Biomass Renewable Energy Environmental Protection Low Carbon City Power Generation and Heating Device

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Abstract. Biomass energy is a kind of renewable energy. The development and utilization of biomass energy can alleviate the pressure of energy shortage, reduce environmental pollution, and improve the future energy structure. This article aims to achieve eco-friendly, low-carbon, intelligent, modern, smoke-free, energy-cyclable and renewable energy through the research on biomass renewable energy and environmental protection low-carbon city power generation and heating devices. This paper proposes a modern utility model biomass renewable energy environmental protection low-carbon city power generation and heating device, and the feasibility of the device has been verified through experiments. It is concluded that the change in raw material consumption has little effect on the gas components and calorific value in biogas. The power generation and heating device has good adaptability to the amount of raw materials, and its comprehensive pollutant emissions are compared with traditional coal and petroleum. Power generation and heating facilities are reduced by 99%. The research in this paper helps to alleviate the shortage of energy supply in my country, develop a circular economy, and promote the sustainable development of social economy.

Keywords: Biomass Heating, Renewable Energy, Low-Carbon City, Power Generation and Heating Device

1. Introduction

Energy is the basis for the survival and development of modern society, and energy supply capacity is closely related to the sustainable development of national economy [1]. Because of diminishing fossil fuel reserves, volatile oil prices and worries about energy security and the attention to global warming, develop clean and renewable energy has become an urgent subject, new energy industry present high growth [2-3]. The abundance and variety of biomass energy resources make it the preferred energy source for future development of all countries in the world. At present, a variety of biomass energy has been widely used in industrial production and life around the world, such as biodiesel, biogas, fuel ethanol, biomass power generation. [4-5]. In recent years, with the global environmental problems of serious, the shortage of fossil fuels, the biomass energy has become a key development around the world. Many countries established separate biomass research plan and biomass energy development strategy. At present, the biomass energy mainly concentrated in the governments of all countries begin
to intensify efforts to support the biomass power generation technology, governments began to increase the biomass to technology development and research [6-7].

With the development of China's economy, people have higher and higher requirements for living comfort, especially for heating in winter. Therefore, central heating industry has received extensive attention in China [8]. Electricity, is high-quality secondary energy consume a large amount of heat is an energy conversion, is to realize the industrialization modernization raise the level of human social life of the necessary conditions and material guarantee. In heating production, usually the fuel (coal, oil, natural gas, nuclear material) boiler combustion to generate steam to drive steam turbine generators, and waste heat for the urban heating heating [9-10]. But also caused the energy shortage, environment pollution and so on a series of problems. Therefore the development and utilization of clean environmental protection, energy efficient and green ecology, safety, low carbon biomass, renewable energy, has become the consensus of the human society.

In view of the shortcomings of the traditional coal and petroleum power generation heating methods, in order to alleviate the situation of energy shortage and serious environmental pollution in my country. This paper presents a modern utility model of biomass renewable energy environmental protection low-carbon city power generation and heating device, which achieves low pollution and low emissions compared with traditional power generation and heating facilities.

2. Method

2.1 Biomass
Biomass refers to a variety of organisms produced by photosynthesis, solar energy in the form of chemical energy stored in the biological form of energy. Biomass sources are very wide, including agricultural and forestry products processing waste, agricultural waste, aquatic plants, oil plants, human and animal waste and urban and industrial organic waste. According to the using way, biomass is divided into traditional biomass energy and modern biomass energy. Most traditional biomass energy is based on direct combustion, including firewood, straw, animal dung. Modern biomass can improve biomass conversion efficiency through thermal-chemical conversion or biological-chemical conversion technology. Biomass utilization can effectively ensure national energy security, at the same time can achieve zero CO$_2$ emissions in use process, will not produce pollution to the environment, to alleviate the pressure of the shortage of energy and realize the low carbon economy is of great significance.

