Research on User Oriented Benefit Evaluation Model of Power Demand Side Management Based on Computer Software

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Abstract. Power demand side management (hereinafter referred to as DSM) is an important part of smart grid construction in China, which can realize scientific energy saving and power saving. Through DSM, the power grid can dispatch power based on user demand, which can support the sustainable development of national power industry. At the same time, through DSM, the power grid can transmit power intelligently, which is of great significance to the energy conservation and emission reduction of the society. With the construction of smart grid, power DSM has formed an important management system, which can better expand the intelligent and scientific power grid. Through the continuous transformation to energy-saving management system, the traditional load management is no longer suitable for the needs of the society, which requires us to comprehensively review the development of smart grid. Through the DSM system, we can expand the load analysis management means in smart grid, which will better tap the demand side resource potential. Through the effective evaluation system, we can provide more comprehensive, scientific and accurate decision-making basis. Firstly, this paper presents the current load forecasting methods. Then, a model is proposed. Finally, some suggestions are put forward.

Keywords: Computer Software, User Orientation, Dsm, Benefit Evaluation Model

1. Introduction

DSM is a mode of implementing energy efficiency and load management for terminal power users, which is an important way of integrated resource planning. Through the DSM system, the power grid can reduce the power consumption and demand when meeting the same power [1]. In this way, the power grid can save relevant resources, which will provide low-cost power services for the society. Through DSM, the power grid can more scientifically implement the scientific concept of development, which will be more corresponding to the strategic requirements of energy conservation and emission reduction in China. In recent years, the government departments actively promote DSM, which can gradually change to economic and technological means for the purpose of means, which will gradually change the traditional peak shifting and valley filling means [2]. Therefore, the power DSM long-term mechanism is gradually established, which needs to fully tap the demand side
resource potential with energy efficiency as the main factor. At the same time, we put forward a set of perfect DSM project evaluation price system, which can comprehensively consider various practical factors [3]. Through the benefit evaluation model of DSM, the power grid can get comprehensive, scientific and accurate decision-making basis.

2. Power demand forecast

2.1. National electricity consumption data

According to the total amount of electricity consumption in China, this paper constructs a prediction model of electricity consumption, which can get the relevant forecast [4]. The total electricity consumption from 2008 to 2019 is shown in Table 1.

Table 1. Total electricity consumption from 2008 to 2019 (unit: 100 million kwh).

| Year | Electricity consumption (100 million kwh) | Growth rate |
|------|-----------------------------------------|-------------|
| 2008 | 34259                                   |             |
| 2009 | 36430                                   | 5.96%       |
| 2010 | 41923                                   | 15.08%      |
| 2011 | 46928                                   | 11.94%      |
| 2012 | 49591                                   | 5.67%       |
| 2013 | 53223                                   | 7.32%       |
| 2014 | 56384                                   | 5.94%       |
| 2015 | 58020                                   | 2.90%       |
| 2016 | 59187                                   | 2.01%       |
| 2017 | 63094                                   | 6.60%       |
| 2018 | 68449                                   | 8.49%       |
| 2019 | 72255                                   | 5.56%       |

2.2. Stability test

Through Eviews, this paper carries out the stationary detection. Through the analysis of autocorrelation graph and partial correlation graph, we can see Figure 1. If P < 0.5, then the sequence is stationary [5].

Figure 1. Stability test.

The autocorrelation and partial correlation of the first-order differential stationarity detection are shown in Figure 2.
The autocorrelation and partial correlation of the second-order differential stationarity detection are shown in Figure 3.

2.3. AR (2) model
The AR (2) model is shown in Figure 4.

2.4. The model prediction
Using Eviews, this paper analyzes the prediction model form 2020 to 2022, as shown in Figure 5. We can get the predicted values, as shown in Table 2.
Figure 5. Second order differential sequence diagram.

Table 2. The predicted values from 2020 to 2022 (unit: 100 million kwh).

| Year | Predicted Values |
|------|------------------|
| 2020 | 44620.99289508497 |
| 2021 | 45590.86350977743 |
| 2022 | 45672.46304211371 |

3. Benefit evaluation of DSM

3.1. SWOT analysis of DSM

SWOT analysis method is a situation analysis method, which can be carried out according to the internal characteristics and competitiveness of enterprises [6, 7]. By analyzing the external environment of the enterprise, we can analyze the opportunities and threats of DSM, as shown in Table 3.

Table 3. SWOT matrix analysis.

| Opportunity | Strong | Weak |
|-------------|--------|------|
| 1. Deepening China's economic system reform | 1. Internet plus provides supporting resources, such as policy, capital and technology | 1. Application and promotion of monopoly affecting DSM |
| 2. Electric power system reform in China | 2. Advantages of learning advanced technology in the international community | 2. Developing countries are vulnerable to institutional imitation inertia |

| Threat | S-O | W-O |
|--------|-----|-----|
| 1. The change and guidance of multi subject consciousness | 1. Relying on internal advantages | 1. Overcome internal weaknesses |
| 2. Supporting policies need to be improved | 2. Take advantage of external opportunities | 2. Take advantage of external advantages |

3.2. Construction of evaluation index system

At present, China must realize the long-term and stable development of DSM, which needs to clarify the benefits of DSM [8]. Therefore, this paper must establish a complete DSM benefit evaluation method, which can provide a basis for decision-making, as shown in Figure 6.
4. Development path selection of power DSM

4.1. Play the role of market mechanism
DSM and market mechanism are closely linked, and they promote each other. At present, the construction of international electricity market mechanism can be roughly divided into four aspects: energy service competition mechanism, demander resource competition mechanism, demand side response mechanism and energy efficiency license trading mechanism. Power DSM is gradually developed on the basis of market mechanism. The German federal government introduced the market competition mechanism by improving the energy law, which created conditions for the implementation of DSM projects. In the Nordic electricity market, Denmark requires distribution companies to prepare a DSM plan every two years. DSM is helpful to the transformation and development of the market. As a result, appliance manufacturers must improve the performance of their products, which will meet the prescribed energy efficiency standards. The increase of energy-saving products can promote the development of energy-saving industry, which will gradually replace and eliminate high consumption products, equipment and industries.

4.2. Strengthening demand side response mechanism
Any user with flexible electricity demand can participate in the demand side response mechanism. Through the price mechanism, power enterprises can also change the electricity consumption habits of users. Power companies can encourage customers to participate in demand side response by reducing electricity charges or providing financial support. By confirming the acceptance of demand side response, customers can install special controllers and monitors, which can choose their most satisfactory pricing scheme. In this way, enterprises can tailor the electricity price scheme to meet their individual needs.
5. Conclusion
China's power system is undergoing market-oriented reform, which requires us to change the traditional concept. Through DSM, power users can provide multi agent services, which will change the traditional single agent environment. By popularizing DSM knowledge, we can actively guide the public to participate, which will give full play to the competition mechanism and price mechanism. Through DSM, we can provide personalized services according to the needs of customers.

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