Analysis on the Planning and Architectural Design Strategy of the Area in the Front of Modern Thermal Power Plant

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Abstract. Thermal power generation is the main power generation type in China. The area in the front of the power plant serves the whole power plant and plays a vital role. In this paper, concerning the overall planning and design of individual building of the area in the front of thermal power plant, the particularity factor that is different from that of common civil building is analyzed. In combination with specific cases, the main ideas and optimization strategies of architectural design in the area in the front of thermal power plant is proposed.

Introduction

As a basic industry of social development and national economy, electric power industry is developing rapidly in recent years. It is expected that by 2020, China's power generation capacity will exceed 10×10⁸ KW, of which thermal power generation plays a dominating position. Among them, area in the front of the plant, as an important space node of the power plant, is drawing more and more people's attention.

Particularity Analysis on Buildings in the Front Area of the Plant That is Different from Other Civil Buildings

Buildings in the front of the power plant are different from other buildings with the characteristics of mechanization and lifelessness in the power plant, which have the characteristics of the common civil building, but with a big difference from common civil building in the environment background and so on. In the architectural style, material, color, shape, etc., it is different from the common civil building.

Special Location of Buildings in the Front of the Power Plant

In the planning and design stage, common civil buildings play an absolutely important role in the field. Thermal power plant design mainly takes the main power house as the primary consideration. Site traffic and plant production flow design are based on the design of main power house. The planning and design of the area in the front of the plant is affiliated to that of the main power house and is in a secondary position.

Special Environment Background of Buildings in the Front of Plant

Common civil buildings are located in a relatively free environment in the city with free architectural style and non-constrained space form, which are easy to produce rich combination of volume.

The design of buildings in the front of the plant is under the environment background of power plant mechanization and industrialization. The buildings in the front area of the plant are affiliated
to main power house. They are constrained greatly in the design style. The architectural style is usually neat; the façade is concise, which can reflect the industrial aesthetics (Fig.1, Fig. 2).

Figure 1. Huaneng Laiwu Power Plant Project Extension Project Administrative Office Building Construction Stage (Source: photographed by Author).

Figure 2. Design sketch of Huaneng Laiwu Power Plant Extension Project Administrative Office Building (Source: Shandong Electric Power Engineering Consulting Institute Corp., Ltd.).

Facade of Huaneng Laiwu power plant expansion project administrative office building is built with dry hanging of 25mm thick white granite board, which is consistent with the overall color of the plant. Administrative office building is just opposite the main power house, with facade three-stage divided, weakening the building volume and highlighting the main power house. Because the administrative office building plays an important role, vertical lines are used for the façade, simple and pure, which can fully reflect the characteristics of modern architecture and the industrial beauty.

Special Volume Relations of Buildings in the Front of Plant

Common civil buildings are located in the urban environment. The building volume can be adjusted to coordinate with the surrounding environment. Compared to the huge volume of the main power house (Fig.3, Fig. 4), the buildings in the front of the plant are constrained by the land boundary, functional positioning and other factors, thus the two can not be balanced. Through a concise way or method of vertical separation, buildings in the front of the plant have weakened the volume to highlight the main power house.

Particularity of Overall Planning of Buildings in the Front of the Plant

Common civil buildings are restrained by sunlight spacing, building height and urban space, etc. The building design mainly takes site utilization and space structure into consideration.

The location of thermal power plant is usually far from urban building area or planning area. The surrounding environment has small effect on the buildings in the front of the plant with relatively free planning and design.

Figure 3. Huaneng Laiwu Power Plant Main Power House Extension Project.

Figure 4. Datang Binzhou Cogeneration Main Power House Project.

(Source: photographed by author)
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**Location of the Area in the Front of the Plant**

The buildings in the front of Power plant are ancillary buildings serving the main power house, mainly including the office area and living area. Its relationship with the main power house should be fully considered when location is selected. At the same time, in the operation of the power plant, because a large number of pollutants will be produced, buildings in the front of the plant are usually arranged in the upwind direction of the pollutants, far from the main pollution area.

![Overall planning of plant front area of Huaneng Laiwu Power Plant Extension Project.](Source: Shandong Electric Power Engineering. Consulting Institute Corp., Ltd.)

For Huaneng Laiwu power plant expansion project, the power plant base was like "H" type. The main entrance of the west side of the plant and the plant front area are located in the north-central of the base, which is divided into administrative center and production service center according to the functional requirements. It is separated from the main power house by a main road, greatly shortening the distance with the main power house, at the same time, far away from the pollution areas such as the coal mines, dust removal facilities in the southwest side of the plant (Fig. 5).

**Architectural Design of the Area in the Front of Thermal Power Plant**

In accordance with the national regulation, the area in the front of thermal power plant should not exceed 7% of total plant area. Method of centralized layout is adopted for buildings in the front of the plant, simplifying the building function, planning the site reasonably and efficiently, controlling the building shape factor, and implementing intensive management. New materials, new technology and new construction process are used to shape the new image of modern industrial buildings.

The administrative office building of Huaneng Laiwu power plant expansion project building, as a power plant external image display, is located in the north of the main power house. The main entrance is set in the north side. The visitors and plant staff are separated. In front of the entrance lies the square, which is used for administrative office and plant culture show.

Service Center is located in the east of the administrative office building, gathering the function of the canteen, office, power distribution, tool’s room, etc.; in the production office building, tool’s room, bathrooms, maintenance department and laboratory are jointly designed. Two buildings are connected through the corridor, forming a U-shaped plane, and a three-sided enclosed courtyard space for staff’s activities and rest.
The three groups of buildings are in central arrangement to form a joint complex, which has a very positive effect on the rational arrangement of traffic flow lines, improving the economic efficiency of the plant, saving land and improving the mental outlook of the factory (Fig. 6).

**Layout of External Space**

The design of the square landscape in front of the administrative office building should not only highlight its administrative status, but also grasp the rigorousness and openness of the space. Under the allowable circumstance, symmetrical layout can be used for the square in front of the administrative office. Through the orderly landscape sketch and the arrangement of plants, sight is guided, forming a strong sense of outdoor space.

Space environment for public event venues organizations should take full account of the laws of human activity, with different spatial sequences in different arrangements and with natural transitions (Fig. 7).

Reasonable road organization and layout is an important part of the total plane design of the plant. Visitors and commuters flow are mainly in long streamline, while dining, rest and office are mainly in short streamline. According to the different needs, the road space is planned rationally. Through different forms of vegetation greening, the road is classified, forming different visual and spatial feelings.

For example, tall trees and short shrubs on both sides of the main road of Huaneng Laiwu power plant expansion project are reasonably allocated, highlighting the axis for plant entry (Figure 8).
Application of Energy-saving Technology

At present, the area in the front of the plant is an important part of the life and work of the power plant staff. Due to the consideration of process flow, land use and power plant efficiency-cost ratio, enough attention is not paid to the planning and design of the area in the front of the power plant. Therefore, the buildings in the front of the power plant relatively ignore the application of energy-saving building technology measures. China's thermal power plant has a huge energy-saving potential. Selection and application of energy-saving technology should be based on the actual situation of power plant.

The planning and design of area in the front of the power plant should take into consideration the energy saving technologies such as building lighting, wall insulation, building noise prevention, green lighting, energy saving lamps and plant central heating, etc.

Summary
The design of the area in the front of the plant is a comprehensive process, which needs to integrate the plant's external environmental factors, production process, the general drawing transportation and other factors. The design of the area in the front of the power plant must take into consideration from the overall layout, find out all aspects of the contradiction in order to find a reasonable and appropriate solution.

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References