CLAIMS

1. A method for supplying heat energy and carbon dioxide for vegetables and/or algae using exhaust gas from an electric power plant, the method comprising the following steps:

   1) introducing the exhaust gas from the electric power plant to a primary heat exchanger via an exhaust gas supply pipeline to conduct a first indirect heat exchange between the exhaust gas and air from a heat supply system of a vegetables greenhouse and/or a algae culturing house whereby providing heated air for the vegetables greenhouse and/or the algae culturing house;

   wherein a temperature of the exhaust gas from the electric power plant is between 110 and 140°C; a temperature of the exhaust gas after the first indirect heat exchange in the first heat exchanger is between 80 and 90°C; and a temperature of the heated air provided for the vegetable greenhouse and/or algae culturing house is between 40 and 50°C;

   2) introducing part of the exhaust gas after the first indirect heat exchange in the first heat exchanger to a secondary heat exchanger via an exhaust gas transport pipeline to conduct a second indirect heat exchange between the exhaust gas and outdoor air whereby further reducing a temperature of the exhaust gas for facilitating adsorption of carbon dioxide;

   3) introducing the exhaust gas after the second indirect heat exchange in the second heat exchanger to a $CO_2$ pressure swing adsorption device, separating carbon dioxide from the exhaust gas and pumping carbon dioxide to a carbon dioxide storage tank for storage; and

   4) supplying carbon dioxide from the carbon dioxide storage tank to the vegetables

greenhouse and/or a carbon-absorption tank of the algae culturing house during a growth period of vegetables and/or algae.

2. The method of claim 1, **characterized in that** in step 2), the outdoor air is heated by the exhaust gas and is introduced to a tertiary heat exchanger for heat exchange with circulating water of a warm water supply system of the carbon-absorption tank to provide warm water for the carbon-absorption tank.

~~3. The method of claim 1 or 2, **characterized in that** in step 1), a temperature of the exhaust gas from the electric power plant is between 110 and 140°C; a temperature of the exhaust gas after the first indirect heat exchange in the first heat exchanger is between 80 and 90°C; and a temperature of the heated air provided for the vegetable greenhouse and/or algae culturing house is between 40 and 50°C.~~

~~4.~~3. The method of claim 2, **characterized in that** in step 2), a temperature of the exhaust gas after the second indirect heat exchange in the second heat exchanger is between 50 and 60°C; a temperature of the outdoor air heated by the exhaust gas is between 40 and 50°C; and a water temperature of the carbon-absorption tank is between 25 and 35°C.

~~5.~~4. The method of claim 1 or 2, **characterized in that** in step 4), carbon dioxide is supplied once every day at sunny time; a concentration of carbon dioxide in the vegetable greenhouse is controlled at between 600 and 1200 ppm; the vegetable greenhouse is sealed for between 1.5 and 2.0 hours for supplying carbon dioxide, and then a ventilating opening thereof is opened for removal of humidity.

~~6.~~5. A device for supplying heat energy and carbon dioxide for vegetables and/or algae using the method of claim 1, the device comprising a draft fan (3), the exhaust gas supply pipeline (4) connected to the draft fan (3), the primary heat exchanger (5), the exhaust gas transport pipeline (1) connected to a chimney (2), the secondary heat exchanger (12), the $CO_2$ pressure swing adsorption device (14), and the carbon dioxide storage tank (16), **characterized in that**

the primary heat exchanger (5) employs a shell-and-tube heat exchanger (5.1) comprising a gas inlet pipeline (5.3), a gas outlet pipeline (5.4), an air inlet pipeline (5.6), and an air outlet pipeline (5.7); the gas inlet pipeline (5.3) is connected to the exhaust gas supply pipeline (4) via a first pressure blower (5.2), the gas outlet pipeline (5.4) is connected to the exhaust gas transport pipeline (1), the air inlet pipeline (5.6) is connected to an air recycling pipeline of the heat supply system of the vegetable greenhouse and/or the algae culturing house via a second pressure blower (5.5), and the air outlet pipeline (5.7) is connected to an air outlet pipeline of the heat supply system of the vegetable greenhouse and/or the algae culturing house;

the secondary heat exchanger (12) employs a heat pipe exchanger comprising a cold air input end, an exhaust gas input end, and an exhaust gas output end, the cold air input end communicates with the outdoor air via a circulating pump (13), the exhaust gas input end is connected to the exhaust gas transport pipeline (1) via a compressor (11), the exhaust gas output end is connected to an input end of the $CO_2$ pressure swing adsorption device (14), an output end of the $CO_2$ pressure swing adsorption device (14) is connected to the carbon dioxide storage tank (16) via a vacuum pump (15), and the carbon dioxide storage tank (16) is connected to the vegetables greenhouse and/or the carbon-absorption tank (10) of the algae culturing house via a $CO_2$ transport pipe (7) and a control valve (19) disposed thereon;

wherein the device further comprises a tertiary heat exchanger (8), **characterized in that** the tertiary heat exchanger (8) employs a gas-liquid heat exchanger comprising an air inlet, an air outlet, a warm water output end, and a warm water return end; the air inlet is connected to a heated air output end of the heat pipe exchanger via an air transport pipeline (17), the air outlet communicates with the air via an exhaust pipeline (18), the warm water output end is connected to a water inlet of the carbon-absorption tank (10) via a circulating water pump (8.2), and the warm water return end is connected to a water outlet of the carbon-absorption tank (10) via a magnetic valve (8.3).

~~7. The device of claim 6, further comprising a tertiary heat exchanger (8), **characterized in that** the tertiary heat exchanger (8) employs a gas-liquid heat exchanger comprising an air inlet, an air outlet, a warm water output end, and a warm water return end; the air inlet is connected to a heated air output end of the heat pipe exchanger via an air transport pipeline (17), the air outlet communicates with the air via an exhaust pipeline (18), the warm water output end is connected to a water inlet of the carbon-absorption tank (10) via a circulating water pump (8.2), and the warm water return end is connected to a water outlet of the carbon-absorption tank (10) via a magnetic valve (8.3).~~

~~8.~~6. The device of claim ~~7~~5, **characterized in that** the carbon-absorption tank (10) is provided with a temperature sensor (8.4) and a water level sensor (8.5).