

A Discussion on the Benefits of Environment Performance of the Promotion of Kaohsiung Green Building Specialties Policy

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ABSTRACT

"Urban Heat Island" effect leads to high temperature in the urban climate, increased rainfall, reduced wind speed and air pollution as well as other effects. According to "International Association for the Evaluation of Educational Achievement," average carbon dioxide emission in Taiwan is 11.26 tons in 2008, while the building structures are the third source of carbon dioxide emissions. Taiwan is ranked to have the 18th highest carbon dioxide emissions in the world. In view of this, for the new buildings, the Kaohsiung City Government actively promotes the transformation plan for "Green Building • Sustainable Environment", presenting the local culture, green architecture and the concept of public participation, and promotes Taiwan's first "green building autonomous regulations in Kaohsiung", "the policy for design and encouragement reward for Kaohsiung building" and other innovative design policies. Kaohsiung implements existing buildings through "Improvement on Kaohsiung Buildings" action, prioritizing public buildings that are frequented by the people of Kaohsiung. Buildings will be elevated with the suitable solution based on integrated physical environment quality testing and data analysis (including sound, light, warmth, air).

Therefore, this study used the analysis of relevant policies of Kaohsiung city prompted by innovative green building. With the "Building (New) Sustainable Environment" of Kaohsiung City Government, practical benefits and the target completion of the policies will be discussed. From the point of view of environmental health diagnostic, existing buildings are examined for their achievement in actual practice. The aim of this study is to provide hope to enhance the quality of life in Kaohsiung, and to add to Taiwan's research reference.

Keywords: *Kaohsiung buildings, green buildings, innovative design policy*

1. INTRODUCTION

In 2015, Paris Climate Conference (COP21) performed protocols regarding the topic of restraining the global warming, which was aimed at reducing the emission of greenhouse gases and controlling the global temperature would not increase more two centigrade degree in 2100 with the global warming speed. The conference also advocated the concepts of think locally, act globally. To respond the changes of global climate and the trend of international energy conservation and carbon reduction, the central government promotes the policies of "Sponge City" and "Million Solar Roofs". Faced at the problems of high carbon emission, alternations of floods and droughts, the air pollution of PM 2.5 caused by urban island effect and difficult to diffuse, more than 120,000.00 unauthorized buildings and Aging Population with too Few Children and other problems, Kaohsiung City is in need of thinking about how to transform into the healthy and sustainable Southern Taiwan metropolitan district from the image of industrial city to develop the local architectural features and living cultures of Kaohsiung region.

2. TO PROMOTE STRATEGIES AND CREATIVE ACHIEVEMENTS

In order to solve the environmental studies of Kaohsiung and effectively plan and make reformation on sustainable construction environment of Kaohsiung, the countermeasures, "Kaohsiung House Plan" is created. To more properly adapt to the sustainable construction movement, the three cores of the plan are consist of global Environmental Sustainability, the Identity of Reflecting the Local in line with the local conditions of Kaohsiung, and Healthy Residence closed to the populaces' life, which conclude the following creative achievements:

2.3 Twelve creative policy tools

Kaohsiung House Plan has constantly made twelve policy tools initiatively nationwide, and conducts the reformations on sustainable construction environment by away with a higher standard.

2.4 Vertical forests: roof greening and landscape balcony

The landscape balcony with the depth of three meter is initially built in line with the local conditions to create green landscape in metropolis, which seems as a 3-D vertical forest park, creating the unique architectural features and brand, and promoting the construction to the international construction with high quality.

2.5 The universalization of design space

The elderly population in Taiwan will reach to more than 20% in 2025. In response to the upcoming super-aged society, the universal design is further introduced by the laws so that the children, the elderly and disabled person, etc., can conveniently use all sorts of building environments.

2.6 The solar photovoltaic facilities set on buildings

By making full use of Kaohsiung's abundant sunshine to facilitate the renewable energy of solar photovoltaic to develop local characteristics, and to standardize the setting of the solar photovoltaic facilities in the roofs of buildings, the regulations of central government's laws and decrees are broken, and the restrictions on the height of the solar photovoltaic on the roofs are broaden so that those with the height fewer than 4.4 meters are excluded from the volume and height of the building.

2.7 The self-creation of financial resources-the sustainable operating fund of green buildings

The financial resource is self-created by handing in the giving back money of Kaohsiung adjacent. Apart from giving back to sustainable environmental construction, the operation of the innovation policy's mechanism can also be constantly rolled. The operating fund of sustainable green construction of this city is co-managed by experts of industry, government and science.

3. RELEVANT OUTCOMES

3.1 Motivate cities to study from typical example

"Kaohsiung house plan" has motivated more than 10 other cities in Taiwan to learn all sorts of innovation policies of Kaohsiung City, which has become the typical example of green and sustainable city and become the dialogue basis for diplomacies between international cities.



Figure 1: Vertical forests –landscape balcony and transformation of unauthorized buildings - green energy facilities

3.2 Rainwater storage facilities

The disaster prevention of small flood detention: when the rainwater storage amount has reached to 223,920 cubic meters, equivalent to capacity of 119 swimming pools with international standard, then the delay time of the flood peak's arriving is set at about 30 minutes to reduce the disaster of heavy rain's impact.

The rainwater tank: the processed amount of recycled rainwater has reached to 2,761,365.24 liters/ day, which means 1,007,898 tons of water is saved per year, and 156,224 kg of carbon is reduced per year.

3.3 The set amount of solar photovoltaic

The set amount of solar photovoltaic in newly-built construction has reached to 54,446 KWP, equivalent to the amount the set amount of solar photovoltaic of 53 Kaohsiung World Games Main Stadium. It can create 700 million degrees of electricity consumption in one year, and the carbon reduction can reach to 430 million kg/ year.

