Research of Wind-light Complementary System on the Cold Region

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Abstract

Article points out that the wind-light complementary system as an independent power supply system and clean power supply system, which has extensive application, wind-light complementary system are analyzed in the resource use, and the rationality of the system configuration, outlined the development and application of wind-light complementary system at home and abroad. It introduces the content of the project and implementation scheme, and analyses scientifically the prospect and forecasts social and ecological benefits.

Keywords

Wind and sola; power generation system; wind-light complementary; cold region control technology

1. Introduction

There is abundant solar energy, wind energy resources in China. It takes advantage of the complementary properties between wind and solar power, make independent solar and wind power are joined together to form a scenery complementary hybrid power supply system. Scenery complementary system of variable cycle (ISCC) has obvious social and economic benefits. Scenery complementary system generally doesn't and grid connection, high efficiency. And it's use of renewable energy, greatly reducing conventional energy consumption. Low cost, high energy efficiency is one of the advantages of this scenery complementary systems.

2. Domestic and foreign technology research status

Denmark's n. e. Busch and Kollenbach firstly suggested the method of mixed use of solar and wind power. The wind-light complementary system is the wind turbine and photovoltaic components are combined simply. Along with the further wind-light complementary study, at the university of Zaragoza Spain Rodolfo Dufo Lopez created a set of optimization wind-light complementary system software via using c++ language. Colorado State University and National Renewable. Energy Laboratory developed hybrid2 application software, the software can accurately model the actual operation of wind-light complementary system. In recent years, the university of Saskatchewan in Canada Rajesh Karki et have solved how to deploy reasonably wind-light complementary system, according to the load and the scenery resources. They also points out the feasibility of adding the
system capacity. Researchers in Bangladesh optimize configuration of wind-light complementary system by using quasi-Newton algorithm.

Many researchers use meteorological data and predict the feasibility of scenery complementary power generation system. At present, there is no internationally recognized standards to evaluate, analyze, scenery complementary power generation system, and no data conversion intervening the regional standard criteria. Currently, Luis, based on existing photovoltaic standard (IEC - 61724), put forward a new method of P/WHE system evaluation and this method was applied in the engineering example. In recent years, Foreign researchers have developed some large tool software packages to simulate the wind power, photovoltaic and its complementary power generation system performance. TRNSY are more widely used. Barsoum concluded that the feasibility of P/WHP system according to the local resources type, by maximizing the use of new energy and minimizing the consumption of energy optimization system. Gregrois concluded that certain areas of energy type determines the pattern of the new energy. Vukman pointed out that as long as the right electric storage device joining, P/WHP system can gain stable electricity.

As early as in 1982, Yu Huayang et studied the solar energy, wind energy generator energy conversion device, the wind-light complementary system research into practical application stage. In recent years, semiconductor research institute of Chinese academy of sciences, Guangzhou and Hong Kong polytechnic university developed a set of reasonable design which use CAD to optimize scenery complementary system. In addition, the energy research institute of Hefei university of technology created the a simulation model of variable structure of scenery complementary system, in order to be able to reasonably predict system efficiency and the feasibility of the control strategy. The model can reconstruct a variety of structure of complex power systems, and computer simulation calculation.

Mobile communications, Fujian postal communication technology co., LTD., gives the typical configuration of scenery complementary system for mobile communications, which solved the problems of equipment power supply in the construction of mobile communication.

Implement of the strategy of western development in our country, the western region has rich resources of wind and solar, therefore, scenery complementary power supply will become the main way of generating power.

Currently, scenery complementary system has been wildly used, such as scenery complementary street lamps, scenery complementary communication station, scenery complementary water pumps, scenery complementary building and scenery complementary daily products. Photovoltaic grid-connected power generation, in the developed countries, 80% of products used in grid-connected power generation, but in our country is almost zero, the future of large-scale wind and solar power generation is imperative.

3. The previous work foundation

This project combined with the actual situation, mainly aimed at the special original and process problems to develop the study of the solar panel processing array processing technology, low temperature technology and permanent magnet synchronous generator technology and so on. Based on the power output characteristics of wind power and photovoltaic power generation, wind-light complementary system coordinated control strategy is proposed.

Based on this strategy, the research work mainly revolve around the following three basic points, namely the power output stability, and power dispatching, the efficiency of electric power production.

4. Project description

The research content
At the lowest temperatures of minus 30 degrees Celsius under low temperature environment, researchers try to create high-performance wind-light complementary system. And it mainly research the problem of wind-light complementary system of the power imbalance in low temperature
environment, in view of the actual operation of the system nonlinear characteristics and parameters of uncertainty, wind power generation system should use adaptive control strategy to realize the balance of power required real-time compensation, which ensure smooth dc voltage of bus. Considering the battery charging interference, with the help of battery charged nonlinear model to design charging tracking controller. Based on the power output characteristics of wind power and photovoltaic power generation, it put forward coordinated control strategy of wind-light complementary system.

5. The solution of key technology

1) It is proposed to solve the problem of the increase of temperature make battery reduce efficiency and the output power. This project adopts the suitable for working under low temperature environment of GaAs solar cells.

2) Disturbance observation method was adopted to realize the maximum power output of photovoltaic power generation system, project design have robust interference suppression effect of controller to compensation photovoltaic power output (Fig. 1).

![Fig. 1 Solar energy resources on average distribution](image1)

3) Simulation analysis

4) Researching the composition of high and low temperature motor, which can make the motor run for a long time in low temperature environment.

Technical index
Reference indicators:
The annual average wind speed: more than 3 m/s
Supply: 1 KWH/day
Reliability: system in continuous without wind and solar energy can normal supply 2-3 days (Fig. 2).

![Fig. 2 Wind energy distribution](image2)

The system power supply parameters:
The system power supply power: 500 v (inverter power);
Power supply voltage: single-phase 220 vac.:
Power supply frequency: 50 HZ.
Application prospect and social and ecological benefits.
With the improvement of quality of clean energy equipment, export share increasing year by year, at the same time, with modern detection technology, control technology and the energy storage technology developing, clean energy industry starts to upgrade.
Scenery complementary system takes advantages of wind power and solar power, technology is mature. The combination of wind and solar power has natural advantages. Wind energy is another kind of solar energy conversion. It determines the scenery complementary system to have higher reliability and more practical value.
From the marketing point of view, scenery complementary system also has the obvious social benefits and economic benefits. Scenery complementary system generally don't and grid connection, can save a lot of cost. And by using renewable energy, greatly reduces the consumption of conventional energy.
The project research results applied to the production of integrated scenery power generation device, Which will increase the use of clean energy performance in a cold district, improve the clean energy production equipment industry in the international status and competitiveness.

6. Conclusions
Project adopt the group leader responsibility institution, Changchun university is responsible for realizing DC/DC synchronizing converter, battery processing process equipment design and adjustment, solar panel processing array processing technology, permanent magnet synchronous generator technology and equipment manufacture in low temperature.
This team included researchers who engaged in machine vision, speech processing, feature fusion, model building and energy. This study based on Changchun college of electronic information engineering, laboratory equipped with the high frequency signal generator, spectrum instrument, generator comprehensive experiment system and power distribution equipment, complete sets of systems, such as data collecting and modeling can be used in the early stage of the project, hardware installation and testing of the late assignment. The software and hardware condition is sufficient to ensure the smooth completion of this project.

References