Development and utilization of clean energy in Tibet

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Abstract. With the acceleration of modernization, environmental protection and sustainable economic and social development have attracted more and more national attention. Therefore, the development and utilization of clean energy has important practical significance under the background of the national scientific outlook on development. As an important ecological protection area in China, it is an inevitable trend for the future economic and social development of Tibet to take clean energy as energy support. Therefore, accelerating the development and utilization of clean energy in Tibet is of great significance to respond to the national energy strategy, the economic development of the autonomous region, the protection of ecological environment and the stability and prosperity of the region. Therefore, we need to promote the energy revolution, accelerate energy technology innovation, and build a clean, low-carbon, safe and efficient modern energy system.

Keywords: Tibet region; Clean energy; Development and utilization.

1. Solar thermal utilization

1.1 Solar cooker

Solar cooker is a photothermal product that used solar energy earlier in Tibet. It encountered great difficulties in demonstration and promotion in the 1980s. Due to the limited cognition of farmers and herdsmen, it did not accept this practical solar photothermal product at the beginning. Scientific and technological personnel overcome many difficulties, went deep into the homes of farmers and herdsmen, publicized solar energy related knowledge, hand-in-hand taught how to use solar ovens, and let farmers and herdsmen personally experience the benefits of solar ovens and their role in ecological and environmental protection. Through continuous publicity by scientific and technological personnel, solar ovens were gradually accepted by the majority of farmers and herdsmen. At present, solar ovens have been spread all over Tibet. Solar ovens can be seen everywhere in cities and towns, agricultural areas and pastoral areas. Some families even have 3 or 4 solar ovens. Solar ovens have become an indispensable product for farmers and herdsmen. They have not only brought convenience and benefits to the lives of farmers and herdsmen, but also contributed to the protection of the ecological environment in Tibet. Most of the solar stoves popularized and applied in Tibet are cast iron condensing solar stoves, some of which are bulky, non foldable and inconvenient to carry. Aiming at the actual situation of nomadic mobility and lack of living fuel of herdsmen in pastoral areas of Tibet, scientific and technological personnel have studied and developed a portable and foldable portable solar cooker. So far, the solar stoves promoted are used outdoors. They need to be focused every 10 minutes or so, which is inconvenient to use. Scientific researchers are committed to the research and development of indoor solar stoves to meet the cooking energy needs of farmers and herdsmen in Tibet.

Fig. 1 Application of solar cooker in Tibet

1.2 Solar water heater

Solar water heater is one of the main contents of the development of solar heat utilization industry. In the promotion and application of solar water heaters in Tibet, solar water heaters with flat plate collectors were first used. With the development and progress of technology, vacuum tube collectors and solar water heaters have been basically used in recent years. After more than 20 years of research and development, the solar water heater has successfully solved the problems of antifreeze, pipe explosion, aging, heat preservation and water leakage of the water heater. Solar water heaters are already market-oriented products in Tibet. With the improvement of the living standards of urban and rural residents, solar water heaters have been widely used in cities and towns and some conditional villages, which has brought great convenience to local residents in providing bathing hot water and domestic hot water. In addition to being widely used in families, solar water heaters now use a large-area central heating water system combined with buildings in some relatively centralized communities, hotels, schools and troops. This central heating water system is more convenient to operate, easy to manage, higher heat utilization rate and lower cost, and is more and more favored by the market.

Fig. 2 Application of solar water heater in Tibet

1.3 Passive solar house

Passive solar house is a kind of building that collects, stores and distributes solar heat energy completely through the reasonable layout of building orientation and surrounding environment, the ingenious treatment of internal space and external form, as well as the appropriate selection of materials and structures. Passive solar house is one of the earlier technologies for solar energy utilization in Tibet. It has been applied and popularized in Ali Region, Naqu region, Lhasa City, Shigatse region and Shannan region since the 1980s. Combined with the architectural characteristics of Tibet and the people's living habits, the main promotion and application is the additional sunshine room passive solar room. Because the additional sunshine room passive solar room has an additional sunshine room with a certain space, and the additional sunshine room has gradually become the people's living space, so it is favored by the majority of farmers and herdsmen and has been widely used. In recent years, according to the different use places of passive solar houses and the

