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Predictions of energy profile of four states in USA

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Abstract

In this paper, we calculate the value of the residual energy in 2001-2009 in four states by establishing Grey Prediction Model. We use MATLAB software programming to predict the energy profile of each state, as you have defined it, for 2025 and 2050 in the absence of any policy changes.

Keywords: Entropy weight coefficient method model; regression model; clean and renewable energy.

1. Introduction

Energy is an important material basis for people's survival. It is also the basis for all countries to achieve economic growth and promote social development. The sustainable development of a country cannot do without sufficient energy security. With the rapid development of modern society, the human demand for energy is increasing day by day. However, the contradiction between the limited traditional energy and the energy needed for its development has become increasingly prominent. As a result, green energy such as clean energy and renewable resources has become the focus of international attention today. More countries will save energy, develop renewable resources and clean energy as a long-term strategy for energy development.

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, we calculate the value of the residual energy in 2001-2009 in these four states by establishing Grey Prediction Model, and use MATLAB software programming to predict the energy profile of each state, as you have defined it, for 2025 and 2050 in the absence of any policy changes.

We get that Arizona and Texas may have a large energy profile in the future. They can meet their energy use based on their own production.

2. Main results

2.1 Model Theory

We often call the system of information clearly known as the white system. The unknown information in the system is called the block system. Part of the information in the system is clear, and some of the information are not clearly known as the gray system.

Incomplete information systems can be viewed in the following four situations:

1. The element information is incomplete
2. Structural information is incomplete
3. The order information is incomplete
4. Operational behavior information is incomplete

The gray prediction method has the following features: First, it treats discrete data as continuous variables and discrete values in the process of change so that instead of using the raw data directly, the generated quantity is added up and a series of models are generated using differential equations by using the differential equations. In this way, most random errors can be offset. Finally, you can show the regularity.

2.2 Model Basis

The differential equation of gray system theory becomes Gm model. G represents gray, m represents model, Gm (1,1) represents the first order, and a variable differential model.

The modeling process and mechanism of Gm (1,1) are as follows:

Record the original data sequence is non-negative sequence

From $\quad , x^{(0)}(k) \geq 0, k = 1,2,\cdots,n$

The corresponding generated data sequence is

$$X^{(1)} = \{x^{(1)}(1), x^{(1)}(2), x^{(1)}(3), \ldots, x^{(1)}(\mathrm{n}))\}$$

From $\quad , x^{(1)}(k) = \sum_{i=1}^{k} x^{(i)}(i)$, k = 1,2, ..., n

Generate a sequence for live average

$$Z^{(1)} = \{z^{(1)}(1), z^{(1)}(2), z^{(1)}(3), \ldots, z^{(1)}(\mathrm{n}))\}$$

From , $\quad Z^{(1)}(k) = \frac{1}{2}(x^{(1)}(k) + x^{(1)}(k-1))$, k = 1,2, ..., n

Then we called $x^{(0)}(k) + az^{(1)}(k) = b$ As a Gm (1,1) model, a and b are parameters that need to be solved by modeling if $a = (a,b)^{\mathrm{T}}$ Is a parameter column, and

$$Y = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ \vdots \\ x^{(0)}(n) \end{bmatrix}, \quad B = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(1)}(3) & 1 \\ -z^{(1)}(4) & 1 \\ -z^{(1)}(5) & \end{bmatrix}$$

Then, the least-squares estimation coefficient sequence of the differential equation is calculated $x^{(0)}(k) + az^{(1)}(k) = b$, should be satisfied

$$\hat{a} = (B^T B)^{-1} B^T Y$$

$$\frac{dx^{(1)}}{dt} + ax^{(1)} = b$$

Called the gray differential equation,

$$x^{(0)}(k) + az^{(1)}(k) = b$$

It is called the shadow equation. As mentioned above, then there

1. The whitening equation solution or time response function is

$$\hat{x}^{(1)}(t) = (x^{(1)}(0) - \frac{b}{a})e^{-at} + \frac{b}{a}$$

2. The time response sequence of Gm (1,1) gray differential equation is

$$\hat{x}^{(1)}(k+1) = (x^{(1)}(0) - \frac{b}{a})e^{-ak} + \frac{b}{a}, k = 1,2,\cdots,n$$

3. Select $x^{(1)}(0) = x^{(0)}(1)$,then

$$\hat{x}^{(1)}(k+1) = (x^{(0)}(1) - \frac{b}{a})e^{-ak} + \frac{b}{a}, k = 1,2,\cdots,n$$

4. Restore the value

$$\hat{x}^{(0)}(k+1) = \hat{x}^{(1)}(k+1) - \hat{x}^{(1)}(k), k = 1,2,\cdots,n$$

2.3. Solutions and Results

First, we calculate the value of the remaining energy percentage.

year	2001	2002	2003	2004	2005	2006	2007	2008	2009
AZ	-0.95175	-0.95362	-1.11716	-1.19019	-1.41622	-1.98685	-1.91096	-1.67441	-1.54699
CA	-1.61642	-1.59303	-1.65294	-1.85486	-1.81178	-1.84489	-2.07611	-2.12212	-2.07277
NM	0.761077	0.758479	0.757261	0.751033	0.752432	0.74123	0.718049	0.7172	0.722208
TX	-0.06083	-0.11408	-0.09706	-0.11572	-0.06566	-0.08974	-0.06117	0.024785	0.051833

Part of the remaining percentage of energy in the graph

Then we started using the gray prediction model to predict 2025 and 2050. Through programming, we use a computer for gray model applications. The final result is as follows.

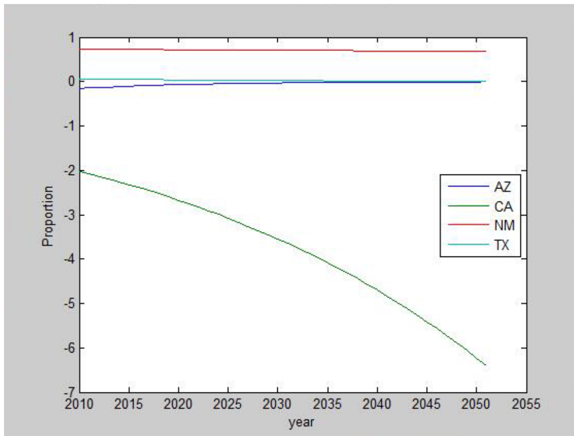

Figure 1. **simulates the percentage of remaining energy**

The proportions in Arizona and Texas are similar, with the ratio remaining at zero from 2010 to 2050, which means that their energy production is almost equal to their energy consumption. The ratio of NM from 2010 to 2050 also has long-term stability. The most surprising is the proportion of California. About -2, falling to -3 and -6.5 in 2020 and 2050, respectively.

Forming a data analysis, we have some predictions. First, Arizona and Texas may have a large energy profile in the future. They can meet their energy use based on their own production. More importantly, although the NM ratio is not as stable as the above, the figure shows that it can provide more energy to other countries or export to other countries.

References

[1] https://www.eia.gov/state/seds/sep_use/notes/use_tot.pdf

[2] http://westernenergyboard.org/wieb-board/who-what/

[3] https://en.wikipedia.org/wiki/Geography_of_Arizona

[4] https://en.wikipedia.org/wiki/Geography_of_California

[5] https://en.wikipedia.org/wiki/Climate_of_Texas

[6] https://wrcc.dri.edu/narratives/NEWMEXICO.htm

[7] Yi Desheng , Guo Ping: Grey Theory and Method, Petroleum Industry Press, 1992.