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APPLICATION RESEARCH OF RENEWABLE ENERGY IN GENERATION ELECTRICITY, WATER LIFTING AND DRIP IRRIGATION SYSTEMS IN INNER MONGOLIA, CHINA

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Abstract

Renewable energy is presently well in all parts of the world, and it's environmentally friendly and clean. In China, the high-power wind-solar complementary power generation system is urgently needed to meet the existing household electricity consumption in the pastoral areas. The combined operation of road and crushing greatly reduces the times of rolling grassland, realizes and satisfies the operation requirements of drip irrigation improvement technology for natural mowing grassland. It is suitable for natural mowing grassland, natural grassland improvement, rejuvenation and regeneration, and small and medium-sized grassland artificial grassland construction. The machine well water output is required to reach 150-200 t/h, which requires a large amount. The drip irrigation system was used by automatic control using electric energy from these batteries. It is recommended to use renewable energy (solar and wind energy) because it is prepared to provide large amounts of energy and to apply the pitch control mechanism on the large wind turbine to the 100 KW medium-sized wind turbine, to change the complicated three independent pitch control forms into synchronous control, and for the first time to use a large number of sensors to realize intelligent control of the small and medium-sized wind turbines.

Keywords: Renewable energy, Solar, Wind, Pastoral area, Inner Mongolia, China.

Introduction

Renewable Energy

It is a type of energy that is inexhaustible and does not run out, and it is called as soon as it is almost finished again, and it comes from natural resources such as wind, water and the sun. The most important characteristic is that it is clean and environmentally friendly, Carbon, and does not adversely affect the surrounding environment, nor does it play an influential role in the temperature level. Renewable sources of energy are completely incompatible with their non-renewable sources, such as natural gas and nuclear fuel (EPRI, 2010).

These sources lead to global warming and the release of carbon dioxide when used. Considering the importance of renewable energy, a new type of business has recently emerged under the name of renewable energy (EPRI, 2018). Most of its work has focused on harnessing and harnessing renewable energy sources as a source of income and material benefit through its promotion, (Hossain *et al*., 2015). Exploitation of renewable energy, high cost, and the lack of mechanisms and technologies necessary enough, but there are a large number of countries that are preparing to start investment projects for renewable energy, while taking care to draw the dimensions of the policies of these projects, and work to develop and develop (Reca *et al*., 2015) . Renewable energy features, there are a range of features that renewable energy has to offer, making it a great source of energy.

The most important of which is renewable energy is present well in all parts of the world. Renewable energy is environmentally friendly and clean. They exist permanently and are renewable again. It is easy to use based on simple techniques and mechanisms (Chandel *et al*., 2015). It is very economical and convenient, It's an important factor in environmental, social and all fields. Help create new jobs. Helps to mitigate the damage of gas and thermal emissions. Prevent harmful acid rain, limit the collection of waste in all its forms. The abandonment of crops from chemical contaminants, thus raising agricultural productivity. They use uncomplicated techniques and can be manufactured locally in developing countries. Types of renewable energy renewable energy comes from several sources and has different types, and can be divided into several categories:

Wind energy: People rely on wind turbines to extract energy from the wind, generate electricity from it, and use wind energy to produce mechanical energy in so-called windmills. Approximately 2% of the sunlight that falls on the surface of the earth turns into wind energy (Delgado, 2017)

This is a huge amount of energy, which exceeds the world's need for consumption in any year. Wind power has many uses, most notably: pumping water using wind power; wind-powered pumps are widely distributed in Australia, parts of Africa, Asia and Latin America (NREL, 2011). Wind power may soon be used to generate electricity on farms and homes, at lower cost than fuel. Move ships and push their sails. It is highly reliable as a good alternative to fossil fuels, and is available permanently and continuously, and is considered one of the cleanest and environmentally friendly sources of energy, (Hand *et al*., 2012; Denholm *et al*., 2012 and IREDR, 2018).

Utilization of wind power in China：until end of 2017, Wind Energy of China grid connected capacity had reached 163.67 million KW which year-on-year gross of 10.1%, offshore wind power had been connected were up 37 % year-on-year with 2.02 million KW. In 2017, new wind power installed in China has connected to the grid 15.03 million KW, down 22% year on year. China's wind power generation continues to gross rapidly which reaching 305.7 billion KW * h in year 2017, an increase of 28% over the same period last year. The generation capacity of Inner Mongolia, Hebei, Yunnan, Gansu, Shandong, Shanxi, Ningxia, Liaoning,

Xinjiang, Jiangsu and Heilongjiang all generate more than 10 billion KWh, In some provinces, the proportion of wind power generation in the whole society has reached a high level in the whole society. In Inner Mongolia, Gansu and Ningxia, the proportion of wind power generation in the whole society of their provinces exceeds 20%, (Sitranon *et al*., 2015; Das and Ram, 2004 and Mahkamov and Orda, 2005).

The above is a demonstration of a basic solar/wind/generator power system that clearly shows how to put the components together. To build your beginner's expandable solar power system, you will start out with your solar panels, charge controller, battery bank, and power inverter. You can add additional solar panels, batteries, wind turbine, and backup generator later, (Jokar and Saleh, 2015; Shaonan *et al*., 2017; Techanche *et al*., 2011; ASAE, 1075 and DeTar *et al*., 1996).

It is not nearly as hard to put together a small solar power system for backup electricity for your home as you thought it was. Nor is it as expensive as you thought it was, either. Don't let lack of technical knowledge or money deter you from getting started on your dream of getting off the grid! And don't fall for scams and big out of pocket layouts. You can do this yourself, and you can do it easily and cheaply, (Dhuyvetter *et al*., 1995; Doorenbos and Pruitt, 1977; El Amami *et al*., 2001; ECDE, 2013; Strbac *et al*., 2011; ERAP, 2018 and Castronuovo and Lopes, 2004).

