A study of operational cycle of terminal distributed power supply based on Big-data

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Abstract. In China, the distributed power supply industry enjoys a rapid development trend. For the users' side of the distributed power mode of operation, there are various types. This paper, take rural as an example, mainly studies the all round life cycle operation mode of rural distributed solar power plant, including the feasibility study plan and investment suggestion of the initial construction of the rural power station, and the operation and maintenance in the middle period. China's vast rural areas, areas per capita is large, average households have independent housing and courtyards, available building area is no problem. Compared with the urban areas, the return rate of investment is low, the investment options is rare, the collective is strong, the risk tolerance is weak and so on. Aiming at the characteristics of the rural areas in the above rural areas, three kinds of investment schemes of rural distributed photovoltaic power plants are put forward, and their concrete implementation plans are analyzed in detail. Especially the second option, for the farmers to consider the risk of investment, given their principal security, which greatly reduces the farmers into the power plant loss of funds risk. At the same time, according to the respective risk of farmers, given the corresponding investment advice. Rural income is generally low, the expected benefits of distributed photovoltaic power plant can significantly improve the income of farmers, improve the quality of life of farmers, coupled with the strong rural collective farmers, rural distributed photovoltaic power plants will mushroom, which On China's photovoltaic construction and even the supply of clean energy is of great significance, so as to truly benefit the national energy strategy and rural construction.

1. Introduction

In recent years, rural distributed photovoltaic in China by the central government and local government departments at all levels of strong support. Farmers in their own roof, greenhouses and other installation of photovoltaic modules, simple, and there is no guarantee of property rights, no high-rise shelter, low investment costs, so the potential is huge. Precise poverty alleviation is aimed at poverty-stricken groups to carry out targeted poverty alleviation has become the inevitable demand for poverty alleviation work in China [1]. The implementation of the national photovoltaic poverty alleviation policies to promote...
distributed photovoltaic power generation in rural areas to address the basic livelihood of poor farmers. Aspiring to become "China's first application of photovoltaic" Hefei City to develop a clear "light. Poverty alleviation "task: that is, the next five years, that is, to 2018 to complete the 1000 poor families" PV poverty "task. 

February 5, 2017, the Central No. 1 document released, rural photovoltaic power generation was first written into them: the implementation of rural new energy action, promote photovoltaic power generation, and gradually expand the rural power, gas and clean coal supply. This is the industry looked at the formal sound of the photovoltaic industry into the countryside of the horn, 2017 will be the development of rural photovoltaic development of the first year!

Distributed photovoltaic power plants in recent years, much attention, the state departments introduced a series of documentary policy promotion. However, although the state and all levels of government policy support, distributed photovoltaic power plant construction has always been bland, difficult to have a big momentum of development. According to the latest statistics released by the National Energy Board, at the end of 2016, China's total installed capacity of photovoltaic power generation capacity of 77.42 million kilowatts, of which 67.1 million KW centralized power plant, distributed photovoltaic power plant 1032 million KW. Distributed photovoltaic accounted for only 13.3%, and the community expectations and policy objectives gap is huge.

Rural construction of distributed photovoltaic power plants can significantly change the energy use of rural areas, positive incentives to farmers to use electrical cooking (to avoid the use of straw and other fire cooking), thereby improving the rural air situation; improve farmers on television, air conditioning, Refrigerators and other use of the initiative, so as to improve the living standards of farmers and quality of life.