characteristics of buildings, the passive solar houses popularized and applied by scientific and technological personnel include direct benefit type, heat collection and heat storage wall type, trump wall type and additional sunshine room type passive solar houses. In the high and cold areas of northern Tibet, schools only use burning cow dung for heating in winter. Students not only have to go to class, but also need to pick up cow dung. During class, they add cow dung to the stove, which has greatly affected students' learning. In recent years, scientific and technological personnel have adopted various forms of passive solar room technology in these areas, and some even adopted a combination of active and passive solar room technology to solve the problem of school heating in winter, There is no need to burn cow dung in the classroom, and the learning environment has been greatly improved. Solar buildings are widely used not only in schools and dormitories, but also in schools and families. The field test results show that after adopting the passive solar house technology, the indoor temperature is at least 8 ℃ higher than the outdoor temperature, which can basically meet the heating requirements in winter. At the same time, the transformation or construction cost of the passive solar house does not exceed 20% of the construction cost. The passive solar house solves the winter heating problem of farmers' and herdsmen's families, office buildings and schools, and greatly improves the living environment, life treatment, office and learning environment.

Fig. 3 Application of passive solar house in Tibet

2. Solar photovoltaic utilization

Since the mid-1980s, Tibet has successively carried out research and promotion of solar power generation technology. The promotion and application of solar photovoltaic power generation technology in Tibet are mainly solar household systems and independent photovoltaic power stations. Solar household system has developed from 10W and 20W to 360W; From the original lighting problem can only be solved to now, it can not only solve the lighting problem, but also watch TV, play DVD, bring tea maker, bring computer, etc., with better performance and more comprehensive functions. The independent photovoltaic power station is mainly used to solve the basic power consumption problem of the county and township governments. Now, as long as the number of centralized households reaches 20 villages, the independent photovoltaic power station can be used to solve the power consumption problem; From solving the basic power problem to now, the power problems of office, production and living have been solved, which has greatly improved the living and production conditions of farmers and herdsmen, and the office conditions of counties, townships and villages, and the power consumption level has been greatly improved. From fixed independent photovoltaic power station to automatic tracking photovoltaic power station, roof grid connected photovoltaic power station combined with buildings and large grid connected photovoltaic power station.

Tibet has successively implemented special solar energy promotion and utilization projects such as "construction of photovoltaic power stations in counties without water and electricity", "pilot project of Guangming project", "Ali Guangming project", "Tibet sunshine plan", "light of science plan", "Ali photoelectric plan", "power transmission to villages project", "golden sun demonstration project", "power construction project in areas without electricity", which has greatly alleviated the

shortage of conventional energy in Tibet. In addition, photovoltaic power generation is also widely used in Qinghai Tibet railway, meteorological stations, optical cable communication, military, armed police and highway systems. As of 2010, 602 independent photovoltaic power stations have been established in areas without electricity, 16456 sets of solar household systems have been promoted, and the total power has reached 14430kw, which has solved the power consumption problem of 307000 people and improved the power consumption of 13000 people.

Fig. 4 Application of independent photovoltaic power station in Tibet

3. Wind energy utilization

The development and utilization of wind energy resources in Tibet began in the 1990s. The introduction and demonstration of wind power generation technology was carried out in Ali Region. The application of wind power generation technology in Tibet is mainly hundreds of watts of household wind power generation system, wind solar complementary household power generation system and independent wind solar complementary power generation system. However, the power of a single wind turbine is small. In the "power transmission to the countryside" project implemented in 2002, more than 10 wind / light complementary power stations were built in Naqu, of which the power of a single wind turbine is 1kW.

