Research on Applications of Solar Power in Countryside

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Abstract. Solar energy is a new pollution-free energy of maturetechnology andabundantreserves. This paper firstly introduces the concept and characteristics of the solar power, and then analyzes the necessity and feasibility of its applications in rural areas. Finally, this paper gives three examples of the applications of solar power in the rural areas, which are sewage treatment, heating system and greenhouse cultivation in order to providesome references for the related researchers.

Concept and Features of Solar Power

Solar energy generally refers to the solar radiation energy, which is a type of natural energy.Since the formation of the earth, the creatures are mainly provided with the sun's heat and light to survive. Humans have learned to sun dried objects to preserve food as salted fish. Solar energy has become an important part of human energy use in the case of fossil fuels, and has been continuously developing. The use of solar energy has two ways of passive use and photoelectric conversion, solar power is an emerging renewable energy. The amount of surface heat energy mainly depends on the size of the solar altitude angle. Therefore, people area available to make use of the solar energy resources more fullyin the high latitude and high altitude areas. There are two main ways for people to use the solar energy.One is the heat storage, heat collection and direct use of heat, such as has been widely used in the solar water heater, solar cookers, air conditioner, passive solar heating room, dryer and heat collector. The other is photoelectric conversion. We convert solar energy into electrical energy and savings, eventually in the form of power supply to meet people's needs. This is currently the main direction of the application of solar energy, such as the solar battery, hydrogen production device and solar bicycles, automobiles and aircraft.

Necessity and Feasibility of Applications of Solar Power in Countryside

At present, China's rural persons mainly rely on the traditional straw and firewood as the main source of energy.Electricity, gas and other commercial energy is still usedrelatively in a low rate. Specifically speaking, the rural energy consumption can be divided into three categories. First, the energy to cook mainly depends on the straw. The effect of the large use of biogas input is not stable and the maintenance is not convenient for many farmers to bring inconvenience to the family so that it is not widely used. The second type of the energy is electricity. The third is the energy to heat. With the improvement of the living standards of the first farmers, the demand for energy in the rural areas has increased sharply, which has intensified the contradiction between the supply and the supply of rural energy, which makes the rural energy use face a series of problems. China's rural life energy use structure of a single long firewood and straw and other biomass. With the medium and long term urbanization, the acceleration of the process of industrialization, the farmers and urban residents' life style is becoming more and more convergent. Traditional energy cannot meet the

rural life. Secondly, the rural energy use efficiency is low. Again, the technical services cannot keep up with the construction of rural energy projects. Therefore, it is urgent to develop and utilize new energy resources in rural areas.

Solar energy has affordable and reliable characteristics, which can save considerablehome energy costs. A solar water heater can save nearly a thousand Yuan in the process of supplying hot water for consumers. The technology of combine the simple chemical principle with mechanical engineering is more and more mature, which will solve the problem of the influence of the bitter salt water in the northern countryside. Solar power can make good use of the limited resources. Buildings are generally not more than three layers in countryside.The vast majority of rural housing hasan ordinary solar hot installation conditions. It is easy to install and use the solar energy. The opening and utilization of solar energy in China's rural areas have obvious advantages.

Concrete Applications of Solar Power in Countryside

For a long time, rural domestic sewage treatment did not receive due attention. As the rural population living scattered, most of the sewage without treatment directly flow into the river or into the nearby underground. Some built sewage treatment facilities are underutilized. The solar power can change the current situation. Centralized collection and sewage into the sewage treatment system in the anaerobic pool, part of the sewage in the anaerobic tank complete degradation process and improve the sewage can biochemical, thus speeding up the sewage treatment speed and saving energy consumption. After anaerobic treatment of sewage and oxygen into the pool, the facultative pond there are a lot of denitrifying bacteria, denitrifying bacteria in the facultative pond. A large number of organic compounds will return to the mixture of large amount of nitrate nitrogen and nitrite nitrogen reduced to nitrogen gas, and reduce the concentration of nitrogen in sewage. Then the sewage enters the biological contact oxidation tank, and the organic matters in the sewage can be degraded further. Biological contact oxidation process was designed to be used as an aerobic treatment process. Bio contact oxidation process, also known as submerged biological filter, is the active sludge process and biological filter. Ammonia nitrogen by nitrification of ammonia nitrogen concentration decreased significantly, with the nitrification process, wastewater nitrate nitrogen concentration increased; activated sludge phosphorus accumulating bacteria in aerobic conditions to absorb a large amount of phosphorus, and the transformation is not soluble poly phosphate in the body, finally settling tank discharge of surplus sludge phosphorus removal system. After settling pond treatment, the water was finally entered into the wetland filter for further treatment, and the sludge produced by the sedimentation tank was treated by the method of artificial regular cleaning. Wetland treatment techniques rely on physical, chemical and biological interaction of water purification process, through filtration, adsorption, precipitation, ion exchange, absorption of plant and microbial decomposition to achieve further depth of sewage treatment. When the sewage flows through the wetland bed, a large number of suspended solids and insoluble organic matter was packing and root interception. The dissolved organic matter by biofilm adsorption and microorganism's metabolism degradation, also has a part of organic matter is plant uptake and removal. Ammonia nitrogen wastewater in the wetland in hand by adsorption, filtration, precipitation, plants, and microorganisms as nutrition absorption can be removed. In addition, the artificial wetland has strong sterilization effect on Escherichia coli.

