Planning of Petrochemical Industrial Park Based on Health Idea—A Case of Changlian Industrial Park in Yunxi

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Abstract—The concept of Health has been discussed a lot in urban planning field in recent years. This paper presents the application of health idea in urban planning practice. By analyzing a case of petrochemical industry park planning, It attempts to explain the implement of health ideas in practice.

As progressively of modern urbanization, modern city is becoming homogenization and unhealthy. It’s easy to get lost while pursuing economic benefits in city construction. It has become a key problem in urban management that how to keep city’s healthy and sustainable development.

Health City, as well as Low-Carbon City, are the popular concepts based on health idea. Its essence is to pursue the harmony and coexistence of economy, society and environment. Popular concepts reflect the transformation of goals and connotation of these concepts, like health city and low-carbon city, taking the deep study and understanding of goals and connotation of these concepts, like health city and low-carbon city, taking the particularity of petrochemical industry into account with the space functions, industrial structure and spatial arrangement together.

Keywords—Urban space; Industry structure; Health city; Low-carbon Economy; Sustainable development;

I. INTRODUCTION

With urbanization, the city’s economy developed rapidly. For the existence of city as a economic entity, its environment, resources, and lack of social value as well as huge demand of economic value is generally one of the current contradictions while urban city developing. The city we are concerned about is no longer merely an economic entity, but the real space environment to achieve human life, growth and joy of life. Healthy Cities movement and low-carbon city concept initiated are aimed at finding a solution to this problem. Urban Development’s “Health” concepts have important significance in optimizing the quality of the environment of urban space, dealing with the problems of urban expressway construction, establishing the harmonious and friendly relations between people and environment and ensuring the sustainable and stable development of urban economic, society and environment.

II. CITY HEALTH

A. Healthy city

Health, in the modern scientific concepts, is the expression of the good condition of psychology and physiological substances. "Healthy City" is one of the strategic options to solve urban problems for the moment.

In 1994, WHO (World Health Organization) clearly stated, "Healthy Cities" concept. " Healthy city action strategies were proposed and began rapidly implemented worldwide. China Healthy Cities Program began in 1994, involved Beijing and Shanghai at first; subsequently joined Chongqing, Haikou, Baoding, Dalian. The construction of China's urban health concern initially on the field of public health, and has gradually evolved into an integrated activity related to society, environment, public health, urban management and other areas. China's urban health concepts are continuously implemented in urban construction and management practices as strategic actions, like "sustainable development", "building a harmonious society", "to promote sound and rapid development of the city" and "ecological safety and environmental friendly society", "low-carbon economy" and so on. China's urban construction is always expanding towards all health-related areas (such as housing, education, transport, environment, etc.) according to local conditions, and taking systematic, integrated approaches to solve the problems that affect urban life.

B. Low-carbon city

In essence, the low-carbon city, on the one hand is to promote the rational development of city’s resources, on the other hand, mainly reflected in the search for the environmental protection and sustainable way in the urban industry. Urban industry is the lifeblood of the economy, while those resource-saving and environment-friendly energy-saving environmental protection industry is a catalyst for economic growth. The State Council executive meeting examined and adopted the "State Council’s decision on accelerating and developing the strategic new industries", identified that with the "low carbon" concept, the strategic choice for the urban industrial is "energy saving, new generation of information technology, biotechnology, high-end equipment manufacturing, new energy "and other key areas, and specified the direction of the industrial development road under the "low-carbon city" concept.
III. KEY POINTS IN THE PLANNING OF PETROCHEMICAL INDUSTRY PARK

A. Contradictions that petroleum and chemical industry’s ‘getting health’ facing

1) Industrial pollution

Petrochemical industry has a long chain, the upstream and downstream industries that rely on oil refining and processing may include: oil refining industry, ethylene industry, synthetic materials industry, paint industry, fine chemical products, special chemical products, rubber products industries. Most of these industries must have expertise, but also they are high-capital-invested, high-labor-share, high resource and energy consumption, high-tech-intensive industries, with a lot of combustible, explosive and toxic dangerous chemicals and high-temperature and high-pressure cryogenic production facilities, most of the production process will produce heavy pollution.

