Claims

1. A plant factory growing system, wherein the system comprises a plurality of independent planting units, connecting corridors and equipment; wherein at least two planting units are grouped together and are communicated by a ventilation fan; the two units within the group are interchanged between day and night, and the temperature difference between day and night is realized by means of a heat pump unit; and connecting corridors are arranged between groups that are not communicated with each other;

the equipment comprises:

energy equipment installed outdoors: a photovoltaic generator, a substation, a gas generator, as well as an outdoor temperature probe and a carbon dioxide probe; exhaust gas from the gas generator is piped into each planting unit through a pipeline and a branch pipe leading to each unit;

the equipment installed in the connecting corridor includes an air filter at both ends of the connecting corridor, a distribution box, a controller and a heat pump host system inside the connecting corridor, as well as a connecting corridor temperature probe and a connecting corridor carbon dioxide probe;

the equipment installed in each planting unit comprises: a lighting assembly, a temperature probe, a humidity probe, the carbon dioxide probe, a light probe, an air intake fan, an exhaust vent and a heat pump end system; the main body of the planting unit is insulated and airtight, and a door to the planting unit opens at one end of the connecting corridor;

two planting units in the group are connected by a ventilator to create air circulation; and

the heat pump host system and the end system are connected by the pipeline to form a heat exchange system, which is switched by a valve so that the end system becomes a condenser or an evaporator respectively, thus realizing a heat exchange between different planting units.

2. The plant factory planting system according to claim 1, wherein the air filter is provided at both ends of the connecting corridor having a lift, a stair and other equipment equipped internally.

3. The plant factory planting system according to claim 1, wherein the system is arranged in the main body of a building structure.

4. The method of operating the system using any one of claims 1-3, wherein the method is specified as follows:

1) using an artificial light source to meet light requirements of plants at different physiological stages through fully controllable light spectrum, light duration and light intensity, and to create controlled diurnal and planting cycle variations;

2) using an insulated and airtight building structure, the total heat within each group is kept relatively constant by air and heat exchange and by controlled exchange with the outside air to take away excess heat in summer or to supplement it in winter with a heat source or exhaust gas from a generator;

3) the day/night interchange between two adjacent planting units is during the morning hours of outside world, which on the one hand allows for maximum use of valley power and photovoltaic power and minimal use of peak power, while at the same time all management work is done during natural daylight hours and workers do not need to work night shifts;

4) using the controller to automatically switch the power supply according to the amount of photovoltaic power generated and the time of valley power, and using the grid power completely during the valley power stage, and giving priority to photovoltaic power during other periods, and using gas power generation to supplement when photovoltaic power is insufficient;

5) taking exhaust gas from the gas generator as a source of supplementary carbon dioxide, as well as heat in winter;

6) using the controller to automatically control the outdoor air intake according to changes in indoor and outdoor temperature and a carbon dioxide concentration in order to discharge excess heat in summer or to supplement heat in winter, and to regulate oxygen and carbon dioxide concentrations; and

7) using the heat pump to exchange heat to create a low temperature zone to satisfy cooling needs of dormant plants.

5. The specific daily cycle management method of the system according to any one of claims 1-3, wherein the method is described by an operation method of two adjacent planting units within a group, and the operation method of two diurnally opposite planting units within other groups is the same:

the two adjacent planting units in the group are the planting unit one and planting unit two respectively; 0-4am of the planting unit one is in the late night period, the light is zero and the temperature is optimal of planting crops at night; while the corresponding time of the planting unit two is from 12-16pm, and the light is a saturation point of planting crops, and the temperature is the optimum temperature of photosynthesis of planting crops during the day, which is the most intense period of photosynthesis; this is the time when the optimum

temperature is maintained in both planting units by means of a heat pump unit; the outside time of this period is 16-20pm and the electricity consumption strategy is the transition from photovoltaic + power generation to power generation, wherein the exhaust gas from the generator supplements the planting unit two with carbon dioxide;

