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ScienceDirect

Procedia Engineering 205 (2017) 680–685

Procedia Engineering

www.elsevier.com/locate/procedia

10th International Symposium on Heating, Ventilation and Air Conditioning, ISHVAC2017, 19-22 October 2017, Jinan, China

Prediction and Research on the Dynamic Load of A Certain Industrial Park in Shenyang

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Abstract

To improve the sustainable development of the industrial park, a more accurate cooling load estimation method was adopted to provide the basis for the selection of the size of the cold and heat sources. DeST simulation software was used to simulate the building energy consumption, and nine factory buildings' dynamic load analysis model were established. The distribution of hourly cooling load of the industrial park was obtained. Compared with the total load of traditional designed heating load method, this method achieved to saving energy 18%. In the energy planning of industrial park, the introduction of dynamic load forecasting method has advantages for the sustainable development of the park. It influences the reduction of energy consumption and save of initial investment. The research lays the foundation for the realization of the rationality, the scientific nature and the energy conservation and emission reduction of the construction.

Peer-review under responsibility of the scientific committee of the 10th International Symposium on Heating, Ventilation and Air Conditioning.

Keywords: Dynamic load; DeST; Industrial Park; Shenyang

1. Introduction

In the traditional load forecasting, the predictors used the area thermal index method to forecast the load, which became a general and legitimate load forecasting method. However, this prediction method re-enlarges the demand side load [1]. And the cooling capacity of the cooling load determined by this load index is about 1/3 greater than the actual demand [2]. Meanwhile, the industrial energy consumption accounted for nearly 70% of China's energy consumption, while the industrial building energy consumption accounted for more than 10% of industrial energy consumption [3].Therefore, it is necessary to develop the annual dynamic load forecasting method in the industrial

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1877-7058
Peer-review under responsibility of the scientific committee of the 10th International Symposium on Heating, Ventilation and Air Conditioning.
10.1016/j.proeng.2017.09.841

park planning, and is also the trend of scientific and energy-saving requirements, which will have a positive impact on energy conservation.

At this stage, the annual dynamic load forecasting methods include: time series method, regression analysis, gray prediction method, neural network method and other methods. Using the seasonal time series model, Sun Jing and others predicted the air conditioning load of Shanghai medical center, and got a relatively high prediction accuracy [4]. Wang Du et al. established the residual sequence on the basis of the general gray model GM (1,1), and divided the sequence into several periodic waves by periodic homogeneous superposition method, which obviously improved the medium-term prediction accuracy[5]. Based on this, taking an industrial park in Shenyang as an example, the author applies the building energy consumption simulation method, and uses DeST software to carry out annual dynamic load forecasting and research.

2. Methods

2.1. General situation of the industrial park construction

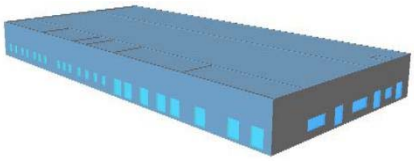
The industrial park is located in Liao zhong Coastal Economic Zone, Shenyang. The park width of east-west is 1550m, length of north and south is 856m, which can be planned land area of 1040306.61m−2. Building monomers include body stamping, welding the joint plant, body paint shop, assembly shop, testing adjustment workshop, frame joint workshop, car body shop, car joint factory, chassis parts library shop, laboratory shop, storehouse material warehouse, sewage treatment station and so on.

2.2. Establishment of dynamic load analysis model

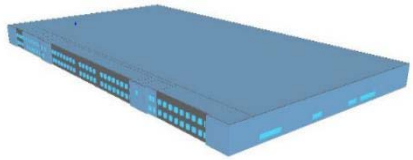
The research objects are all kinds of buildings of industrial park, In order to simplify the model and keep the accuracy of the simulation results, the author puts forward the classification method of the main influencing factors. The author selected nine typical plants of high energy consumption as the modeling objects, the basic situation of construction showed in table 1. By studying the methods of domestic and foreign industrial park building load forecasting and finishing building design data, each of buildings was made a simulation analysis with combining a variety of specifications on Shenyang City Industrial Park plant. It will determine the impacts of various influencing factors on the dynamic load of the building, then build the dynamic load of each building corresponding analysis model. Partial building model are shown in Fig. 1.

Table 1. Basic situation of construction.

Building name	Building area [m^2]	Building storey	Building height[m]
Body stamping and welding the joint plant	42881.81	1−3	19.50
Body paint shop	29041.46	2	19.50
Assembly shop	28531.34	1−3	14.50
Testing adjustment workshop	5572.04	1	9.50
Frame joint workshop	15399.16	1−2	14.50
Car body shop	8470.77	1−2	13.10
Car joint factory	16618.00	1−2	16.20
Chassis parts library shop	16027.12	1−2	10.50
Laboratory shop	5663.60	1−2	12.50



Testing adjustment workshop



Chassis parts library shop