In China, with the continuous improvement of living standards in pastoral areas and the rapid growth of herdsman's electricity consumption, the original low-power generation system has been difficult to meet the herdsman's electricity demand, and the high-power wind-solar complementary power generation system is urgently needed to meet the existing household electricity consumption in pastoral areas. Table (1) illustrate the Specifications of low power generation systems Boyang Renewable Energy Company. Inner Mongolia, China. Beginning of 2015, Boyang Renewable Energy Company, a project partner, has promoted large-scale high-power wind-solar complementary power generation systems in Inner Mongolia. By the end of 2016-2018, more than 6500 sets of wind-solar complementary power generation systems have been installed in Inner Mongolia only. Since 2000, more than 15,000 wind-solar complementary power generation systems have been installed in various places. The high-power wind-solar complementary system can generate 6-12 kilowatt-hour electricity per day, which can fully meet the daily electricity demand of herdsmen, such as lighting, watching TV, computer, electric cooker, electromagnetic oven, daily water lifting and so on, Connolly *et al*., 2011; Mansour *et al*., 2015a; Mansour *et al*., 2015b; Mansour, 2015a; Mansour, 2015b; and Mansour *et al*., 2014 and Parastegari *et al*., 2013).

Table 1 : Specifications of low power generation systems Boyang Renewable Energy Company. Inner Mongolia, China.

System Specification	3KW	2KW	1KW
Wind power	1.5KW	1KW	400W
Solar power	1.5KW	1KW	600W
Control Inverter System	4KW	3KW	1KW
Battery（12V200Ah）	8	4	2
Average daily power generation	12	8-10	4
Available Electrical Appliances	Lighting, TV, Freezer, Rice Cooker, Induction Cooker, small Water Pump	Lighting, TV, Freezer, Rice Cooker, Induction Cooker	Lighting, TV, Freezer, Rice Cooker

Drip irrigation system:

Drip irrigation has advantages over conventional systems of irrigation as an efficient means of applying water; especially where water amounts are limited. Drip system used to uniformly distribute water in agricultural fields. If water can be applied efficiently in an irrigation field, water could be saved, and both crop quantity and quality could be increased (Muche, 2013).

Korpaas *et al*. (2003) Found that the maximizing uniformity in the application of water is one of the ways of saving the irrigation water. Should be evaluating the uniformity emission of the drip irrigation system in the field. Yang and Jackson (2011) States that the moisture profile of the frequently irrigation treatments under the cropped conditions showing that downward water movement is restricted to depth 0.6 m in which lateral movement occurs no further than 0.6 m cm from the emitter and commented that water movement is observed to almost 1.0 m from the emitter, while downward movement is restricted to about 0.65 m. Soil moisture distribution when the irrigation water was applied from a water source, but with different rates of the drippers discharges. The continuous drip irrigation treatments showed a water loss, by the deep percolation, of 26 percent of the total water amount of irrigation water below 0.6 m depth after 720 min. The lateral liens water distribution, in the same treatments, showed that 80 percent of the water in the wetted volume was distributed up to 0.45 and 0.43 m horizontally from the point source after 720 and 1440 min, respectively. Only 12 percent water loss under the depth of 0.6 m was found with a pulsed irrigation group and 0.29 and 0.4 m lateral distribution after 720 and 1440 min, respectively, (Ardizon *et al*., 2014). Abdalla *et al*. (2019) stated that drip irrigation system resulted in an outward movement of water from the application point to the wetted profile. The size and duration of the wetted profile depended on the irrigation period, irrigation intervals and the length of the season time for drip irrigation while the deployment

depth was caused by the lowest hydraulic conductivity of the irrigated soil. The lateral movement of drip irrigation was enhanced if the soil was stratified, initial soil moisture was low, and the rate of application was low. At the high moisture tension (low moisture content), the lateral movement of drip irrigation system was low in coarser layers and pronounce in the fine soil layers, (Ardizon *et al*., 2014; Abdalla *et al*., 2019; Kapsali *et al*., 2012; Mansour *et al.,* 2016a; Mansour *et al.,* 2016b)

The objectives of this research work were studying the using of renewable energy in storage the electricity generation for agricultural activity in drip irrigation by automation controller system at in the pastoral area at Xilingole vocational college and Boyang renewable energy Co. in Inner Mongolia, China.

Materials and Methods

Using wind power for the water pump system and irrigation system

Fig. (1) Shown the design of a water pumping system using wind turbines for drip irrigation system, the components are wind turbine connected to the pumps by cables, pumps connected to a water tank by water (PVC) pipes, drip irrigation system connected to a water tank by water pipes. Fig. (2) Shown the combination solar-wind power system, components are Wind turbine, solar panel array, emergency generator, charge controller, inverter, battery bank and panel box. Fig. (3) Shown the wind power turbine diagram, Components are blades, hub, low speed shaft, gearbox, high speed shaft, generator, nacelle and tower. Fig. (4) Shown the wind -solar generation system, and Fig. (5) Shown the solar-wind PV energy power by generative system, Mansour *et al.,* 2016b; Mansour *et al*., 2015c; Mansour *et al*., 2015d; Mansour *et al*., 2015e; Mansour *et al*., 2015f; Mansour and Aljughaiman, 2015; Mansour and Aljughaiman, 2012; Jimmy Dodge, 2017; Tayel *et al*., 2018; Ibrahim *et al.*, 2018)