The Is the distribution of a distributed photovoltaic power plant in rural areas? In view of this problem, many experts have given a lot of analysis, but also pointed out that the rural PV construction problems: lack of funds, rural single-family distributed photovoltaic power plant capacity is small, the power time does not match, the family itself Lack of stability and other issues, especially the source of funds to become an important factor restricting the development of distributed photovoltaic in rural areas; Secondly, the rural areas of the power grid structure does not match the problem has not yet been resolved. Han Yongqi [2] pointed out that the lack of demonstration households, rural photovoltaic power plant funding, grid structure and grid technology to be improved and improved is a major reason for the impact, and gives the relevant issues. Zhong Yinyan [3] studied the rural poverty alleviation project in Hefei, and put forward the strategy of rural collective investment. Ren Yadi [4] for the "self-built for use, full Internet", "self-built for personal use, the power of the Internet", "contract energy management, full Internet", "contract energy management, electricity Internet" four operating modes, Out of the rural PV power plant construction revenue analysis, given the incentive policy related research, and pointed out that the balance of the Internet for self-built more beneficial. Zhu Lin [5] studied the impact of distributed photovoltaic power plants on rural economic, social and ecological aspects. Wang Yu [6] for the remote areas of rural areas, especially in difficult areas of electricity, analysis of the importance of distributed photovoltaic power plants, and gives the promotion of recommendations: such as changing ideas, increase financial support, strengthen the publicity and so on. However, the author believes that the above study can not solve the rural distributed photovoltaic power plant status essentially, and can not solve the rural distributed photovoltaic power plant to promote the problem. Collective investment for average farmers is not enthusiastic, collective management for the state to contribute to poverty and other effective, only the farmers are not likely to contribute to collective construction. Taking into account the characteristics of rural households and the initial cost of a distributed PV plant (3-10KW, the cost of 3-10 million), a single farmer family can basically afford their own. The author believes that the impact of rural photovoltaic power plant construction is the main problem lies in the risk. Farmers' income is lower than that of urban areas, low level of education, low tolerance to risk, and risk-averse investors. In view of the above characteristics, this paper presents three.
The project construction and operation mode feasibility plan design, the risk level from low to high, and gives the different types of farmers investment options. For each of the three investment models, given their different operating modes. The article concludes with the main contents and conclusions.

2. Operation models in initial stage

First of all, in view of the low degree of acceptance of rural risk characteristics, put forward three different investment power station construction feasibility plan design, three kinds of program risk from low to high. The main purpose of the above program is due to slow progress in rural PV construction, and rural collective property is strong, hoping to have some users to join in order to achieve the lead demonstration effect. Second, for each farmer, given the farmers how to choose their own most matching investment decision-making recommendations.

2.1. Resource Integration

(1) Roofs Renting

The first option takes into account the large number of rural roofs, and individual farmers can not invest in the construction of photovoltaic power plants for various reasons. At this time, enterprises or other investors can obtain the area of PV power plant by leasing the roof of the farmer or other building area. Other uses of farmer roofs or idle buildings are limited and the opportunity cost is small, so that the roof rental costs are necessarily low and the benefits of win-win between business and farmers.

The advantage of the program is that it can be built with less cost to build a site area, which has been adopted in many places, such as Jiaxing. For farmers, it is possible to obtain risk-free benefits such as rents or tariffs by renting roofs, which is beneficial for improving farmers' lives and promoting distributed PV plants. Its shortcomings are also obvious, mainly to increase the investment costs of investment and power plant risk. The increase in input costs refers to the rent that the investor needs to pay the owner of the roof. The risk of a power plant is that a distributed PV plant is built on a roof and other buildings, and whether the building has more than 25 years of life uncertainty poses the risk of future cash flow.

(2) Government Guarantee or Subsiding

To fund a distributed solar energy power plant, the initial cash outflow of farmers is relatively large, and the cost recovery cycle would be no less than 3-5 years, or even as many as 8 years or more, which greatly affects the farmers' enthusiasm to invest building a photovoltaic power plant. If once because of natural disasters and other uncontrollable causes of loss, for the lives of farmers will have a huge impact, thus affecting the country and social stability. The second option considers the state to compensate for the loss caused by uncontrollable causes, to ensure the stability of the peasant property, and to achieve the same purpose as insurance. For those who are willing to build photovoltaic power plants on their own roofs, but the lack of funds for farmers, the state should provide free or low-interest loans, etc. support.

China's rural development is seriously behind the city, and the income gap is huge. Precise poverty alleviation as one of the country's focus, reflects the country's attention to the improvement of farmers' lives. This program combines the two characteristics of national precision poverty alleviation and farmers' risk acceptance, which not only promotes the construction of distributed photovoltaic energy, but also improves the income level of farmers.

(3) Joint capital

Rural self-building photovoltaic power plants are at greater risk, but by working with others or companies, they can share risk and share benefits. This model is suitable for those who can bear a certain risk, and get greater benefits. This model country burden is smaller than the second program, for the annual income of about 5W families can bear this part of the loss. With the rural income level and cultural level of the dual increase, gradually increase the degree of risk acceptance.

Option 3 fully embodies the idea of revenue sharing and risk sharing, which not only solves the situation of the initial funding of the project, but also can enjoy the benefits of the completion of the power station. For example, through the cooperation with the PV module business, by paying some of
the equipment required to enjoy the right to use equipment, the remaining money through the monthly power generation gains. This will improve the PV module business to sell the reliability of the device, but also increase the diversification of business income.