2.2 Biomass Power Heating Unit
Made acid separation tower, tower, methane-producing tower, tower of aerobic, microbial recovery tower, tower of geothermal heat, recharge well, driving Wells, the biomass fuel boiler, biomass gasification boiler, steam turbine generator, cold suspected tower, heat recovery tower, air separation oxygen generator, plasma deduster, central electronic controller respectively by machinery, piping, after mechanical connection circuit, electronic coupling, power coupling and thermal coupling biomass renewable energy environmental protection low carbon city electricity heating unit. Biomass low temperature biochemical reaction process, biomass renewable fuel gasification low carbon combustion process, renewable geothermal energy utilization process. The organic biomass is heated from 4 °C to 38 °C through flue gas through heat exchange, and converted into methane CH$_4$ biogas by bacterial microorganisms, and the biomass fuel gas is burned in the boiler to generate hot steam, which drives the turbine generator to generate electricity. Part after aerobic treatment of water by supercritical water oxidation reactor after oxidation treatment, supplement the condensed water into the boiler, the other part to the underground thermal field returned to earth after absorption of geothermal energy heating steam turbine generator power generation at the back of the gas condensate to 90 °C, taken to a heating boiler to produce steam, form the heat energy recycling. At the same time in the electronic controller under the control of mediation, in in the off-peak electricity will be sent to underground thermal energy storage, peak to take out the underground thermal energy supplement
electricity heating heating.

3. Experiment

This article mainly uses the literature research method, investigation research method and so on. Through the retrieval of relevant literatures such as strategic management, development strategy and biomass power generation and heating, we will deeply understand the research results, theories and practical applications of strategic management, development strategy and biomass power generation and heating, and comb it with the research content of this article. Through interviews and investigations with experts in the biomass power generation industry and heating managers, we have a deep understanding of the industry characteristics of biomass power generation, making the analysis of this article more objective and comprehensive, and enhancing the reliability of the research in this article. Based on the analysis of the problems existing in the traditional coal-fired power generation heating method, this paper proposes a renewable modern utility model biomass renewable energy environmental protection low-carbon city power generation and heating device. With a view to alleviating the energy shortage and promoting the sustainable development of society.

4. Discussion

4.1 Analysis of Heating Device for Biomass Power Generation

The traditional coal-fired power generation heating method has the problems of low comprehensive heat efficiency of energy utilization, large heat loss of conversion power generation, large consumption of non-renewable mineral energy, high power generation heating cost, and serious pollution. Therefore, this paper studies a renewable modern utility model biomass renewable energy environmental protection low-carbon city power generation and heating device. The domestic sewage enters the separation tower by the pressure of the pump. The centrifugal force received during high-speed rotation movement is different. The large mass is thrown to the outer ring, and the small mass is left in the inner ring. It is separated and discharged through different outlets. The supernatant liquid is sent to the heat recovery tower through the pipeline, and the separated concentrated liquid is sent to the acid generation tower through the pipeline. The crushed organic household food waste and the concentrated liquid separated by the separation tower are put into an acid-generating reactor (acid-generating biochemical reactor) and mixed with the supernatant heated to 38°C to be hydrolyzed into soluble sugar by fermentative bacteria, Peptidases, amino acids and fatty acids are absorbed and decomposed by microorganisms and converted into acetic acid, hydrogen and carbon dioxide, and the concentrated liquid after the acid generation reaction is sent to the methanogenic tower. The biomass water and biomass biogas after the reaction of the methanogenic tower are sent to the aerobic tower, and the oxygen entering the aerobic tower is converted into 38°C reclaimed water by oxidative biochemical reaction through the packing between the trays, and recovered by microorganisms. After the tower, part of it is sent to the supercritical water oxidation reactor, where it is oxidized into pure water and sent to the boiler to supplement condensate, and part of it is sent to an underground thermal field (geothermal field) to absorb underground thermal energy. In the general supercritical water oxidation reactor, the temperature and pressure of biomass or sewage change with the change of temperature and pressure, and the three states of solid state, liquid state and gas state are triple points. The oxidant used for supercritical water oxidation is air or oxygen. Therefore, the oxidation of organic substances is carried out in a homogeneous phase rich in oxygen. The high-temperature reaction temperature is 400-600°C, which accelerates the reaction rate. The oxidation reaction of supercritical water is completely thorough. At the same time, a large amount of heat is released during the oxidation process, and the reaction can maintain the heat by itself. The condensate or hot water supply and the underground hot water exchange heat in the geothermal heat exchange tower. The low-temperature condensate water or low-temperature hot water is heated by the geothermal water. The heating method is surface heat exchanger-heat exchanger. In the surface heat exchanger, the cold and hot fluids are separated by the wall surface, and the heat is transferred from the hot fluid to the cold fluid through the
wall surface. Biomass gas and air are burned in the furnace through the burner to release a large amount of heat, which rapidly increases the temperature. The working fluid (water, steam) in the radiant heating surface arranged around and at the top of the furnace absorbs the heat in the furnace to maintain the temperature of the furnace cavity Not exceeding the standard. The high-temperature flue gas formed after burning in the furnace enters the flue through the furnace outlet and exchanges heat with the heated surface arranged on the top flue, so that the flue gas continuously releases heat, and the temperature is gradually reduced. Finally, the low-temperature flue gas is sent to the heat through the outlet recycling tower. The feed water (condensed water) fed into the boiler by the pump, after high pressure and pressure, enters the heat recovery tower, absorbs the heat energy of the exhaust gas of the boiler tail, and enters the water cooling wall, thereby forming a high-temperature steam-water mixture in the water cooling wall, and flows upward through the steam water. After separation, the separated water continues to circulate, and the separated saturated hot steam is sent to a low-temperature superheater and a high-temperature reheater for heating, and the superheated steam that meets the requirements enters the steam turbine through a pipeline to do power generation. Biomass fuel enters the furnace, part of it is converted into volatiles and the other part is converted into solid carbon to participate in the reduction reaction. The condensing tower is a large surface heat exchanger. During operation, cooling water enters from the cooling water inlet and enters the return water chamber through the cooling water pipe. The low-temperature steam comes in from the pan-gas inlet and releases heat to the tube wall, and the cooling condenses into condensate, maintaining a certain vacuum at the exhaust of the steam turbine, causing it to expand to a certain condenser pressure and transform into mechanical work. The condensed condensed water is used as make-up water to participate in the thermal cycle again. The heat recovery tower uses the heat of the flue gas at the end of the boiler to heat the sewage, condensate and hot water, and transfers the heat to the sewage, condensate and hot water. In order to achieve heat exchange between flue gas and water and gas. The low-temperature flue gas discharged from the heat recovery tower enters the flue gas channel of the plasma dust collector. The harmful substances in the flue gas, oxygen and water vapor are mixed with the catalyst to carry out catalytic cracking reaction, and the monomeric carbon dioxide and water are generated and discharged into the atmosphere. Through the circuit and wireless transmission, the hardware parts are connected together to form a central electronic controller.