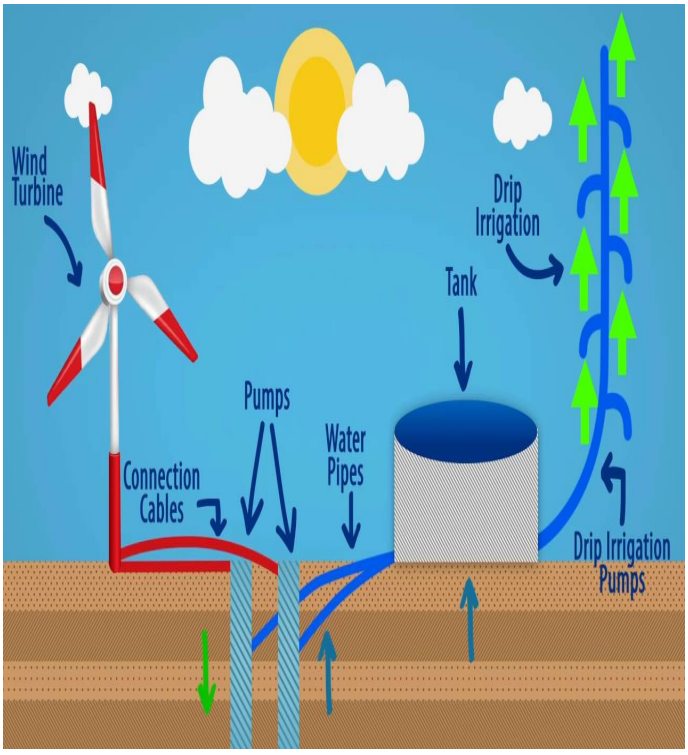


Fig. 1 : Design of a water pumping system using wind turbine for drip irrigation system