2) Product structure’s “sub-healthy”

Products of low quality, a single species, too much low-end products is a prominent problem in the product structure of petrochemical industry. China’s Petrochemical Enterprises Cluster Development and production base is still in its infancy, the intensity level of refining integration is relatively low as well as the optimization level of regional resources. Reflections are as follows: combination between the oil refining and chemical enterprises combined is not enough, cooperation and comprehensive utilization rate of products from upstream and downstream chemical products, raw materials and fine chemical is not high, multi-level and multi-network construction of space, business and products still need be improved.

3) Extensive land use

Petroleum Chemical Industry Park’s land use is currently divided into 6 major categories, manufacture land, residential land, utilities facilities land, green buffer, public administration land, agricultural areas and other sites.

Due to the process need and the construction of standard factory buildings in the park, most of the manufacture land’s development intensity is not enough, and most buildings have only one or two floors. Besides, the park’s products changed periodically, so there are most of the conversions, expansion project needs space placement. For example, the Yunxi Changlian Industrial Park mentioned in this article, is a new placement park for the conversions, expansion project after refining 20 million tons of ethylene for Yangtze River, in the request of industrial expansion. In this case, there exist some contradictions. The present standard process region cannot be adapted to the requirements of process and capacity of new projects, which led to the redistribution of land resources and duplication. These are the direct performance of the present extensive management in the development of the land resources in petrochemical industry.

4) High occupancy rate of public resources

As the petrochemical industry and the production has its particularity, besides the requirements of basic infrastructure (roads, parks, green space, parking) in the public resources construction, there are also special requirements in the scale, location and type of public facilities. A healthy and completed Petrochemical Industrial Park, includes not only adequate water, electricity, gas and other energy production, but also perfect ancillary facilities of infrastructure services, such as public health, management of office, industrial and commercial tax, financial and banking, postal services, telecommunications, public security, development training, catering, business services and other basic services facilities.

B. Key points in the planning of petrochemical industry park on the health perspective

1) Multi-coordination and cooperation planning principles

Petrochemical industrial park planning is based on the collection and interpretation of the upper-level planning. For example, determining the spatial expansion boundary of the park should be based on the urban comprehensive planning and land use planning, then choosing a reasonable site for the industrial park. On the other hand, it is necessary to absorb the construction objectives and strategies of different special planning. According to the data and information provided by relevant departments, interpreting related special planning programs, distributing rationally according to local conditions in land use, upstream and downstream industries’ selection, transportation and municipal pipe network, pipe rack, wiring and other aspects with fully respect for status quo conditions.

During planning process, it is necessary to coordinate continuously the views of different local governments and apartments, launch extensive and deep consultation on contents determined by the planning draft; carry out planning publicity, consult the public’s and experts’ opinion. Petrochemical industry is a special type of industry, of which the process has special requirements in land distribution and pipe network layout, so that it’s more important to solicit relevant departments and petrochemical experts’ opinions according to the specific conditions, based on the “health” industry requirements and with scientific serious attitude.

2) Industry intensification

Specifically, industry intensification, is to seek development from a long-term and regional perspective. It should combine petrochemical industry and regional leading industry with relevant economy through the linkage between enterprise and local government; based on serving the local leading industries’ basic products and business, develop the industry from “one-dimensional” relationship between the upstream and downstream to a diverse “network” structure. The intensive concept in industry, is the application of “recycling economy”, “low-carbon economy" in industrial construction. First of all, it is a low-carbon modes of production; an overall symbiosis model of industry production process which includes production, product exchange and resource allocation; with efficient resource metabolism, and reduces carbon emissions. Second, it is application of the health concept in industry. Production mode based on the circular economy, organize the production process in accordance with the mode of production, so that the upstream and downstream products can be mutually transformed, to achieve recycling and
reduce resource consumption and waste emissions. (Figure 1: Schematic diagram of the petrochemical industry chain)

3) Land use intensification

Land use intensification is reflected in two aspects, first, fully understand of the existing land use, not to damage much of the natural environment, the industrial park’s building should be on the basis of ecological protection. Second, make rational spatial structure and land distribution planning.