4-6am of the planting unit one is in an early morning period, when the temperature rises gradually in preparation for daytime metabolism and light remains at 0; the corresponding planting unit two has an afternoon period from 16-18pm, when the light decreases from the light saturation point to a light compensation point to 0; as the temperature gradually decreases, photosynthesis gradually weakens; this period is characterized by a gradual equilibrium of temperature, oxygen and carbon dioxide through the exchange of air between the two planting units by means of the ventilation fan; and the outside time of this period is 20-22pm and the electricity consumption strategy is generator-based;

6-8am of the planting unit one is in the morning hours, when the light rises step by step to reach the light saturation point, and the temperature rises from the equilibrium point to the optimum temperature of planting crops during the day; correspondingly, the planting unit two enters the night time of 18-20pm, when the light is zero and the temperature drops from the equilibrium point to the optimum temperature of planting crops at night; a heat pump unit transfers heat from the planting unit two to the planting unit one during this period, thus cooling the planting unit two and warming the planting unit one; the outside time of this period is 22-24pm and the electricity consumption strategy is completely grid power;

8am-15pm of the planting unit one is in the daytime period, when the light at the highest light saturation point, and the temperature maintains at the optimum temperature of planting crops during the day; correspondingly, the planting unit two enters the night time of 20pm-3am, when the light is zero and the temperature maintains at the optimum temperature of planting crops at night; the optimum temperature is maintained in both planting units by means of the heat pump unit; the outside time of this period is 0-7am when the grid is at its lowest price and the electricity consumption strategy is completely grid-based;

planting unit one is still at its peak photosynthesis during the day at 15-16pm, and the corresponding time of the planting unit two is 3-4am, late at night; the outside time of this period is 7-8am, which is the parity time; the electricity consumption strategy is grid power + electricity generation, as the exhaust gas from the generator is needed to replenish the planting unit one with carbon dioxide during this period;

in the planting unit one, from 16 to 18pm, light decreases from the light saturation point to the light compensation point to 0; as the temperature gradually decreases, photosynthesis

gradually weakens; 4-6am of the planting unit two is at the morning time, the temperature rises gradually in preparation for daytime metabolism and light remains at 0; this time is characterized by air movement through the ventilation fan, which balances temperature, oxygen and carbon dioxide in both planting units; the outside time during this period is 8-10am and the electricity consumption strategy is first generator + grid and then PV + generator as photovoltaic power generation rises;

18-20pm of the planting unit one is already in the night time, the light is zero and the temperature drops gradually from the equilibrium point to the optimum temperature of planting crops at night; the corresponding time of the planting unit two is 6-8am, the light rises step by step to the light saturation point and the temperature rises from the equilibrium point to the optimum temperature of planting crops in the daytime; the outside time of this period is at 10-12am, the PV generation reaches its maximum stage and the electricity consumption strategy is PV + gas generator;

20-24pm of the planting unit one is in a late night period, with zero light and the temperature maintains at the optimum temperature of planting crops at night; correspondingly, the planting unit two enters the daytime, when the light is the light saturation point and the temperature maintains at the optimum temperature of planting crops in the daytime; the optimum temperature is maintained in both planting units by means of the heat pump unit; the outside time of this period is 12-16pm when the photovoltaic generation is at its maximum and the electricity consumption strategy is photovoltaic+gas generator;

workers work from morning to afternoon in nature, covering the light hours of both planting units;

in summer, the total heat of a system increases because of the thermal conductivity of walls and the supplementary heat of the exhaust air, which can then be relied on to take away the excess heat by exchanging air with the outside world; this takes place between 2 and 5 am outside time, when the outside temperature is at its lowest and the carbon dioxide concentration is high, while at the same time the temperature in the planting unit one is highest; and

in winter, the total heat of the system is reduced due to heat dissipation from walls and can be partially replenished by the exhaust gas from the generator; the period for heat supplemented by the generator is mainly 17-21pm, and the simulated time of the planting unit two is 13-17pm, and 7-9am of the outside time, the simulated time of the planting unit one is 15-17pm; if the heat supplemented by the generator can not maintain the total heat balance, the heat is supplemented by air exchange with the outside world; in winter, the temperature is highest at 14-16pm of the outside time, at this time, the simulated time of the planting unit one

is 22-24pm when the temperature is lowest, and the air exchange is performed on the planting unit one.