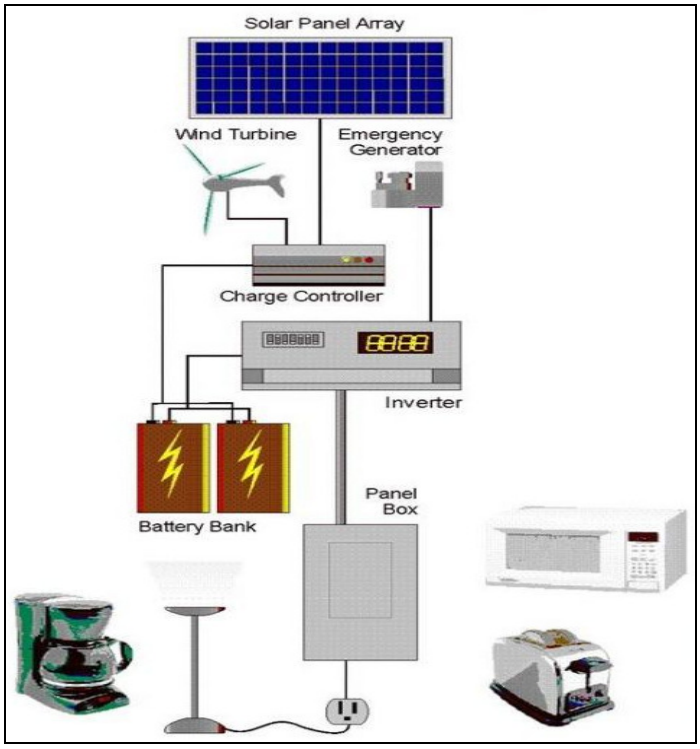


Fig. 2 : Combination solar-wind power system

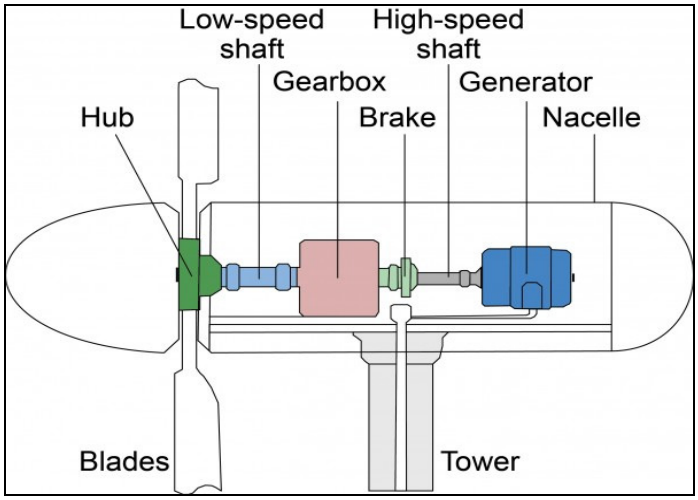


Fig. 3 : Wind power turbine diagram

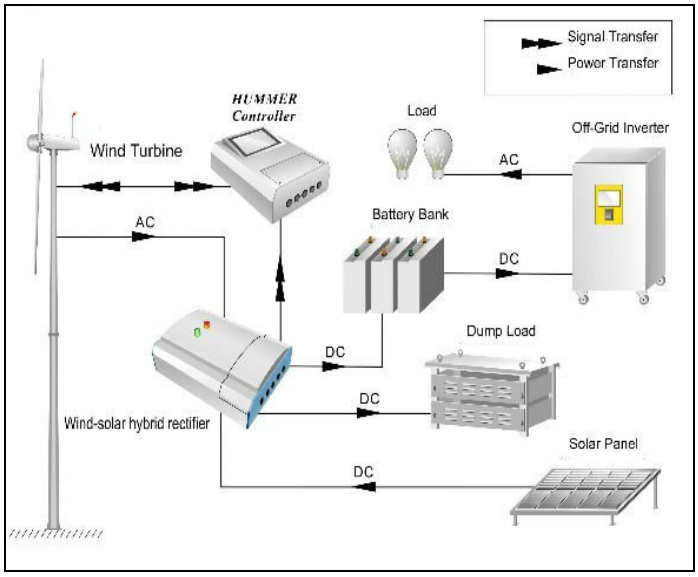


Fig. 4 : Wind -Solar generation system

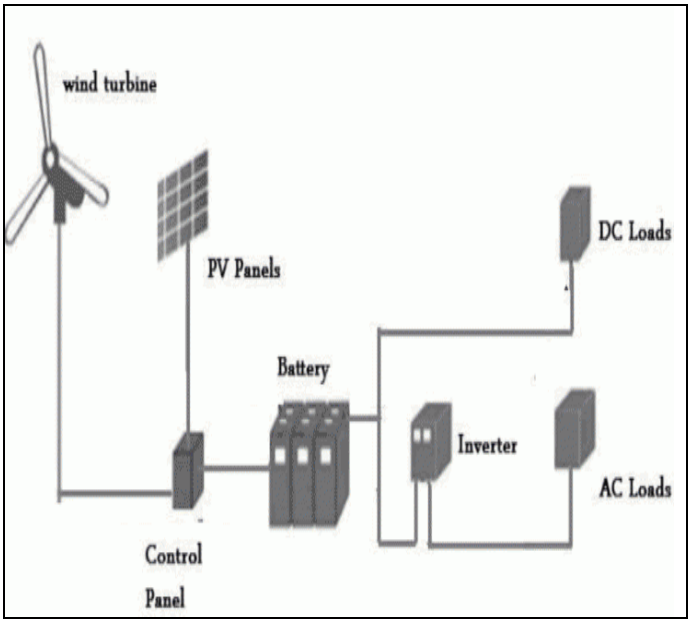


Fig. 5 : Solar-Wind PV energy power by generation system

Pumping system efficiency:

Using and applying different types of pumps, it can propose to water pumps that are increasing efficiency based on the type of pump, (Tayel *et al*., 2016a).

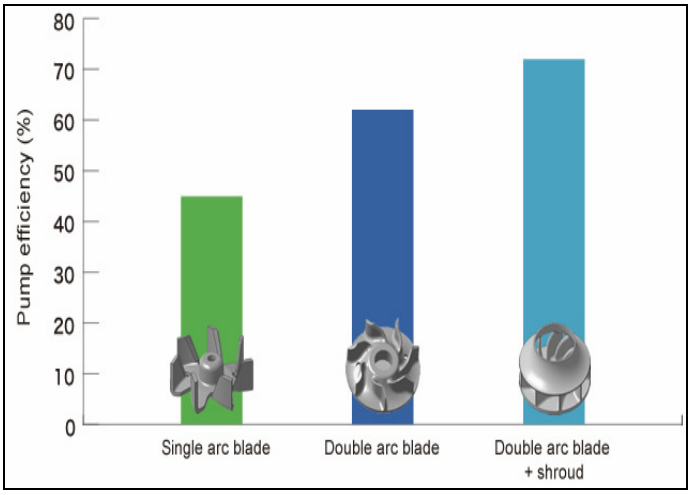


Fig. 6 : The effect of pump type on the pump efficiency (%)

The power generation of a wind turbine at different wind speeds

In Figures 6, 7 and 8 windmill for water pump/small wind turbine generator for irrigation pump. (500 w), (Pibars and Mansour, 2016)

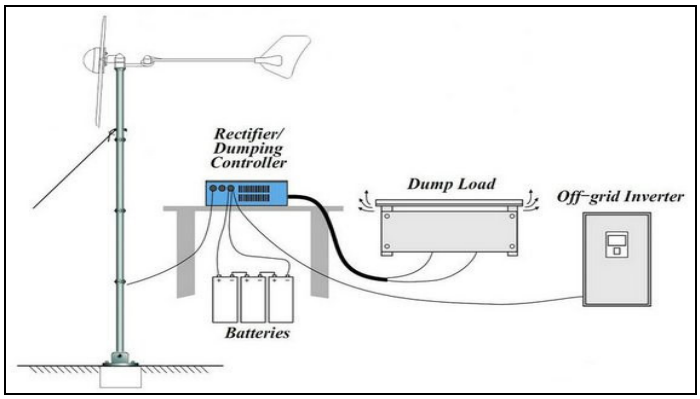


Fig. 7 : Windmill for water pump/small wind turbine generator for irrigation pump

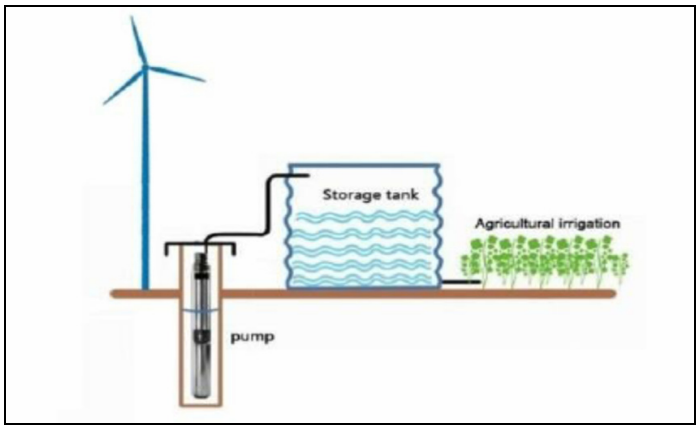
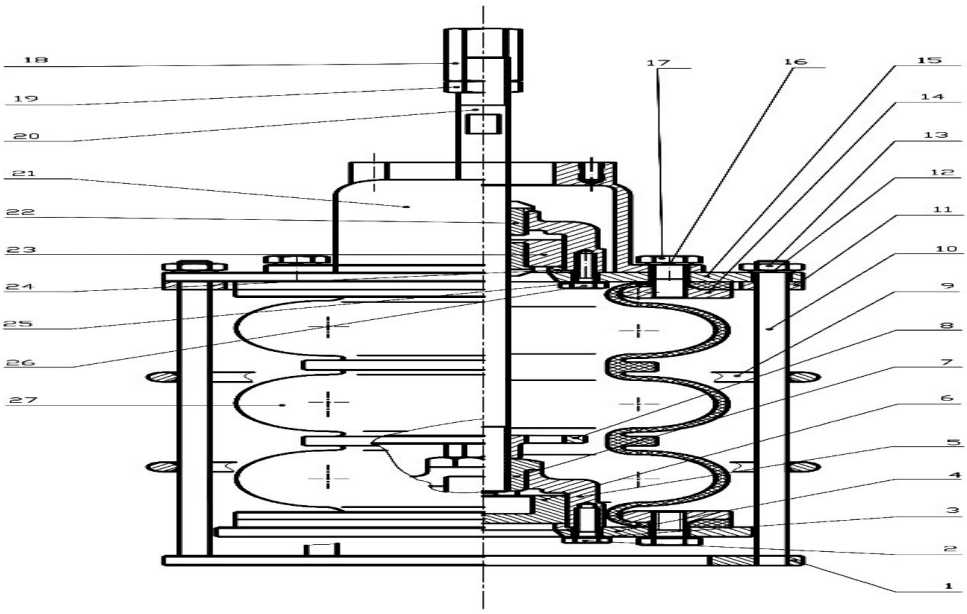