After the treatment of rural sewage, the water can reach the level A of the "discharge standardof urban sewage treatment plant pollutant", which can be showed in Table 1.

Table 1 Comparison between the Sewage and Treated Water

	COD_{Cr}	BOD_5	ammonia and nitrogen	phosphate
previous sewage	350	150	30	2.5
treated water	120	20	15	1.5
removal rate	65%	86%	50%	40%

The countryside is relatively backward and poor for a long time. The heaters installed in the cold area of farmhousebelong to luxury demand. The basic fuel mostly relies on local agricultural straw and scavenging the firewood, or buy a small amount of coal is used as auxiliary fuel. In addition to fuel, the traditional heaters are the heating furnaces.At present, in addition to a small number of very affluent areas and farmers, the vast majority of areas and farmers still maintain the traditional way of heating. The average temperature in a building is much lower than that of the city's central heating, while the indoor temperature is only about 8 degrees Celsius in the outdoor -10. Indoor temperature: control at no less than 14 degrees C, the economy mainly includes one-time investment and operating costs and maintenance costs, such as the three aspects. Economy is one of the most important factors in the research program. If the energy target is in front of the energy target but the capital investment is beyond the actual capacity of the rural areas, it is also doomed to failure. Less than or equal to the traditional heating methods of investment; in accordance with the national policy level requirements are to reduce the use of traditional energy and reduce emissions for the environment. If the government takes coercive measures to improve farmers' awareness of environmental protection, it is clear that it doesn’t work. If the farmers accept the plan, we can give some guidance and support to them in the economic and practical fields. As can be seen from the Table 2, solar energy is suitable for the farmers to adopt with a comprehensive consideration.

Table 2 Comparison between Coal Furnace, Gas, Electric Energy and Solar Power in Heating System in Rural Areas

	coal furnace	gas	electric energy	solar power
reproducibility	bad	bad	bad	good
cleanness	bad	ordinary	ordinary	good
CO_2 emission	bad	good	good	good
invest	low	high	high	low
operation expenses	ordinary	ordinary	high	low
maintenance expenses	bad	good	good	good
comprehensive assessment	bad	ordinary	ordinary	good

With the development of science and technology, economy developed rapidly in our country rin recent years, especiallythegreenhouse agriculture. The application of solar power in the greenhouse planting improves the farming efficiency. Solar powered irrigation system refers to the solar panels, the irrigation controller and the pumps, which are connected in sequence. The irrigation control valve is installedin the water outlet pipe of the pumpto solve the problems of irrigation in the areas without electricity. It has the advantages of environmental protection, no running costs, long-term unattended operation and other advantages. We can make use of the artificial means to season vegetable production and high economic price of agricultural products through scientific and technological means to control and change the environment inside greenhouse.Greenhouse shading system is an important facility for greenhouse cooling, which is divided into internal and external shading systems. The internal and external shading system can not only decrease the temperaturein

summer, but also can play the role of energy conservation in winter.The application of solar power in modern agriculture promotes the efficiency of solar energy and effectively reduces the cost of agricultural production.

Conclusion

Currently, the application technology of solar power is gradually mature. The features of high cleanness and low price make the solar energy have a very broad market in the rural areas. Under the background of ecological civilization construction, the applications of solar power in countryside can contribute to the energy structure and economydevelopment. The solar energy will be applied more and more widely in the future in the countryside.

References

[1] ZouXiaoxia, WanYunfan, LiYu'e,GaoQingzhu, TheEffect of Energy-Saving and Emission Reduction of Solar Energy Resource Utilization in Rural Areas of China, J., Renewable Energy Resources, 2010, 28(3): 93-98.

[2] Zhen Wenlong.Research on development strategy & government policy of the Photovoltaic Solar Industry in China,taking Spainas comparison, D., University of International Business & Economics.2007

[3] Wang Junhui, Guan Ailing, Li Linlin, Dai Juanjuan, Wang Shaojun, Application Research in Rural Sewage Treatment by Solar Micro Power

[4] GaoXinyu, FanBoyuan,ZhangHongguang, Study on Application of Solar Heating System in New Countryside Construction, J., ActaEnergiae Solaris Sinica, 2009,30(12):1654-1657.

[5] Li Baojian, Zang Chao, Liu Yao, Zhan Jian, Energy Consumption Analysis and Energy Saving Measures of a Sewage TreatmentPlant in Jiangxi Province, China, J., Technology of Water Treatment, 2015,41(6): 116-122.