2.2. Investment Strategies
This paper puts forward three innovative investment and management models for the different degree of farmers' risk acceptance. For different types of farmers, should take the most suitable for their own investment strategy. Simply according to the degree of risk of different, you can choose the most suitable for their own investment type.

According to the farmers' lifestyles and sources of income and other different, you can choose their own way of life investment. For example, as transportation becomes more convenient, farmers migrate more and more, this part is more suitable for the first way or the third way, that is, renting their own homes to obtain rent and cooperation with others to build, to avoid nobody Management and maintenance of photovoltaic power plant phenomenon. For most farmers, disposable funds can basically assume the construction of 3-10KW distributed photovoltaic power plant, the use of the second investment is the most suitable, both to ensure the safety of investment funds, and no accident can get considerable benefits for the increased Family income, especially the income source of poor households, is helpful.

3. Operation and preservation
The initial stage of the project is the investment model and the revenue model is established after the establishment of photovoltaic power plants and to achieve grid. As the distributed photovoltaic power plant into a smaller, relatively simple PV modules, and its maintenance is basically a regular cleaning, the cost can be basically ignored. For the distribution of power generation, different investment patterns have their own income distribution.

For the first investment model, its regular maintenance can be done by the owner. All the income of the power station investors have access to the owner can be free of charge by electricity or rent, etc. to obtain risk-free income. The second way the owner is the only investor in the power station, the proceeds are owned by the owner, and the state can get the amount of the income of the owner by the amount of electricity. The third is to take the cooperative business model, that is, the owner and others co-investment and other ways to share power generation income, the way income distribution can be diverse, free choice.

The project can be used to generate electricity from the use of self-use, the balance of the Internet model can also be used in full Internet mode. For the second farmer self-built power station, the use of margin Internet access than the full amount of Internet access to get better returns.

4. Post-Investment management
With the continuous progress of technology and the cost of PV modules continue to decline, the current life of photovoltaic power plants in 25 years or so. Although the life of rural housing is limited, but with the economy and the improvement of farmers' lives, the rural areas generally bid farewell to the past, the simple roof, 5 years the number of new homes can account for more than 1/3 and a substantial increase in new building life, fully able to support the photovoltaic power plant Lifecycle operation and maintenance.

Existing research shows that 5 to 11 years of photovoltaic power plants not only can cover the cost, but also can get a small amount of benefit. In order to encourage owners to protect the normal operation and power generation of power plants and improve the service span of power stations, especially for the first and third investment model, the owner can benefit from the latter part of the photovoltaic power plant in the latter part of the power generation, The enthusiasm and initiative of photovoltaic power station.
5. Conclusion

China is a big agricultural country, more than 80% of the population in rural areas, rural areas, farmers, agriculture is China's economic and social development of the important features. From the area where solar energy can be exploited, the rural areas of China's rural areas are rich in solar resources, sparsely populated and have a large number of available land, and should develop large-scale ground-based photovoltaic power plants. In the eastern part of the population, Development of distributed photovoltaic power plants. Distributed photovoltaic construction is the most important resource is the roof, and in China, the roof resources are mainly distributed in the vast rural areas, here will be a very promising future of the distributed PV market.

This paper argues that the main problem affecting the construction of rural PV power plants is the low income of rural areas and the disgust of farmers. While the initial construction of photovoltaic power plant larger funds, the key issue is not the lack of financing channels, for 30-100 thousands investment, most families can afford that amount. Although most families have this part of the funds, but can not bear the loss of about ten thousand Yuan. In view of the above problems affecting the rural distributed photovoltaic power plant, this paper recommends three different types of investment strategies and specific implementation suggestions.

In fact, this paper puts forward the investment operation mode can have a variety of ways to achieve, but in essence can be attributed to the above three types of investment model. Specific operational models can be diversified and liberalized, only to take into account the interests of the power station investors can be. This article does not elaborate the specific business model, because the situation is different, the specific circumstances need specific analysis, such as Lin Yang model, Xiulin mode can learn from. Hope this article can cause the national governments at all levels to solve the risk of rural construction of photovoltaic power plants to solve the farmers to worry about, to speed up the construction of rural distributed photovoltaic power plants.

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