Fig. 8 : Wind-Powered for irrigation system

The capsule diaphragm pump is matched with the mechanical wind water lifting machine. Among them, the capsule diaphragm is also known as air spring, corrugated air tire and rubber air bag. It is widely used in facilities and parts that need stroke control, isolation and shock absorption. With an air spring, it has good smoothness when extracting seawater and river water. This type of capsule diaphragm pump is designed as high lift and small flow pump. According to the stroke, three curved capsules are determined, as shown in figure (9). This tower-type capsule diaphragm, made of rubber clip wire, can be deflected, flexible and can realize flexible transfer of force, which is the core component of pump body structure. There are two types of iaphragm, as shown in Table (2), which can be used for small flow drip irrigation system (Pibars and Mansour, 2016, Tayel *et al*., 2015a, El-Hagary, 2015, Tayel *et al*., 2015b, Tayel *et al*., 2013, Tayel *et al*, 2016b, Tayel *et al*., 2016c).

Table 2 : The key parameters of the capsule type rod pump

Model	Diameter (mm)	working stroke (mm)	The height of the pump (mm)	weight (kg)	Capsule			
					Outer diameter (Mm)	Drift diameter (mm)	Height (mm)	Capsule number
FSM300	300	140	35	29	220	110	300	3
FSM200	200	120	30	16	160	80	250	3



1	limit disc	10	support bar	19	outlet connection
2	lower tray bolts	11	limit spacing ring	20	upper valve housing
3	lower press ring	12	support rod nut	21	upper valve
4	lower tray	13	upper pressure ring	22	upper valve seat
5	lower valve seat	14	upper tray	23	upper hood bolt
6	lower valve	15	upper tray bolt	24	capsule diaphragm
7	lower valve housing	16	long nut	25	Lower shell bolt
8	upper bound bit block	17	Mounting lock nutr	26	bolt
9	support ring	18	tie rod	27	Capsule

Fig. 9 : Structure Drawing of the Diaphragm rod Pump

China independently developed intelligent pasture drip irrigation system model: In order to improve the desert grassland ecological environment, China Boyang Renewable Energy Co., Ltd. carried out a demonstration of "solar energy low-cost intelligent zoning drip irrigation project". The project combines "no-tillage and buried pipe technology", "low-cost solar energy technology" and "intelligent time-division drip irrigation technology". The combination of the three technologies has opened a new way of thinking about green life in arid pastoral areas, (Tayel *et al*., 2015d; Goyal and Mansour, 2015; Eldardiry *et al*., 2015; Tayel *et al*., 2015e; Tayel *et al*., 2012a; Tayel *et al*., 2015b).

(1)"No-tillage burying pipe technology" is using the self-developed "grassland root cutting and replanting burying pipe machine" to bury drip irrigation pipe in the bottom of the seed bed, and at the same time carry out replaying and soil covering suppression. This equipment mainly solves the problem of water evaporation in the irrigation process and solves the problem of drip irrigation tube in place and reuse, (Tayel *et al*., 2015b; Mansour *et al*., 2018a; Mansour *et al*., 2018b; Mansour *et al*., 2018c; Mansour *et al*., 2018d), The application of no-tillage technology can maximize the protection of grassland surface from damage, at the same time, through cutting grass roots to achieve the asexual reproduction of grassland; through replanting local high-quality grass seeds to improve grassland, and then through covering soil and suppressing moisture to restore the grassland landscape as shown in Figure (10).

Fig. 10 : Grassland root cutting and replanting burying pipe machine

(2) "Low-cost solar energy technology" means that the system does not need to be connected to the power grid and equipped with expensive components such as diesel engines and batteries. The whole system uses only a small number of direct-drive pumps with photovoltaic modules, which reduces the cost of the system significantly. The system realizes the start and stop of the pump by changing the voltage of photo-voltaic module by illumination intensity. For example, at 9:00 a.m., when the voltage of the photo-voltaic module is enough to drive the pump, the system starts to work until 5:00 p.m. when the voltage is insufficient and the light intensity is insufficient to drive the pump, it automatically shuts down as shown in Figure (11).

(3) "Intelligent time-division irrigation technology" means that users can automatically set irrigation area and irrigation time to achieve "precise irrigation" and make the most effective use of limited water resources.