4.2 Analysis of Test Results

The consumption of raw materials is 200, 400 and 600 kg/h, the primary air volume is 100, 200 and 300 m$^3$/h (standard state) and the secondary air volume is 120, 260 and 380 m$^3$/h (standard state) respectively. In contrast, the proportion of each gas component in the biogas produced and the calorific value of biogas are shown in Table 1 and Figure 1.

**Table 1.** Gas composition and heating value under different raw material processing conditions

| Amount of raw materials/ (kg·h$^{-1}$) | $\varphi$ ($H_2$) /% | $\varphi$ ($CO$) /% | $\varphi$ ($CO_2$) /% | $\varphi$ ($O_2$) /% | $\varphi$ ($CH_4$) /% | $\varphi$ ($N_2$) /% | Calorific value (Standard state)/(MJ·m$^{-3}$) |
|--------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------------------------|
| 200                                  | 10.52          | 17.39          | 15.88          | 1.20          | 3.82          | 48.72         | 4.695                             |
| 400                                  | 14.02          | 16.44          | 12.69          | 1.22          | 3.16          | 53.02         | 4.727                             |
| 600                                  | 16.63          | 11.75          | 15.9           | 1.39          | 3.86          | 28.68         | 5.061                             |


Figure 1. Biogas calorific value under different raw material processing conditions

It can be seen that the change in raw material consumption has little effect on the gas components and calorific value in the biogas, which shows that the biomass renewable energy environmental protection low-carbon city power generation and heating device has a good adaptability to the raw material amount. At the same time combined with geothermal energy, the comprehensive emission of pollutants is 99% less than that of traditional coal and petroleum power generation and heating facilities, which is lower than the carbon emissions of nuclear power generation and heating facilities.

5. Conclusion

My country's current energy supply situation is grim, and the burden of environmental quality is heavy. Based on concerns about energy security issues and concerns about global warming, the new energy industry is showing high growth. The existing urban power generation and heating equipment is also accompanied by pollution while heating, which has affected the sustainable development of society. Therefore, the development and utilization of clean and environmentally friendly, energy efficient, green ecology, safe and low carbon biomass renewable energy has become the consensus of human society. In this paper, through the research on biomass renewable energy and environmental protection low-carbon city power generation and heating devices, it can alleviate the shortage of energy supply in my country and improve and protect my country's ecological environment.

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