3.4 The of lighting and energy saving

To standardize 97% of existing buildings in the city, the high-energy lamps and interior decorations shall not be used when applying for interior decoration for the buildings and changing the use of buildings. So far the energy-saving lamps applied in the case have reached to 2,861,768 watts, which can reduce the electricity consumption of 2,862/ hour. Calculated by using 16 hours one day, then, the reduced electricity consumption is 16,714,080 kWh/ year, and the reduced carbon amount is 10,228,188 kg / year.

3.5 The creation of universal space suit for All-Age

The universal design of the bathroom: the moving lines of the passageways are smooth and the net width of the door should reach 80 cm so that wheelchair users can be in and out smoothly and steadily, and the area has reached 12,406 square meters.

The universal design of social hall: Extending the traditional construct concept of "courtyard" space to create spaces of social hall for all-ages in the community, of which the area has reached 1,369 square meters.

3.6 To create the business opportunity for green building industry

By supporting green energy industry, increasing more than 2,500 job opportunities per year and newly- increasing 500 high-standard green buildings in four years to motivate the green business opportunity with about more than 700 billion of total industries, and to improve the job opportunity and wishes of returning the hometown to provide services for the people of Kaohsiung.

3.7 Verticals forest

The green area on the roof is 160,921 square meters.

The area of landscape balcony is 70,360 square meters, of which Green area 23,453 square meters. The balcony landscape with the depth of 3 meters, breaking the laws and decrees, is combined with more than 1/3 shrubs and arbors to afforest. By adjusting the micro environment, and creating a healthy rest space to promote the plane surface greening to become the vertical forest. By replacing the former frozen cement and iron sheet to transform the image of industrial city into Kaohsiung garden city.

The total green area has reached 184,374 square meters, equivalent to the areas of about 28 football fields, and the reduced carbon is 3,687,480 kg.



Figure 2: The landscape balcony that can be used for sun shading and rest

3.8 The total amount of reduced carbon

The execution of the "Kaohsiung house plan," can reduced the annual carbon amount of 13,500 tons, equivalent to the carbon amount stored by 13.5 ten thousand arbours. So far the total reduced carbon amount has reached to 47,250 tons, equivalent to carbon amount stored by 4,725 ten thousand arbours.

3.9 Cross-border action and social participation

"Kaohsiung house plan" is a cross-domain construction action studied and participated by citizens and experts from industry, government and science. Now 100 green building awarding brands of Kaohsiung houses has been awarded certificates, 100 outstanding creative design works of Kaohsiung houses has been selected, 45 ACCD of Kaohsiung house has been cultivated, and more than 12,000 people have participated in the relevant activities. The plan emphasizes the public participation and empowerment of community, and is driven by the units of metropolis, economy, education, agriculture and marine division dividedly. Having launched the responses of 348 schools, and 95 agricultural and fishery facilities, the plan has got 144 buildings of construction license of Kaohsiung house, a total of 11,950 households.

4. THE FUTURE KAOHSIUNG GREEN BUILDING 3.0 VERSION DEVELOPMENT ASPECT

4.1 Orange construction planning

The most important element of orange technology is H2O, which stands for health, happiness and offering. Its correlative calculation is orange computing models are health model, happiness model and offering model. The details are as follow:

- Health Technology: senior medical care and old timers living technology are becoming increasingly important. Medical prevention of illness has become a crucial issue. To advance and develop senior living quality and green-orange health care is the challenging issue.
- Happiness Technology: in order to promote happiness indicator, engineering technology and social science and humanity can be used to advance public safety, anti-stress, pleasure, social relationship, education, energy, financial wellbeing.
- Offering Technology: other than establishing personal health and happiness, orange technology also promotes happiness in others. Offering technology uses technological innovation to better interpersonal relationship.

4.2 Intelligence: disaster prevention

Cloud technology can provide designers to directly on Web-GIS cloud system to design site development, install and control various water tanks in order to set and measure the precipitation.

4.3 Life box

Newly built residential households have to install a family emergency shelter. It is about 1.6~3.4 m² (determined by the surface area of the house). The door is made of steel board, and the four walls, ceiling and floor are made

of concrete with steel foundation that are thickened to 200~300mm (determined by the height of the house). The inside has one or two vents and has electricity, internet and radio.

5. SUSTAINABLE DEVELOPMENT AND CONCLUSION

The city plan shown by Kaohsiung sustainable construction on its local culture, sustainable nature and friendly environment is: under the pluralistic development of the overall Kaohsiung city, not forgetting the traditional geographic landscape, architectural features and ethnic culture to show respects to different ethnics, cultures and regional characteristics by Kaohsiung house plan.



Figure 3: The field surveys on Kaohsiung house

Kaohsiung house case is integrated by project management, from which benefits of Kaohsiung house is studied and analysed. Inviting and getting the scholars and experts from industry and government to jointly study, analyse and discuss the case to formulate the basic standard of the sophisticated direction for Kaohsiung house plan's policy tools. Establishing the database of Kaohsiung house's newly-built cases to track application case progress of Kaohsiung houses which have got the licenses for the construction, and to build the databases of photos, decrees, construction methods, cost analysis on the basis of the weekly field surveys. Meanwhile the wind environment, ambient heat, light environment or user satisfaction will be studied and analysed by simulation software and questionnaires, and the benefits of industry, the economy and reduced carbon will be quantified.

To promote the sustainable environmental feedback mechanism, the financial resource should be self-created by paying agent money, fees for regulations and giving back money, besides which shall be executed by the management mechanism of sustainable green construction's operating funds. Apart from the direct giving back to sustainable environmental construction, the operation of the innovation policies' mechanism should be constantly scrolled.

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