Fig. 11 : Intelligent time-division irrigation technology

Automatic drip irrigation system

The drip irrigation automatic control system consists of damp sensors, temperature sensors, signal circuits, digital adapters, an LCD module, a data transfer engine and a spiral coil control. A signal is sent via the unit in Figure 1, and important data are automatically estimated by ground moisture and temperature measurements. RTD, such as PT100, is used as temperature sensors, but a density sensor can be used to detect soil moisture. The sensors are installed in the soil below a certain depth (determined by the planted plant). When moisture is reduced to a certain level, RESALE resale signals to the control unit for the purpose of stopping irrigation and this transmits it to the valves and valves for network irrigation and related electric drip irrigation system control unit (working by the storage power in batteries by solar and wind energy in the farm) are executing a command to shut down and so's automatic system is activated without the intervention of the human factor in the process throughout the growing season and even begin to harvest measures of Automation controller unit and Application in Field, (Mansour *et al*., 2018e; Mansour *et al*., 2018f; Mansour *et al*., 2018g; Mansour *et al*., 2005; Mansour 2006).

Statistical analysis: COSTAT program was used to carry out Statistical Analysis. The treatments means were compared using the technique P of analysis of variance (ANOVA) and the least significant difference between systems at 1 % (Mansour *et al*., 2010a)

Result and Discussion

The following is a quick list of what you will need to put together a small-scale solar power system for your home, which you can expand later. It uses an 80-watt solar panel which is linkable to more panels if you want to add more later. It uses a 1500-watt inverter and a 30 AMP charge controller, which leave lots of room for you to add more solar panels and more batteries.

You won't be able to do a whole lot with this little system. You won't run your central heat and air off this, nor any major appliances. But you will be able to run some lights, your laptop, radio, cordless phone, charge cell phones, watch TV, and use some of your smaller appliances. You will want to research about how much electricity your appliances use, and how you can reduce your energy use. As you move towards total energy independence, you will benefit by finding energy-efficient appliances, which may be more expensive, but well worth it for the return in savings on your electricity usage. Some quick tips: Beware coffee makers, they use lots of electricity! So do hair dryers! And laptops use much less electricity than desktops.

It is a good little system to get started with and is expandable to large enough to where you could power a small dwelling or cabin with it, by adding batteries and panels. If you add more batteries, you will need to re-calculate the gauge of your wire to accommodate the new power load.

Another addition you could make to improve this system would be to add a Kill-a-Watt to it, so you can see a read out of your power usage.

We found all the components of this system at one place. This will make it easier for you to get it all at once. (But not necessarily cheaper. The same solar panels can be gotten elsewhere for a substantially lower price!), Its saving you the work of having to learn what size charge controller and inverter to get. Don't get smaller. These are way too big for this system. That does not hurt anything. But that way, you won't have to go out and buy bigger ones when you expand your system. If you get these items too small, you are going to have problems. May as well go ahead and get the right ones from the start.

Then all you will have to do is add more panels, add more batteries, or more components like wind or generator, more inverters, and adjust the grouping of the batteries, and gauge of the wiring to accommodate to the adjustment of the amp differences.

As you get into this, you will learn more ways of improving your system and adding more things to it to make it more efficient and powerful.

Wind efficient generator

Hummer generator is one of the most advanced generators in the world. Made of refined permanent magnetic material, special copper alloy, aviation aluminum alloy and stainless steel, it is highly efficient in power. Due to its smallness, it can be placed inside the nose cone to reduce air resistance and increase efficiency.

Due to its advanced technologies, refined materials and unique design, H12.0-50000W wind turbine wind energy utilization factor is as high as 0.42, while generator efficiency is >0.92.

Smart Control: H12.0-50000W wind turbine is controlled by a comprehensive smart system. Through our years of monitoring on wind turbine operation, we successfully develop an automatic control system for small and medium scaled wind turbines.

This smart system can automatically seek wind direction and constantly monitor generator working status, rotation speed, generator temperature, wind speed and direction etc. All data will be transmitted to control center.

When an abnormal situation takes place, our control center will instruct wind turbine to deflect from wind direction. After the problem is released wind turbine will turn to face the wind direction again and resume generation.

H12.0-50000W wind turbine system, both off grid and grid tied are available.

Rare Earth Permanent Magnet Motor and its intelligent control for 100KW Distributed Wind Power System: In the Chinese market, small and medium-sized wind turbines are mixed and uneven. Some products are designed and manufactured at a very low level. For example, there is no speed control system for kilowatt-level wind power generation, and only "unloading resistance" is used as load control. Once the "resistance" burns off or the sliding ring contacts badly or the conductor disconnects, the wind turbine will be in a "flying car" state, with terrible consequences. When discussing the reliability of wind power generation with Danish experts, we reached a consensus: "In recent years, the improvement of reliability of large and medium-sized wind turbines has benefited from the widespread adoption of speed control systems (i.e., both pitch and yaw systems). It is very risky to simplify or abandon the proper speed control system in practice unless the diameter of the wind turbine is very small". In order to improve reliability, the speed regulation design of 100 KW distributed wind turbines developed jointly by Xilingol Vocational College and Boyang Renewable Energy Co., Ltd. adapts pitch control, yaw control and electromagnetic braking system, which not only improves reliability but also improves power generation efficiency, Table (3).

