} & y_{m3} & y_{m4} \end{bmatrix} \qquad (1)$$

$$R=\left(r_{ij}\right)_{m\times n} \qquad (2)$$

Is the standard value of the j the evaluation object on the i the evaluation index　Among them:

Play an active role in the indicator:(1) $Y_{ij}'=\left(maxY_j-Y_{ij}\right)/\left(maxY_j-minY_j\right)$

This indicator plays a negative role: $Y_{ij}'=\left(Y_{ij}-minY_j\right)/\left(maxY_j-minY_j\right)$

②Definition entropy When there are m evaluation indexes and n evaluation objects in the evaluation index, the entropy of the i-th index is defined as:

$$Hi=-k\sum_{j=1}^{n} f_{ij}\ln f_{ij},\quad i=1,2,\ldots,m \qquad (3)$$

$$f_{ij}=\frac{r_{ij}}{\sum_{j=1}^{n} r_{ij}},\ \ k=\frac{1}{\ln n},\ \ when\ f_{ij}=0,\ so\ \ f_{ij}\ln f_{ij}=0 \qquad (4)$$

③Determine the entropy in determining the i-th index of the entropy, the i-th index of entropy is defined as:

$$w_i=\frac{1-H_i}{m-\sum_{i=1}^{m} H_i},\ \ 0\le w_i\le 1,\ \sum_{i=1}^{m} w_i=1 \qquad (5)$$

TOPSIS is one of the most famous classic indexing methods. TOPSIS method includes two basic concepts: ideal solution and the negative the ideal solution. The so-called ideal solution is an optimal solution, each of its attribute values, also known as weight, in the alternative to achieve the best value; negative ideal solution is the worst-case solution of each attribute value to the worst value. The program ranking rule compares each option with the ideal solution and the negative ideal solution. If one of the solutions is closest to the ideal solution and away from the negative solution, then the solution is one of the best solutions. (Distance is calculated based on Euclidean distance.)

This method assumes that each property is monotonously increasing or decreasing. In order to achieve this condition, we cite the above-mentioned linear regression coefficients. If the coefficient is positive, we think the variable is monotonously increasing; likewise, a negative coefficient means a decrease.

The steps we run are as follows: Standardized decision matrix. The 11 characters of these four states are taken as x KJ, and the normalized matrix A. r represents the j character of the normalized I state.

$$a_{ij}=\frac{z_{ij}}{\sqrt{\sum_{k=1}^{m} z_{ij}^2}},\ i=1,\cdots,m;\ j=1,\cdots,n \qquad (6)$$

(1)　Calculate the weighted normalized decision matrix (w　from 5.1.1.1):

$$v_{ij}=w_i r_{ij},\ i=1,\cdots,m;\ j=1,\cdots,n \qquad (7)$$

(2)　Determine the ideal solution and the negative ideal solution:

$$A^{+}=\left\{v_1^{+},\cdots,v_1^{+}\right\}$$
$$A^{-}=\left\{v_1^{-},\cdots,v_1^{-}\right\} \qquad (8)$$

Where: A represent the ideal solution.　A represent　a negative ideal solution.　Take j as an example:

$$v_j^{+}=max\left\{v_{ij},i=1,\cdots,m\right\}\quad v_j^{-}=min\left\{v_{ij},i=1,\cdots,m\right\} \qquad (9)$$

(3)　Calculate the distance from each alternative to the ideal and negative ones

$$D_i^+ = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^+)^2},\ i = 1,\cdots,m$$

$$D_i^- = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^-)^2},\ i = 1,\cdots,m \qquad (10)$$

D_i^+ Represents the distance from solution i to the ideal solution.

D_i^- Represents the distance from the solution I to the negative ideal solution.

(4) Calculate the best solution closest to the ideal solution

$$C_i = \frac{D_i^-}{D_i^+ + D_i^-} \qquad (11)$$

(5) Sort the solution in descending order of C_i.

Table 1

State	Arizona	New Mexico	California	Texas
C\	0.6917	0.6490	0.4871	0.3708

From the above results, we can conclude that the energy situation in Texas is the best. Although California is secondary, it also serves as a reference.

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Bingjun Li." Comparison of Energy Consumption of Four States." International Journal Of Modern Engineering Research (IJMER), vol. 08, no. 04, 2018, pp. 41–43.