Health of the industrial park is not only reflected in the product structure, but also in the land use structure and spatial layout as the carrier of the industry. Petrochemical industrial park's space layout is the arrangement of future industry space in the premise of scientific and reasonable scale argument. Spatial layout is not only required to adapt to the framework of urban comprehensive planning and the industry expansion direction, but also be within the permissible range of the overall urban land-use planning. Intensification of land use, it is able to fit in city-led industrial restructuring and upgrading needs of the petrochemical industry; and also provide flexible spatial structure and spatial distribution vector in the condition of maintaining the completeness of industrial chain.

4) Efficient use of public facilities

Different from other industries, the oil industry’s notable feature is that enterprises are relative dispersive and production environment is mainly in the suburbs. Therefore, building sophisticated public service facilities for living and production, is an important term to ensure petrochemical industry zone’s large-scale production and promote the healthy development of the park.

Municipal infrastructure must be based on simple and efficient principle, to achieve a scientific and accurate scale prediction and resources conservation as the most important goal. Park Planning should reserve development backup land for the public service facilities, the total number should be controlled in 2%-5% of public services land. Reserving backup land is the unanticipated project that needs to be added mainly to develop the park and improve residents’ working and living standards to ensure the sustainable construction of the park.

IV. CASE STUDY

A. Project overview

The base is located in Yueyang City, Hunan Province, Yunxi area. The Changlian sub-park referred in the article is the new branch petrochemical park planned and sited during the industrial upgrading process of local Changling Refining and Chemical Company. Branch park is planned to deal with the 18-billion-yuan “technical transformation expansion” plan that Sinopec is to carried out in Yunxi district. As a 10-million tons large refinery project will be launched soon, a number of new crude oil processing and fine chemical projects are added, but also with a group of technology restructuring projects of original old factories moving out, and these projects will be placed in the Changlian branch park that is being planned. Therefore, combined with the existing industrial base and future development condition of Yunxi Industrial Park, determining the development objectives and strategies, spatial development direction and strategies of Yunxi Changlian petrochemical industrial park formulating the conceptual planning for Changlian branch park in Yunxi district.

B. Key points of planning

There are several key issues including: what’s the appropriate scale of industrial development in Changlian sub-park? What category of industry is suitable for the development of the region? How much impact does the industrial development bring to the environment? What’s the relationship between the Changlian sub-park and region in road transportation, government infrastructure and other aspects?

According to "healthy" development goals, Changlian sub-park’s planning and construction should coordinate the main plant and sub-park, enterprise and local government, input-output reward, pollution control, investment and sustainable development and other aspects of the relationship. The development goal of "healthy and harmonious "is the topic of the development of the park.

C. Implementation of ‘Health’ concept in planning

1) Park Location: protecting the environment, determining the space develop direction according to local conditions.

Based on the existing development basis of Yunxi industrial park, we can use software to analyze the favorable and limiting factors of different develop direction, make comprehensive land use evaluation and determine the site of the park. According to the analysis of existing topography and landform, on the one hand to protect the basic farmland land; on the other hand, to reduce the cubic meter of earth amounts, we should not choose or use steep land. Besides,
according to industry development factors, site factors, transportation factors, considering the direction of land expansion and sub-Park site. (Figure 2: GIS Analysis Chart)

With the comparative analysis of the existing land use development direction, the final choice of Changlian sub-park comparatively has the following significant advantages:

(Figure 3: Changlian sub-Park Site Selection and Space Expansion diagram)

1) close to the production areas of Changlian old factories, industrial piping and pipe rack can be a good docking.

b) land is relatively completed, the development of petrochemical industry needs relatively concentrated land.

c) Changlian company’s second channel built by Changlian company and highway departments will pass through the region, and connect to the external highway transport eastward, which will be a good solution to the transport problems of restructuring enterprises related to Changlian companies or other petrochemical enterprises.

