Vision and Implementation of Green Bio-Industrial Park

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Mankind is facing the most severe challenges. These include extreme weather caused by climate change, environmental degradation caused by over-reliance on fossil energy and fossil energy shortage. These two phenomena gradually lead to the shortage of food and water resources and eventually an impact on the economy. Furthermore, the human destruction of green organism resources has further resulted in the pressure on the environment of the human, psychological pressure, economic pressure, and even the increase in the pressure for survival. Therefore, energy saving and carbon reduction is the only globally recognized solution to prevent such situations to deteriorate. Among the different measures, the most effective way to reduce carbon production is to change the way the energy is utilized. The change in agricultural production model is one of strategies many countries carry out to achieve the carbon reduction. Since agricultural crops are important and influential on human lifestyles from essential food for survival to luxurious food, food has been listed the first human needs before clothing, shelter, and transportation. Therefore, innovative and feasible agricultural production modes for carbon reduction and the fulfillment of human desires are in urgent need. Among the six emerging industries proposed by the Executive Yuan, green energy, biotechnology, and refined agriculture can directly correspond to the needs of the international trend.

Figure 1. Green bio-industrial park

In order to solve the aforementioned difficulties faced by human being, based on the solid agricultural production techniques developed in our university combined with the professions from the college of engineering and business administration, our team proposed the concept, vision, and accomplishment of green bio-industry. We hope that this will in the beginning promote the green bio-industry in the region of southern Taiwan, establish the features of the southern Taiwan industry, and later extend to the international community so that the future agricultural production pattern of mankind will be changed. In order to implement the green bio-industry, we propose the establishment of a green bio-industrial park through a three-stage process. A green bio-industrial park is literally similar to an industrial park or a science park, except that the factories are replaced with green bio-factories, as shown in Figure 1. In the green bio-factories, crops of high demand or high economic value are produced.

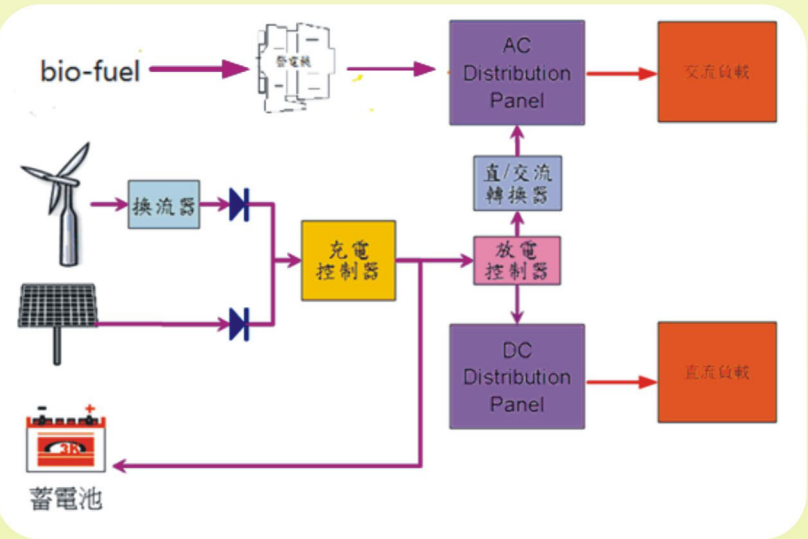

Figure 2. Typical architecture of an energy system

Green bio-industrial parks should at least meet three sustainable conditions and an optimal condition. The three sustainable conditions are energy sustainability, environmental sustainability, and economic

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sustainability whereas the optimal condition refers to the optimal utilization of water resources. Sustainable energy means that the park is capable of producing self-sufficient energy to meet its energy requirement for transportation, livelihood, and production. Environmental sustainability means that the crop production process along with appropriate facility will not cause any pollution to water, air, and soil. Economic sustainability means that the crops produced must bear sufficient economic value so that the investors can within a reasonable period of time recover their investment and gain profit. Optimal utilization of water resources means that only the least amount of water is used. As a result, the operation of the park will be sustainable and be capable of attracting capital investment.