Table 3 : 100kw System Parameters of Wind Turbine

Serial number	Project	Index	Serial number	Project	Index
1	Rated power	100KW	11	Vanes Material	Reinforced FRP
2	Wind wheel diameter	27.55m	12	Number of Vanes	3
3	Cut-in wind speed	3m/s	13	Rated speed	48rpm
4	Rated wind speed	9.5m/s	14	Swept area	596m^2
5	Cut-out wind speed	25m/s	15	Power regulation	Variable pitch
6	Survival wind speed	59.5m/s	16	Direction of rotation	Clockwise
7	Design Life	20年	17	Tower height	30m
8	Converter output frequency	50Hz	18	Generator type	Permanent Magnet Synchronization
9	Cabin weight	5500kg	19	Converter output voltage	AC380V
10	Tower weight	18000kg	20	Wind wheel weight	2900kg

The key technology is to use permanent magnet synchronous generator instead of traditional asynchronous alternator, to apply the pitch control mechanism on the large wind turbine to the 100 KW medium-sized wind turbine, to change the complicated three independent pitch control forms into synchronous control, and for the first time to use a large number of sensors to realize intelligent control on the small and medium-sized wind turbines. While realizing the functions of pitching and active yawing of large-scale wind turbines, the cost of generating units is also controlled. The innovation of this system includes the following aspects:

(1) anti-airspeed system, adopts the power loss braking protection system, that is, in the case of control failure and power failure of the unit, the power loss protection system works to make the unit brake, providing a solution to prevent the problem of airspeed;

(2) adopt dual speed regulation system, which ensures the safe operation of electric drive system and does not make the cost too high;

(3) the rare earth permanent magnet motor with dovetail slot structure has high efficiency and low rotation speed.

The power curve of 100KW wind generator determined by the test is shown in Figure 12.

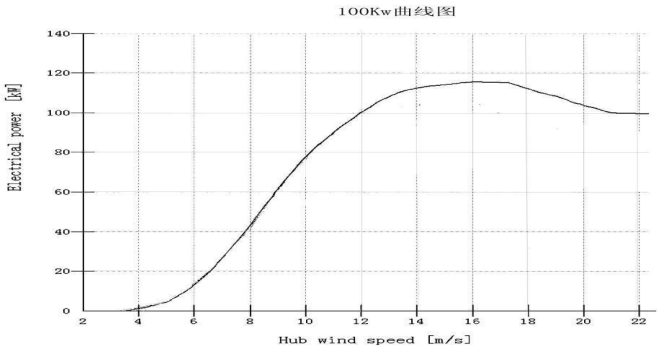


Fig. 12 : The power curve of 100KW wind generator determined by the test

Application of H12.0-50kw wind-solar hybrid system

It can drive air-condition (<=50 horsepower), 10KW water pump or other resistive appliances (<=50KW), the power curve of 50kw wind generator determined by the test as shown in figure (13).

Well used in:

Housing, factory and farm Telecommunication Station Monitoring (hydrology, observatory)

Water-pumping Station

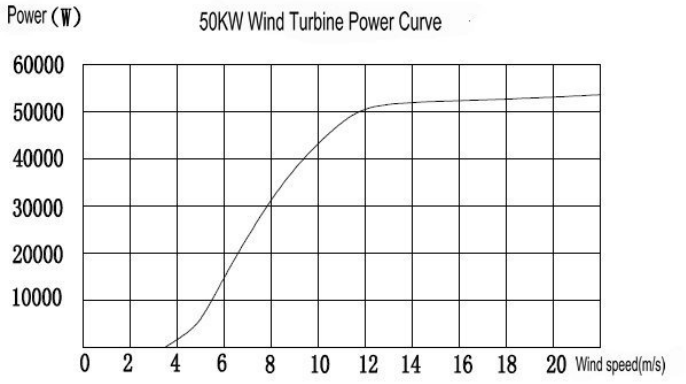


Fig. 13 : 50 KW wind turbine power curve

Technical parameters and mechanical equipment for low-cost pasture irrigation and buried pipelines in pastoral areas:

When configuring drip irrigation system, in order to achieve a flow rate of 4 tons/hour, different power photo-voltaic components and submersible pumps are needed for different lifts. Usually a 10-metre lift requires 800W components with a 500-watt submersible pump. When the lift reaches 120 meters, it is necessary to increase the photo-voltaic module to 6 KW and cooperate with the 4.5 KW pump. Grassland root cutting and re-sowing pipe burying machine mainly consists of seed fertilizer box, suspension frame, hydraulic cylinder, walking wheel, double disc ditcher, seed fertilizer ditcher, drip irrigation pipe burying mechanism, seed conveying mechanism, soil recovery, repression mechanism, drip irrigation pipe bracket pressurizing mechanism, drip irrigation pipe bracket and U-shaped clamp. This machine can complete soil loosening, root cutting, re-sowing, fertilization and drip irrigation pipe laying at one time. The combined operation of road and crushing greatly reduces the times of rolling grassland, realizes and satisfies the operation requirements of drip irrigation improvement technology for Natural Mowing grassland, (Mansour *et al*., 2010b; Mansour 2012; Mansour *et al*., 2013a). The machine has high production efficiency, simple structure, simple operation and low cost. It is suitable for Natural Mowing grassland, natural grassland improvement, rejuvenation and regeneration, and small and medium-sized grassland artificial grassland construction as shown in Fig. (14).

Fig. 14 : Solar low-cost pasture irrigation technology

Discussion

Discussion on Irrigation in Pastoral Areas of China

(1) Grassland irrigation in pastoral areas is closely related to grassland ecological environment.

The grassland irrigation project is an important measure to protect grassland ecology in the pastoral areas. Grassland ecosystems in pastoral areas are facing severe challenges due to ecological problems such as desertification and salinization. Grassland irrigation projects in pastoral areas must protect the grassland ecosystem as the core objective, and then improve the stability of grassland ecosystem and promote the development of local animal husbandry economy. Grassland irrigation can prevent grassland degradation, effectively control grassland desertification, improve grassland soil structure, expand grassland vegetation area, reduce surface water evaporation, and protect grassland ecological environment, (Mansour 2013; Mansour and Gyuricza, 2013; Mansour *et al*., 2013b; Mansour and Elmelhem, 2013; Pibars *et al.*, 2018)

(2) Grassland irrigation in pastoral areas is closely related to the development of animal husbandry economy.

