Discussion and Technical Application of Integrated Energy Planning

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Abstract. Low carbon economy is an inevitable trend of social development. Distributed energy, smart grid and Internet technology are more and more widely used. Based in variety of energy requirement, a integrate energy planning method for is discussed, which include technic of multi-load forecasting, energy integrate and smart grid design. The various steps and the application of the technology to be described in the article. Relevant cases at home and abroad will be introduced in this paper. The brief situation of the project, experience and technical applications are described.

Background

Low carbon economy is an inevitable trend of social development. Great changes have been taken place in development mode of energy and power. Distributed energy, smart grid and Internet technology are more and more widely used in our life. In the new urban construction, green development, intensive layout, intelligent management is the main focus. This is shown as follows:

![Figure 1. Key factor of Smart city.](image)

New problems are faced in Energy integration, supply quality, and economic efficiency with application of smart grid, many city construct projects have applied integrate energy planning technology.

In this paper, a integrate energy planning method for is discussed. This method is based on Multi-time scale forecasting power and energy balance and influence analysis of power grid.

In addition, relevant cases at home and abroad will be introduced in this paper. The brief situation of the project, experience and technical applications are described.

Technical Discussion

Demand Forecasting

According to the requirements and characteristics of the multi energy configuration, the multi-energy energy demand forecasting mainly includes data processing, multi-time scale and multi energy conversion.

The main procedure of demand forecasting discussion is shown as follows:
In data procession: Energy demand of city layout including electrical power, cold and heat load of the building in the area can be obtained through the different users. These are the foundations of the load history database.

The conversion of multi energy sources is mainly determined by the unified conversion parameter such as kw, kcal and so on. In the process, a converting unified unit of the program will be configured.

The year scale data can be obtained from by economic and industrial development. Multiple linear fitting method is used to convert the time scale.

The results of different time scales are obtained for balance and operation simulating, for the basis for different energy allocation schemes.

Energy Integrated

Based on energy demand of the area, method of energy integrated will be discussed. Various energy sources be optimized from the technical and economic aspects.

First, database of energy supply components will be established. Technical and economic parameter will be input and classified.

According to local conditions, a variety of energy allocation schemes will be proposed, including schemes of External supply, efficient use plan, green energy and so on.

The optimization model of decision variables is mainly considered. In the case of energy demand. All kinds of schemes will be comprehensively analysed and compared. Technical, economic and social benefits have their own coefficients. The unified comparative scale is adopted such as currency.

This integrated method compares and analyses the various traditional energy production and new energy production in utilization plans. This is shown as follows:
Smart Grid
The main feature of the smart grid is highly automated control and monitoring of modern communication technology. Generally, Complex energy supply form will be applied in the smart-grid.

Smart grid consists of intelligent power distribution station, unified dispatching management centre, advanced communication system and intelligent user terminal.

In details, many distribution circuits operate in a radial fashion, three-phase main feeder with single-, two-, or three phase laterals.

The design and operation is based on the assumption of centralized generation and the corollary that power always flows from the distribution substation to end-use customers.

The purpose construction of smart grid is shown as follows:

Application of Smart Energy
Kashiwa-no-ha Smart City
Kashiwa-no-ha Smart City optimizes energy usage for the entire city. AEMS plays a pivotal role in this setup, drawing on an independently operated power grid and enabling area expansion as well as enhancing functions. This system is designed to contribute to smart grid progress that underpins lifestyles and innovations[9].

The area integrate energy system is shown as follows:
A smart grid that shares solar, storage cell, and other distributed energy sources between districts was operated in smarty city. Peak electricity consumption for the entire town by sharing electric power company and distributed power between districts will be cut through private transmission lines.

**China-Singapore Knowledge City**

China-Singapore Knowledge city is located in north of Guangzhou, which area of about 120 square kilometres. Based on the analysis of energy demand and resource conditions, a regional power supply scheme with multiple power sources is proposed. Combine regional distributed energy, building type distributed energy and green PV generator, the clean energy allocation in the park has realized the complementary function of multi energy. Reliable transmission is implemented in smart grids with different voltage levels. Digital substation in power users is located near for the transmission of power User interaction is implemented by various mode.

Smart energy construction of China-Singapore Knowledge city is shown as follow:

Area can save 0.8 million tons of standard coal and reduce carbon dioxide emissions by 2 million tons annually. Remarkable social benefits have been achieved.

China-Singapore Knowledge city energy system was selected as national internet-energy demonstration project.
Low–carbon City

Low carbon city is located in west of Shenzhen, which area of about 2 square kilometres. Large scale new users provide a good market for energy utilization. The application scheme of a power grid control centre integration is put forward. CCHP provides power supply and cooling for Park. Biogas power generation has effective reuse of regional waste. Intelligent distribution network planning and design are based on distributed energy deployment. All types of energy are controlled by the energy centre.

The construction diagram is shown as follows:

![Diagram of Low Carbon City](image)

Figure 9. Constructure of low carbon City.

Energy system can save 13,000 tons of standard coal and reduce carbon dioxide emissions by 40,000 tons annually in low-carbon city area. Remarkable social benefits have been achieved. Low carbon City energy system was selected as national energy demonstration project.

Conclusion

Integrated energy application mode will be used in more and more city. This paper introduce new method if integrate energy planning. The method plays an important guiding role and reference for city construction, energy allocation.

In the future work, the procedure of plan will be improved. On the basis of the method of integrate Energy planning, energy planning work of advanced big city area will be carried out. The technology and control level of a city in energy tend to be improved by formulating the development strategy, making the general planning.

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References