In order to implement the operation of such an industrial park, we must consider the building of the two systems, the management system and the production system. The management system includes production scheduling, inventory, marketing, markets, capital, risk, and so on. The production system include production process, environmental monitoring, control of biological growth, biological growth monitoring, control of energy sources, energy consumption monitoring and its control, as well as pollution control of water, air, and soil. The planning for the sources of energy must take full advantage of the geographical characteristics of the region as well as the nature of the crops. A typical example is shown in Figure 2. The sources of energy include solar, wind, and biomass energy. When these sources are absent, the battery is used to maintain the basic operation of the biological plant. The use of biomass in bio-factories is quite unique in comparison with other industrial plants mainly because the agricultural waste produced by bio-factories can be transformed into biomass through appropriate process. Therefore, the development of high energy density and low pollution biomass used in bio-factories is an important issue.

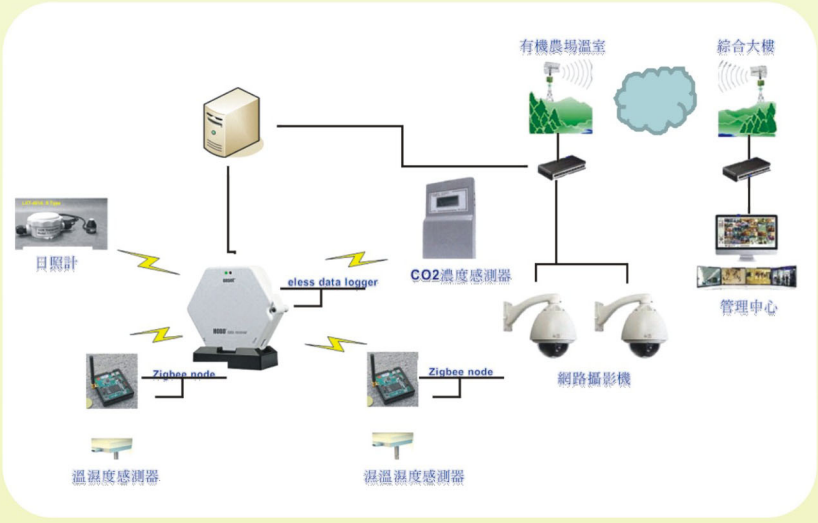

Figure 3. Structure of our wireless remote monitoring system

The growth control in a biological environment includes controlling the environment variables such as temperature, humidity, light, CO2 concentration, water quality. Not only does the control of these environment variables is performed through facilities, but also the planning of the overall bio-factory. The monitoring of biological growth is responsible for the analysis of crop geometry, color, and even the connotation of its composition. The control of biological growth is accomplished through monitoring and control of the environment factors in the bio-factories. When the products need to be diversified or variation of certain areas in the bio-factory needs to be accounted for, environmental control is performed to create a microenvironment rather than a uniform plant environment. All of the above monitoring and control techniques, especially the control of the entire park, can be performed through the ICT technology by network cloud connection. At present, our team has completed a wireless remote monitoring system (Figure 3) that integrates the recording of temperature, humidity, air flow, CO2 concentration, water quality data, etc. in a cloud system and puts together a central control platform.

Not only can the biological growth be controlled through the cloud system, but also the energy and resources. This measure can also assist the management system in relevant analysis and control scheme. In general, the development of a green bio-industrial park requires production scheduling, inventory, marketing, markets, capital, risk, and so on. At the same time, the park needs production facility and process, biological growth monitoring and environmental control, monitoring and control of energy sources and consumption, as well as the pollution control technology of water, air, and soil.

In order to build a green bio-industrial park, our team plan to build three pilot plants through the funding supported by the University of Science and Technology Model Program and to proceed with the study of characteristics and production technology related to green bio-factories. These three pilot plants include an epidemic prevention type green farming factory, a green fruit and vegetable farming factory, and a green mushroom factory. In the future, we will also design and develop the container factory for green shoot and flower seed cultivation.

In view of the situation encountered by human society and the future needs of mankind, our team is confident that the green biotechnology industry has a bright future and will be beneficial to the welfare of mankind. With a strong background in domestic agricultural technology, opto-mechatronics technology, and ICT-related industries, the development of green energy bio-related industry and its technology is promising. This will then upgrade Taiwan competitiveness in related industries and bring us trillions of business in the next century.