The general mode of production in areas dominated by pure animal husbandry is relatively backward. The economic basis of this kind of animal husbandry is weak, its development is not stable enough, and it is vulnerable to adverse natural disasters such as snowstorms. Grassland irrigation in pastoral areas can change herdsman's production concepts, change the backward economic model of animal husbandry depending on nature, make herdsmen contact with new production methods, and feel the production efficiency and economic benefits brought by technology. Irrigation of pasture will effectively improve the production conditions of

pasture and the basic living conditions of pastoral herdsmen. The most important thing is to enable pastoral herdsmen to make effective use of grassland resources and water resources, to give full play to the convenience brought by irrigation facilities, to enhance the livestock capacity of pasture, and to increase the livestock productivity of pastoral herdsmen. The most direct way is to improve the economic income of pastoral herdsmen and promote sustainable economic development, [86-89].

Low-cost irrigation in China's agriculture and pastoral areas: the important symbols of modernization in developing animal husbandry countries are cultivation and improvement grassland and artificial grassland construction. Because of the serious degradation of grassland in large area, the grassland ecosystem is unbalanced. In order to solve this problem, China has been actively exploring effective strategies for grassland restoration over the years. Most of them focus on the basic principles and methods of ecology on natural grazing land, which are comprehensively implemented through enclosure, replanting, irrigation, fertilization, weed control, delayed grazing and soil loosening, (Elhagary *et al*., 2016a; Elhagary *et al*., 2016b; Elhagary *et al*., 2016c; Tayel *et al*., 2013a; Elhagary *et al*., 2016b).

Due to the scarcity of rivers on the surface of grasslands in northern China, lack of irrigation conditions for grasslands, extreme bad weather, drought, wind and rain, in order to improve the productivity of grasslands more effectively, some areas have invested a lot of money to add large-scale sprinkler irrigation machines to solve the problem of water demand for grasslands in their growing period. Although the yield and quality of forage were obviously improved, the cost of forage production was greatly increased. According to preliminary measurements, only about 40-50% of sprinkler irrigation water infiltrated into the ground to provide forage growth. The other sprinkler irrigation water, due to the natural conditions and climatic characteristics of pastoral areas, air drying, large evaporation, most of them are quickly evaporating. Moreover, the groundwater in pastoral areas is generally buried deeper, mostly below 100 meters from the surface, (Sabreen *et al*., 2016; Tayel and Mansour, 2013; Tayel *et al*., 2006; Tayel *et al*., 2007; Tayel *et al*., 2012a; Tayel *et al*., 2012b; Tayel *et al*., 2013)

A large-scale sprinkler irrigation machine matched to the machine well has a high demand for water output. Generally, the machine well water output is required to reach 150-200 t/h, which requires a large amount of energy to carry out water lifting and driving sprinkler irrigation machine operation. The machine investment and power consumption are high, which greatly increases the cost of pasture and makes it difficult to bear the pastoral areas lacking water resources. Therefore, farmers and herdsmen urgently need to provide water-saving and electricity-saving drip irrigation equipment and provide joint operating machinery that can complete loosening soil, cutting roots, replanting, fertilizing, laying drip irrigation pipelines and suppressing at one time, (Tayel *et al*., 2016b; Tayel *et al*., 2016c; Tayel *et al*., 2016d; Mansour *et al*., 2019; Jiandong *et al*., 2013).

Conclusion

When configuring drip irrigation system, in order to achieve a flow rate of 4 tons/hour, different power photo-voltaic components and submersible pumps are needed for different lifts. Usually a 10-meter lift requires 800W components with a 500-watt submersible pump. When the lift reaches 120 meters, it is necessary to increase the photo-voltaic module to 6 KW and cooperate with the 4.5 KW pump. Grassland root cutting and re-sowing pipe burying machine mainly consists of seed fertilizer box, suspension frame, hydraulic cylinder, walking wheel, double disc ditcher, seed fertilizer ditcher, drip irrigation pipe burying mechanism, seed conveying mechanism, soil recovery, repression mechanism, drip irrigation pipe bracket pressurizing mechanism, drip irrigation pipe bracket and U-shaped clamp. Low-cost irrigation in China's agriculture and pastoral areas: the important symbols of modernization in developing animal husbandry countries are cultivation and improvement grassland and artificial grassland construction. Because of the serious degradation of grassland in large area, the grassland ecosystem is unbalanced. In order to solve this problem, China has been actively exploring effective strategies for grassland restoration over the years.

The combined operation of road and crushing greatly reduces the times of rolling grassland, realizes and satisfies the operation requirements of drip irrigation improvement technology for Natural Mowing grassland. The machine has high production efficiency, simple structure, simple operation and low cost. It is suitable for Natural Mowing grassland, natural grassland improvement, rejuvenation and regeneration, and small and medium-sized grassland artificial grassland construction. The machine well water output is required to reach 150-200 t/h, which requires a large amount of energy to carry out water lifting and driving sprinkler irrigation machine operation. In order to improve reliability, the speed regulation design of 100 KW distributed wind turbine developed jointly by Xilingol Vocational College and Boyang Renewable Energy Co., Ltd. adapts pitch control, yaw control and electromagnetic braking system, which not only improves reliability but also improves power generation efficiency.

The key technology is to use a permanent magnet synchronous generator instead of a traditional asynchronous alternator, to apply the pitch control mechanism on the large wind turbine to the 100 KW medium-sized wind turbine, to change the complicated three independent pitch control forms into synchronous control, and for the first time to use a large number of sensors to realize intelligent control of the small and medium-sized wind turbines. While realizing the functions of pitching and active yawing for the large-scale wind turbines, the cost of generating units is also controlled.

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