2) The spatial development concept: based on the docking of industrial pipe racks, to build a "ribbon group-style" industrial space corridor.

Based on the economy and intensification principle, to consider docking the raw materials and industrial pipe racks of the Changlian sub-park with old Changlian enterprises.

Considering spatial structure, we selected the three industrial town near Changlian plant as location, to form a group independent regime (Figure 4: The structure of industrial space). Infrastructure corridors between them have mainly been laid, also avoided the “pie” phenomenon in space expansion. The planning brought up a "one center two points" planning structure (Figure 5: Spatial Development Concept Plan). That is, a growth center, two growing points. One center refers to the Changlian park and sub-park, two points refers to the two industrial towns south to the Changlian company. This region is an important supporting area for the continued development of Changlian company and Changlian sub-park. They are spread as group in space, each group relatively completed, which is good to ecological environment protection.
such as the port town of Jiangyin, its large-scale petrochemical industry and other related industries, have constituted some competition to the planning area.

To breakthrough this disadvantage, we must break the threshold of development; based on making the industrial chain bigger and stronger, enriching the product structure, increasing flexibility in the industrial structure is an inevitable strategic choice. The concept of industrial development addressed in the planning is: diversification and specialization development of petrochemical industry. (Figure 6: Industrial Development Concept Plan)

Specifically, in the current 36 industrial enterprises in Yunxi Chemical Industrial Park, 26 enterprises are closely related with the petrochemical industry. Most of their products are the direct downstream products of petrochemical industry such as solvent naphtha, acetate resin and so on. A big disadvantage of this “single” product is that the industrial structure of the whole park is low-flexibility; at the same time, a large number of downstream products, of which the ability to be transferred is low, are a waste, which does not meet the "healthy" concept. This is the main problem that stop the petrochemical industry in the planning district from becoming bigger and stronger. Problems to be solved now is: to increase the industrial chain, combined with the local related industries. To this end, the concept of industrial development addressed in the article is: diversification and specialization development of petrochemical industry. Specialization refers to making the industry chain’s leading products bigger and stronger, to realize the docking of products with petrochemical industry leading enterprises. Diversification refers to the divergent development with other industry networks, such as the diversification extending to the related manufacturing and logistics industry. (Figure 7: Land Use Planning)

4) Intensive public facilities planning

Most of the production water in the planning area relies on the water supply of Changlian company, supplemented by regional water supply reservoir in order to ensure stable supply. Power supply mainly relies on existing electricity power-supply system, adopting expansion and installment construction’s chronological order supporting facilities. In addition, to stabilize the entire region’s environmental health, an independent “three wastes” treatment system was built in the urban areas of Yunxi Industrial Park. The planning used the "chemical cluster" concept and integrative production facilities. According to industrial production’s requirements for intensive land use, planning adopts net-grid road network, etc. All of those above are measures of intensive use of public facilities. The main water and electricity conditions needed in the project is mainly based on integral plant, according to the development schedule, building new public facilities by stages as needed. Overall, the public facilities adopt economic and intensive support as principle, respond actively to the environment pressure from industrial production, and strive to minimize environmental impact as the basis, to achieve the greatest social and economic benefits.

V. CONCLUSION

"Health" is a concept that needs long-term, sustained compliance. It not only seeks the result, but pays more attention to the construction process. From planning formulation to project implementation, during the process of city construction, to achieve "healthy" city needs people, from the public to city managers, to spare no effort to fully implement.

Petroleum and Chemical Park is a case, the construction of the city needs us to form a consensus of "healthy" concept, and to maintain a sense of responsibility and persistence in pursuing this goal in planning formulation and management. Whether it is a healthy city, or low-carbon city, from the planning method to institutional assurance, we still have a long way to go.

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