Since 2007, Tibet energy research and demonstration center has increased the development and utilization of wind energy resources in Tibet, established wind measuring towers in areas with good wind energy resources in northern Tibet, collected and analyzed data related to wind energy resources, and laid a foundation for further development and utilization of wind energy resources in Tibet. In 2009, wind light complementary power generation technology was introduced in Naqu region, and the wind power generation equipment with a single wind turbine power of 10kW was successfully applied for the first time in Tibet, which marks a new stage in the application of wind power generation system in our region. Since then, the demonstration, promotion and application of wind solar complementary power generation technology have been carried out in many townships and villages in Naqu area, and the R & D and demonstration of key equipment such as wind power generation equipment and wind solar complementary controller have been carried out. The first 100kW wind solar complementary power station with the largest installed capacity in Tibet has been built in Shuanghu special area, in which the power of a single wind turbine generator is 5kW and 10kW. Wind and solar complementary power generation, with a total installed capacity of 220 kW.

Fig. 5 Application of wind solar complementary power station in Tibet

4. Use of biomass

In the 1970s, scientific and technological personnel conducted some exploratory research on the introduction and demonstration of biogas technology in plateau areas in duilongdeqing county and Shannan County, Lhasa, Tibet. Due to the high altitude, low temperature and large temperature difference in Tibet, and the immature biogas technology at that time, the project ended in failure. In recent years, with the continuous improvement of the development level of biogas technology and the continuous improvement of local scientific research and innovation ability in Tibet, through the unremitting efforts of scientific and technological personnel inside and outside the region and combined with mature solar heat utilization technology, since 2004, scientific and technological personnel have gradually carried out the combination of solar greenhouse and household biogas technology in Shigatse, Lhasa, Shannan and other places (cities), successfully studied and popularized solar biogas. The researchers did not stop to continue their research. According to the characteristics that the household biogas fermentation raw materials in Tibet are mainly cow dung and straw, they studied the fermentation process type, fermentation temperature, characteristics of fermentation raw materials, fermentation concentration, fermentation pH value, large and medium-sized centralized biogas projects, solar biogas in high altitude and cold areas, and formulated the solar household biogas fermentation process scheme in Tibet, The technical regulations for the use of rural household biogas digesters in Tibet have been prepared. In view of the characteristics of the plateau environment with high altitude and low temperature in Tibet, the "cylindrical hydraulic biogas digester" technology is introduced, and the solar heat utilization technology is used to increase the temperature and heat preservation of the biogas digester, which solves the technical problems such as less gas production and slow fermentation, so that the solar biogas digester can take root and blossom on the plateau. So far, Tibet has promoted about 150000 solar household biogas digesters and more than 10 large and medium-sized centralized gas supply biogas projects.

Fig. 6 Application of solar household biogas digester in Tibet

5. Conclusion

The development of new energy science and technology in Tibet will strengthen the research and promotion of new energy technologies focusing on solar energy, introduce and develop new products and technologies of photothermal, photoelectric, wind energy, geothermal and biomass energy, develop new energy-saving and emission reduction technologies under the condition of low pressure and hypoxia on the plateau, build a national demonstration base for solar energy industrialization in Tibet, and further improve the construction of solar energy detection and test platform. In combination with the implementation of the national "golden sun demonstration project" and the "power construction plan for power free areas in Tibet Autonomous Region", we will carry out the integration, demonstration and promotion of new technologies for photovoltaic power generation, wind power generation, wind solar complementary power generation and light and heat utilization, promote the wide application of new energy in Tibet, and effectively solve the problem of power consumption in power free villages and towns in Tibet. Focus on the research and development of new technologies and products for light and heat utilization, the introduction, development, test and demonstration of new solar power generation technologies, the research and demonstration of key technologies of wind power generation, and the testing standards of new energy technology products in plateau environment.

References

[1] Gaibaoru Research on the development status and Prospect of domestic clean energy [J] Modern industrial economy and informatization, 2016, (14): 15-16.

[2] Yuan Zhibin Solar energy industry in Tibet [J] High tech and industrialization, 2014, (8): 98-101.

[3] Tian maode Development and utilization of clean energy in Tibet from the perspective of ecological security [J] Tibet development forum, 2015, (3): 42-45.

[4] Guo Jinhui Ten trends dominate the future development of global clean energy [n] China economic times, June 14, 2016 (006).

[5] Zhang Yuan, Hui Bei Analysis and Prospect of multi energy complementary power generation [J] Energy and energy conservation, 2015, (6): 80-81106.